SOIL SURVEY OF

Lafayette County, Missouri

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Missouri Agricultural Experiment Station

Issued February 1975

Major fieldwork for this soil survey was done in the period 1957–68. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1968. This survey was made cooperatively by the Soil Conservation Service and the Missouri Agricultural Experiment Station. It is part of the technical assistance furnished to the Lafayette County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Lafayette County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units.

Foresters and others can refer to the section "Use of the Soils as Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soil and wildlife in the section "Use of the Soils as Wildlife Habitat."

Recreational directors, community planners, and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the section "Recreational Uses of the Soils."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Lafayette County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county in the section "General Nature of the County."

Cover: **Typical view of association 3, 4 miles southeast of Lexington.**

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Issued February 1975

SOIL SURVEY OF LAFAYETTE COUNTY, MISSOURI

BY ALLAN H. JEFFREY, SOIL CONSERVATION SERVICE

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE MISSOURI AGRICULTURAL EXPERIMENT STATION

LAFAYETTE COUNTY is located in the west-central part of Missouri (fig. 1). It is bounded on the north by the old channel of the Missouri River. Three areas of land are on the north side of the present river channel. The county has an area of approximately 404,160 acres, or about 632 square miles. Lexington, the county seat and largest town in the county, is located at the northern edge of the county on the Missouri River. It is about 12 miles east of the west county line and 21 miles west of the east county line. The county is about 33 miles long, from east to west, and averages about 18 miles wide from north to south. The east county line is about 10 miles longer than the west county line.

The climate of the county is continental and has wide changes in temperature from season to season. The fall and winter months have the largest day-to-day changes, and summer temperatures change more slowly.

Farming is the principal enterprise and ranges from livestock farming, which is the major source of farm income, to cash-grain farming and horticulture. Other enterprises include a number of small industrial developments throughout the county and tourism along National Interstate Highway 70.

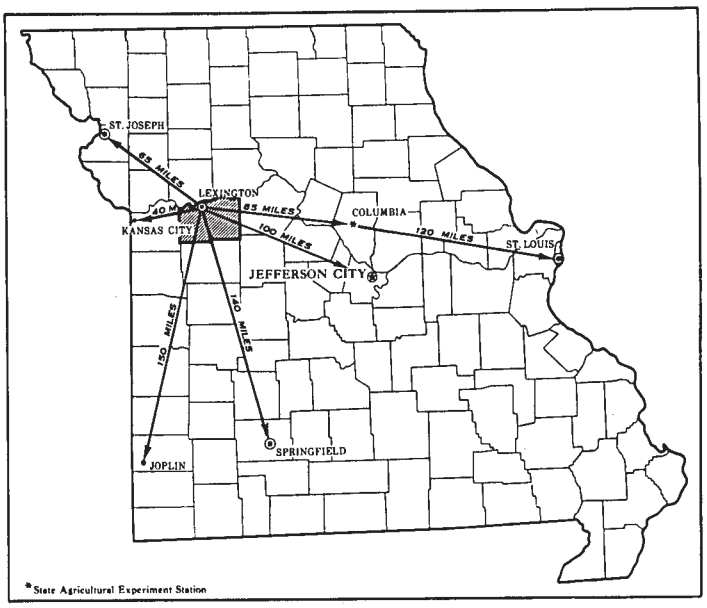

Figure 1.—Location of Lafayette County in Missouri.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Lafayette County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, 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 that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Leslie and Marshall, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name

of a soil phase indicates a feature that affects management. For example, Knox silt loam, 2 to 5 percent slopes, is one of several phases within the Knox series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, 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 mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Undifferentiated groups are shown on the soil map of Lafayette County.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. Blackoar and Otter silt loams is an undifferentiated soil group in this county.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Riverwash is a land type in this county.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Lafayette County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The five soil associations in Lafayette County are discussed in the following pages. The terms for texture used in the title for several of the associations apply to the texture of the surface layer. For example, in the title of association 2, the word loamy refers to the texture of the surface layer.

1. Haynie-Leta Association

Nearly level, loamy to clayey, well-drained to somewhat poorly drained soils on Missouri River bottom lands

This association (fig. 2) consists of nearly level soils on bottom lands, mostly south and east of the Missouri River. Three large tracts occur north of the river. These soils formed in alluvial material 3 feet or more in thickness.

This association makes up about 5 percent of the county. Haynie soils make up about 29 percent of the association; Leta soils, 20 percent; Waldron soils, 12 percent; and minor soils, the remaining 39 percent. Minor soils are in the Hodge, Knox, and Ray series.

Haynie soils are loamy, moderately permeable, and moderately well drained to well drained. Leta soils are clayey, have moderately slow permeability, and are somewhat poorly drained. Waldron soils are deep and dark grayish brown. They are clayey, slowly permeable to moderately slowly permeable, and somewhat poorly drained.

The main enterprises are cash-grain farming and general livestock farming. The principal crops are corn, soybeans, small grains, and alfalfa. Small amounts of timber are also produced, mainly in small areas adjacent

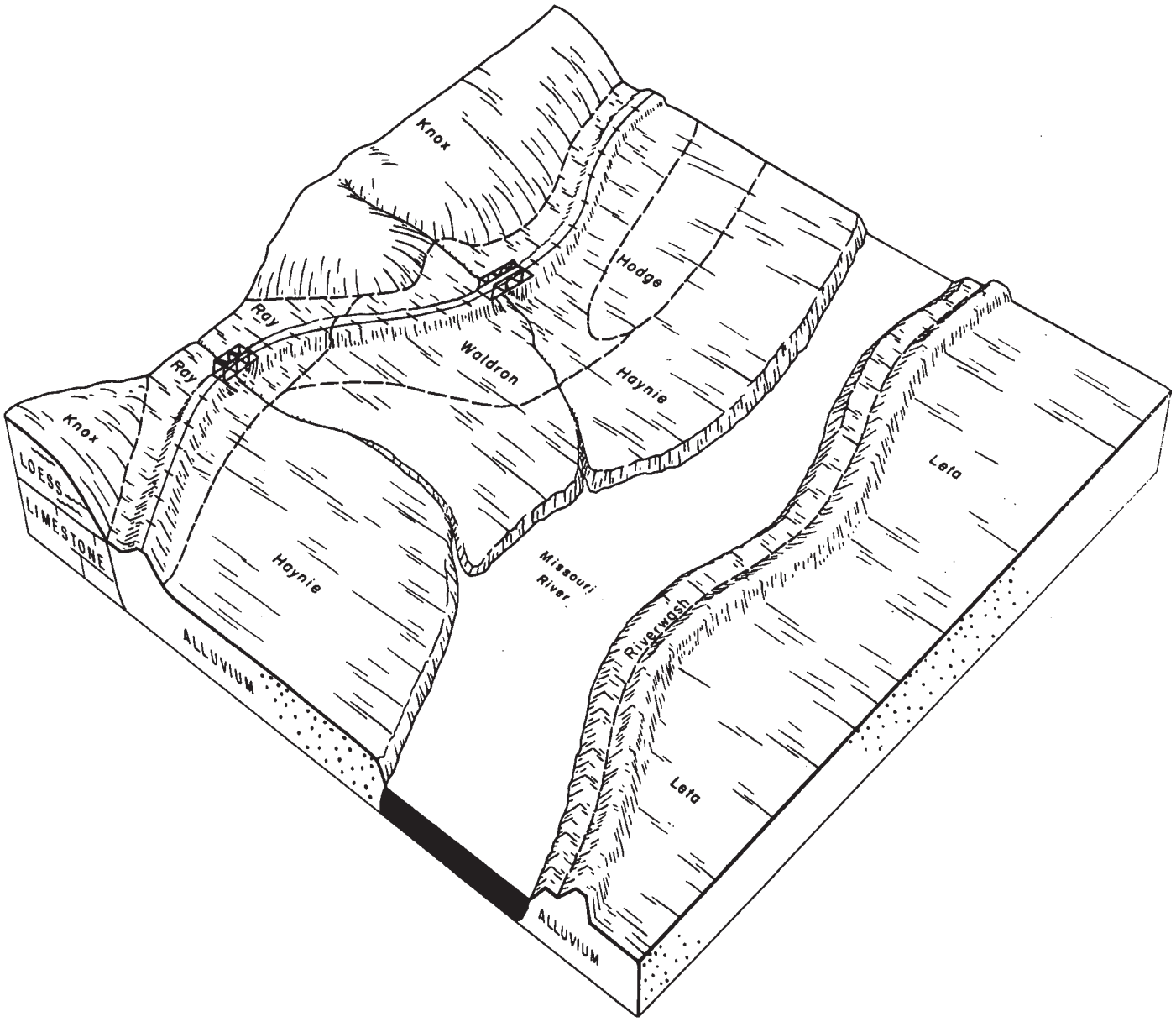

***Figure 2.*—Relationship of soils in association 1 and the underlying material.**

to the Missouri River. Sand, for local use, is available in limited amounts and at a number of places within the association.

Infrequent flooding is a major hazard (fig. 3). Levees provide protection in most places. Other hazards are droughtiness and wetness. Management that includes drainage and irrigation practices is needed.

2. Knox-Marshall Association

Gently sloping to steep, loamy, well-drained soils on uplands

This association (fig. 4) consists of gently sloping to steep soils on uplands in the northern part of the county. It is adjacent to the Missouri River Valley, in the River Hills area. Although this association is small in size, it has a comparatively large number of towns and old town sites. About half of the city of Lexington, the county seat, is in this association. U.S. Highway No. 24 is within the association or immediately outside its southern edge in most places.

This association makes up about 12 percent of the county. Knox soils make up about 69 percent of the association; Marshall soils, about 9 percent; and minor soils, the remaining 22 percent.

The Knox and Marshall soils formed in loess about 10 to 90 feet in thickness. The Knox soils are loamy, moderately permeable, and well drained. They are gently sloping to steep and are on hillsides that have many deep

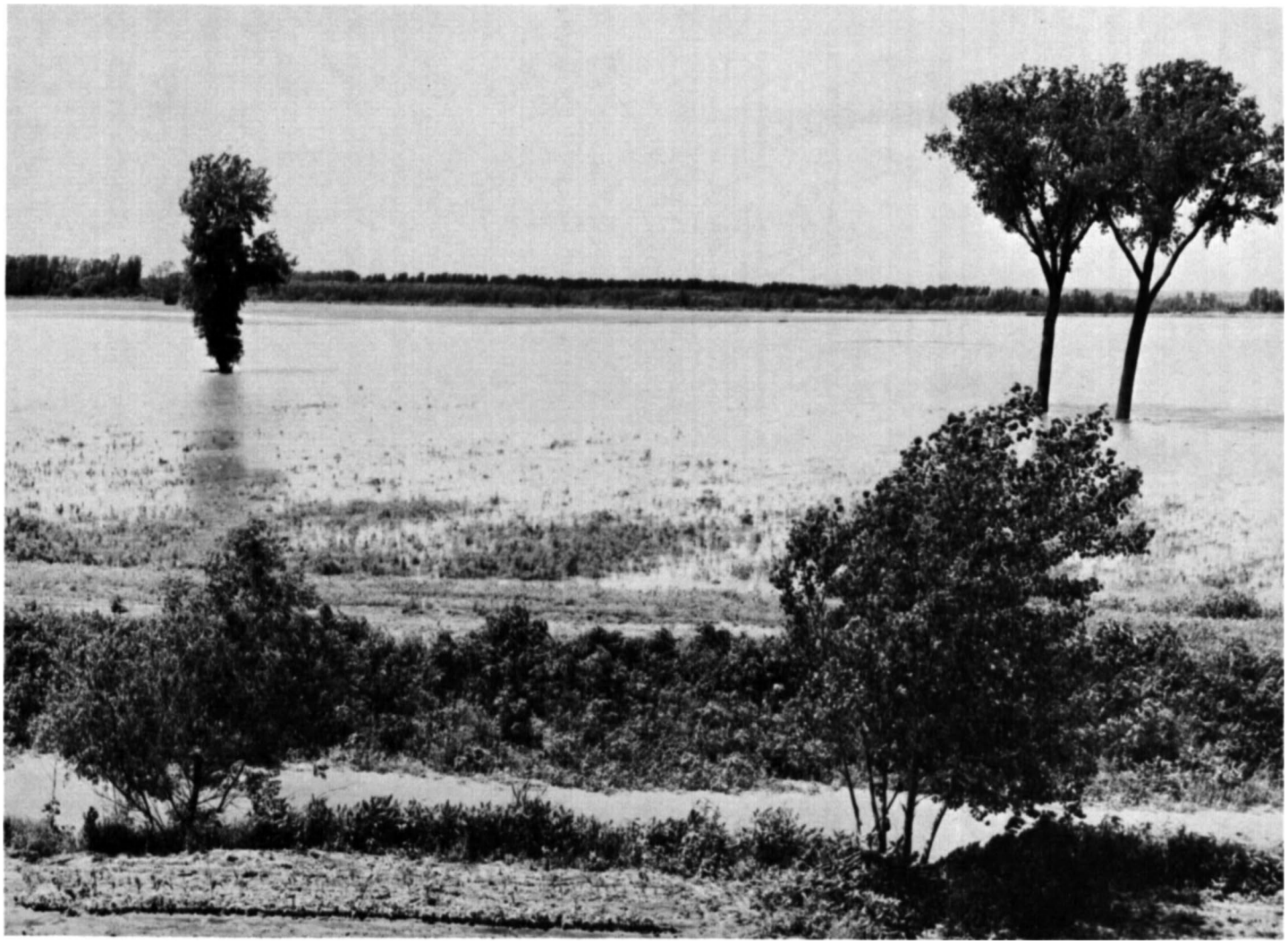

Figure 3.—**Infrequent flooding is a major hazard on soils of association 1.**

gullies and ravines. The Marshall soils are loamy, moderately permeable, and well drained. They are gently sloping to strongly sloping soils and are on ridges and the upper part of hillsides.

Among the minor soils are soils in the Ray, Winfield, Nodaway, Booker, and Sogn series. The Ray soils are loamy, moderately permeable, and well drained. The Winfield and Nodaway soils are loamy, moderately permeable, and moderately will drained. The Booker soils are clayey, very slowly permeable, and very poorly drained. The Sogn soils are loamy, moderately permeable, and somewhat excessively drained.

The main enterprises are raising livestock and growing field crops, trees for timber, and fruit trees. The principal crops are corn, soybeans, small grains, meadow plants, and a limited amount of timber. The principal fruits are apples and peaches (fig. 5).

Because these soils are deep, loamy, and steep, sheet and gully erosion is a major hazard. Management that includes intensive erosion-control practices is needed.

3. Marshall-Higginsville Association

Gently sloping to strongly sloping, loamy, well-drained and somewhat poorly drained soils on uplands

This association consists mainly of soils on uplands in all parts of the county except along the northern edge and in the southwestern corner. These soils are gently sloping on broad ridgetops, sloping to strongly sloping on hillsides, and level or nearly level on bottom lands adjacent to small streams (fig. 6).

This association is served by good roads in all parts. It is crossed by National Interstate Highway 70 in an east-west direction, and by Missouri Highway No. 13 in a north-south direction. Deep-shaft coal mining was common in areas of this association prior to about 1940, and some large mine dumps remain as prominent landmarks.

This association makes up about 62 percent of the county. Marshall soils make up about 31 percent; Hig-

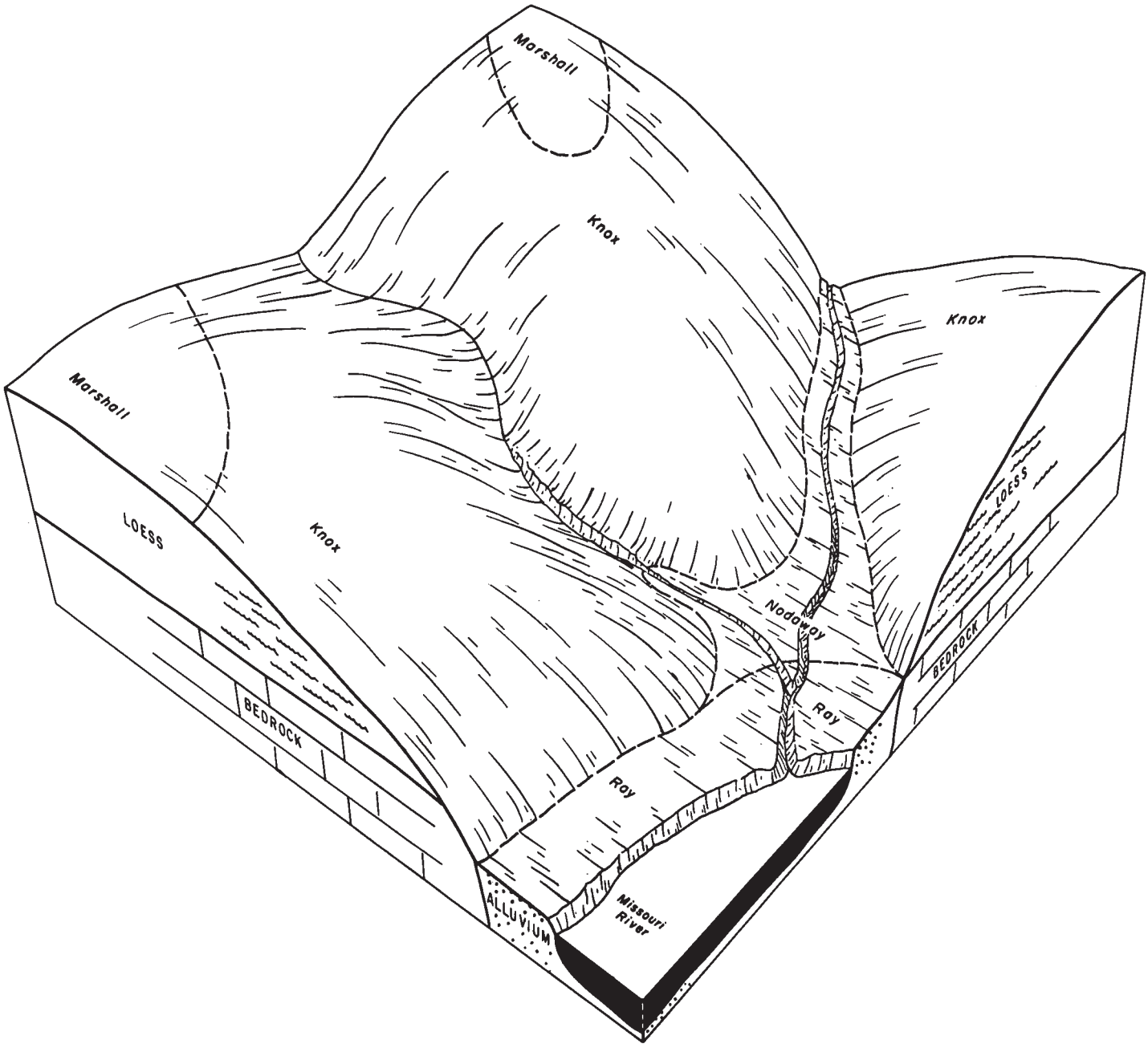

***Figure 4.*—Relationship of soils in association 2 and the underlying material.**

ginsville soils, 21 percent (fig. 7); and minor soils, the remaining 48 percent.

Marshall and Higginsville soils formed in silty loess that ranges from about 90 feet in thickness in the northern part of the association to about 8 feet thick in the southern part. The Marshall soils are silty, moderately permeable, well drained, and gently sloping to strongly sloping. They are on ridges and the upper part of hillsides. The Higginsville soils are silty, slowly permeable, somewhat poorly drained, and sloping to strongly sloping. They are on ridges and hillsides.

The minor soils include nearly all of the other soils that are common to Lafayette County on uplands and small stream bottoms. These soils formed in loessal, alluvial, and residual materials. On uplands they are gently sloping to strongly sloping and are in small to large areas on ridges and hillsides. They range from deep to shallow and from loamy to clayey. The level or nearly level bottom land soils are in very small to large areas along small streams. These minor soils are all deep and range from loamy to clayey. Included are very small areas of minor soils on small stream terraces or benches.

The main enterprises are cash-grain farming, raising livestock, and dairying. Corn, soybeans, small grains,

Figure 5.—**Young orchard on Knox silt loam. Orchards are numerous on soils of association 2.**

and meadow plants and a limited amount of timber are the principal crops. Because these deep loamy soils are gently sloping on wide ridges and sloping to strongly sloping on long hillsides, sheet erosion is a major hazard. Management that includes intensive erosion-control practices is needed.

4. Blackoar-Otter-Nodaway Association

Nearly level, loamy, poorly drained and moderately well drained soils on bottom lands

This association consists of level or nearly level soils on bottom lands along Davis Creek in the southeastern part of the county and along Salt Creek in the northeastern part (fig. 8).

This association makes up about 3 percent of the county. Blackoar and Otter soils, in about equal proportions, make up about 75 percent of the association; Nodaway soils, 7 percent; and Colo, Kennebec, Higginsville, Marshall and other minor soils, the remaining 18 percent.

All of these soils formed in alluvium, and all are level or nearly level. Blackoar and Otter soils are loamy, moderately permeable, and poorly drained. They are on broad areas on the flood plains. The Nodaway soils are loamy, moderately permeable, and moderately well drained. They are on natural levees along old stream channels.

The main enterprise is cash-grain farming. Corn, soybeans, and grain sorghum are the principal crops. A limited amount of timber is also produced, mainly in very small, odd-shaped areas along old stream channels.

Flooding is a major hazard on all the soils of this association; however, the floods commonly occur early in spring, and second plantings can usually be made. Management that includes both drainage and land smoothing practices is essential. This association has many miles of manmade stream channels.

5. Winfield-Sampsel Association

Gently sloping to steep, loamy, moderately well drained and somewhat poorly drained soils on uplands

This association consists mainly of gently sloping to steep soils in the southern and western parts of the county. Some soils, along small stream bottoms, are level to nearly level (fig. 9).

A number of active limestone quarries that produce crushed limestone and numerous inactive limestone quarries, both large and small, are in this association. Good roads serve all parts of the association.

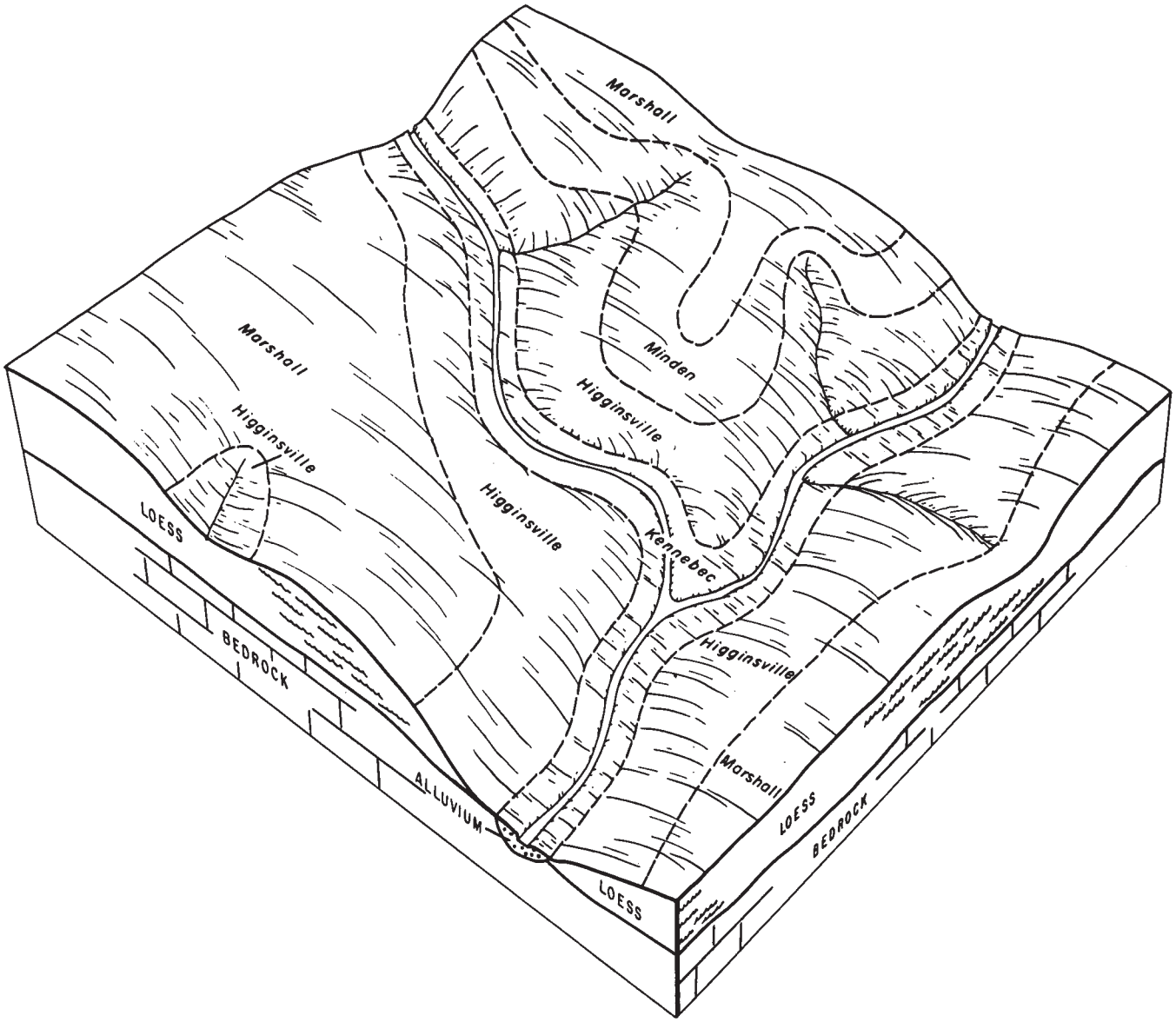

Figure 6.—**Relationship of soils in association 3 and the underlying material.**

This association makes up about 18 percent of the county. Winfield soils make up about 36 percent of the association; Sampsel soils, 29 percent; and less extensive soils, the remaining 35 percent.

The Winfield soils formed in loess 3 or more feet thick (fig. 10). They are loamy, moderately permeable, and moderately well drained. They are gently sloping on ridges and sloping to moderately steep on hillsides throughout the association.

Sampsel soils formed mainly in shale residuum 4 feet or more in thickness; however, some loess is included in places. These soils are loamy, slowly permeable, and somewhat poorly drained. They are gently sloping to strongly sloping on hillsides throughout the association.

The less extensive soils of this association are Higginsville, Leslie, McGirk, Sogn, and other minor soils that are common on small stream bottoms in uplands of the county. Leslie soils are loamy, slowly permeable, and somewhat poorly drained; McGirk soils are loamy, slowly or very slowly permeable, and somewhat poorly drained; and Sogn soils are loamy, moderately permeable, and somewhat excessively drained. The Sogn soils are in areas where surfaces or ledges of limestone, shale, or sandstone bedrock are exposed.

The main enterprise is the raising of livestock. Principal crops are corn, soybeans, grain sorghum, small grains, meadow and pasture plants, and a limited amount of timber. Deep, silty and clayey, sloping to moderately steep soils and shallow, silty, moderately steep to steep soils make water erosion, both sheet and gully, a major hazard. Management that includes varied and intensive erosion-control practices is essential.

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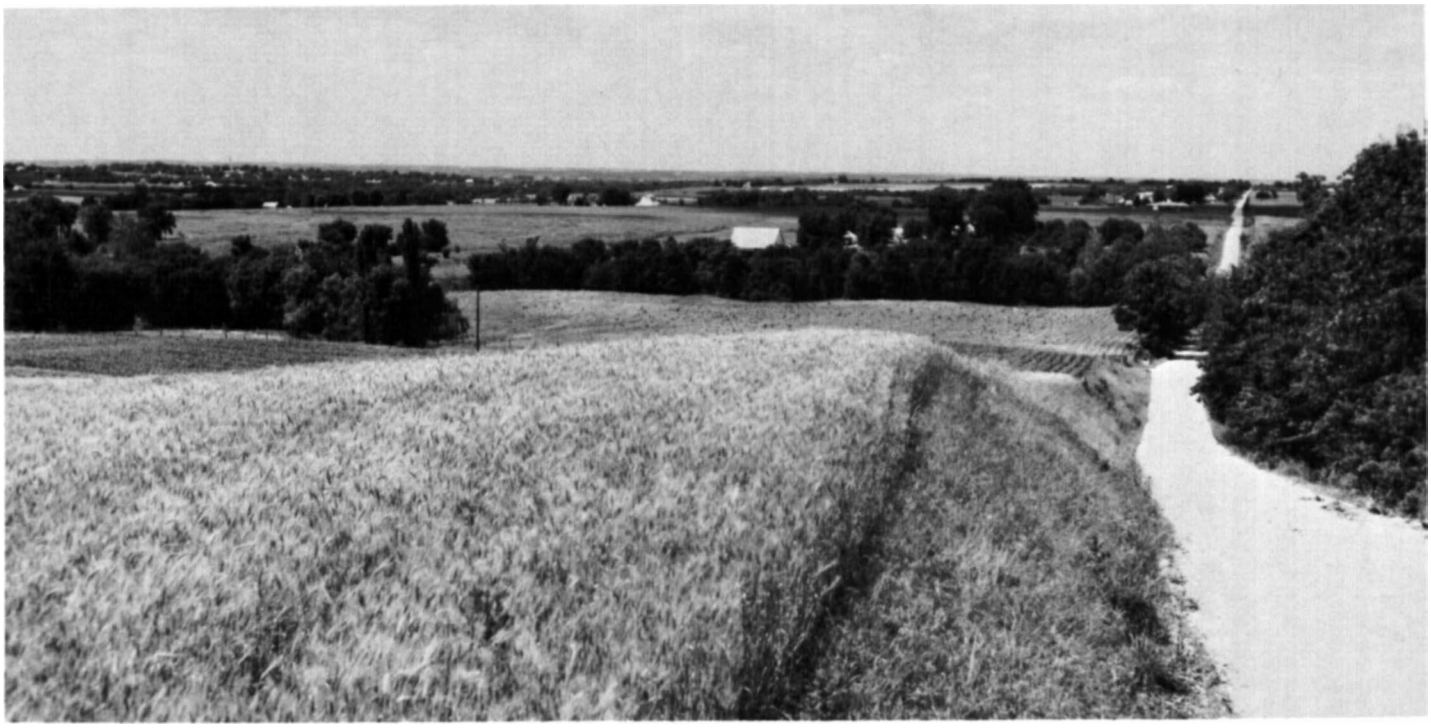

Figure 7.—**Cultivated crops and small areas of trees on Marshall soils in association 3.**

Descriptions of the Soils

This section describes the soil series and mapping units in Lafayette County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for moist soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Riverwash, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit in which the mapping has been placed. The page for the description of each capability unit can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*5*).[1]

Blackoar Series

The Blackoar series consists of deep, poorly drained, nearly level, loamy soils on bottom lands that are along small streams. These soils formed under tall grasses in 3 or more feet of alluvium. Beneath the alluvium is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is very dark gray silt loam about 21 inches thick. The subsoil, extending to a depth of 72 inches or more, is dark-gray silt loam that has dark yellowish-brown mottles in the lower part.

Permeability is moderate, and available water capacity and fertility are high. After rainy periods these soils are slow to dry.

Blackoar soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops.

Representative profile of Blackoar silt loam, in an area of Blackoar and Otter silt loams, in a plowed field 6 miles south of Higginsville, 190 feet north of Davis

[1] Italic numbers in parentheses refer to Literature Cited, p. 65.

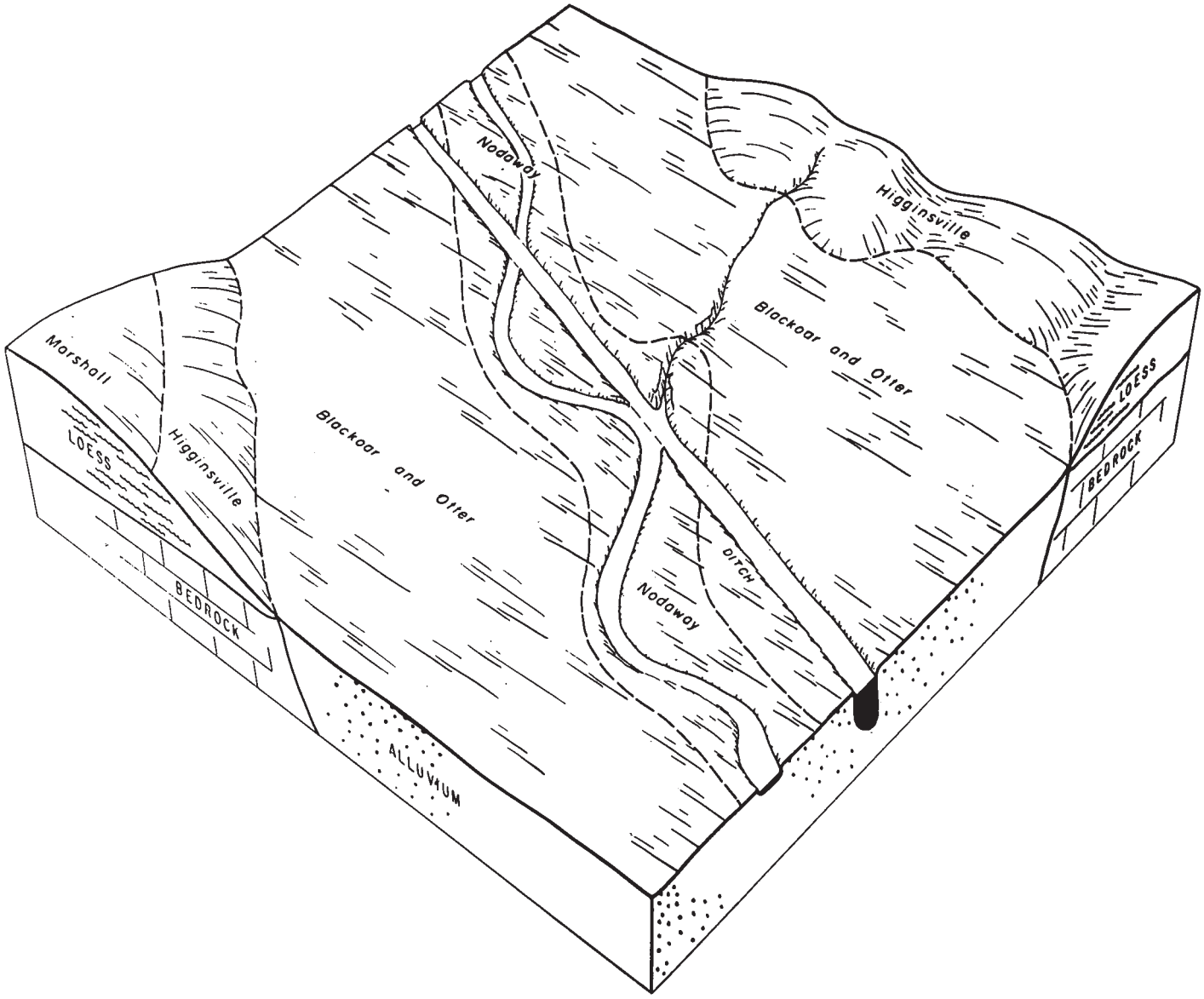

***Figure 8.*—Relationship of soils in association 4 and the underlying material.**

Creek ditch, and 30 feet east of road; in SW¼NW¼ of sec. 11, T. 48 N., R. 26 W.:

Ap—0 to 9 inches, very dark gray (10YR 3/1) silt loam; weak, fine, granular structure; friable; many roots; neutral; abrupt, smooth boundary.

A12—9 to 21 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; friable; few roots; slightly acid; clear, smooth boundary.

B21—21 to 31 inches, dark-gray (10YR 4/1) silt loam; common, faint, dark yellowish-brown (10YR 4/4) mottles; moderate, medium, granular structure; friable; few roots; medium acid; gradual, smooth boundary.

B22—31 to 72 inches, mottled dark-gray (10YR 4/1) and gray (10YR 6/1) silt loam; common, fine, faint, dark yellowish-brown (10YR 4/4) mottles and light-gray (10YR 7/1) coatings on peds; moderate, medium. granular structure; friable; few roots; medium acid.

The A horizon ranges from very dark gray to black in color and from 16 to 21 inches in thickness.

Blackoar soils have a coarser textured A horizon than the associated Colo and Zook soils.

Blackoar and Otter silt loams (Bk).—These nearly level soils are in tracts of 3 to 200 acres or more on bottom lands near small streams.

Each of these soils has the profile described as representative for its respective series.

Included with these soils in mapping were small areas of Bremer, Colo, and Kennebec soils.

These soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. Wetness is a major hazard. Management that includes drainage practices is needed in places. Capability unit IIw-1.

Booker Series

The Booker series consists of deep, nearly level, very poorly drained, clayey soils on stream terraces of small tributaries to the Missouri River. These soils formed under wetland grasses and trees in 5 or more feet of

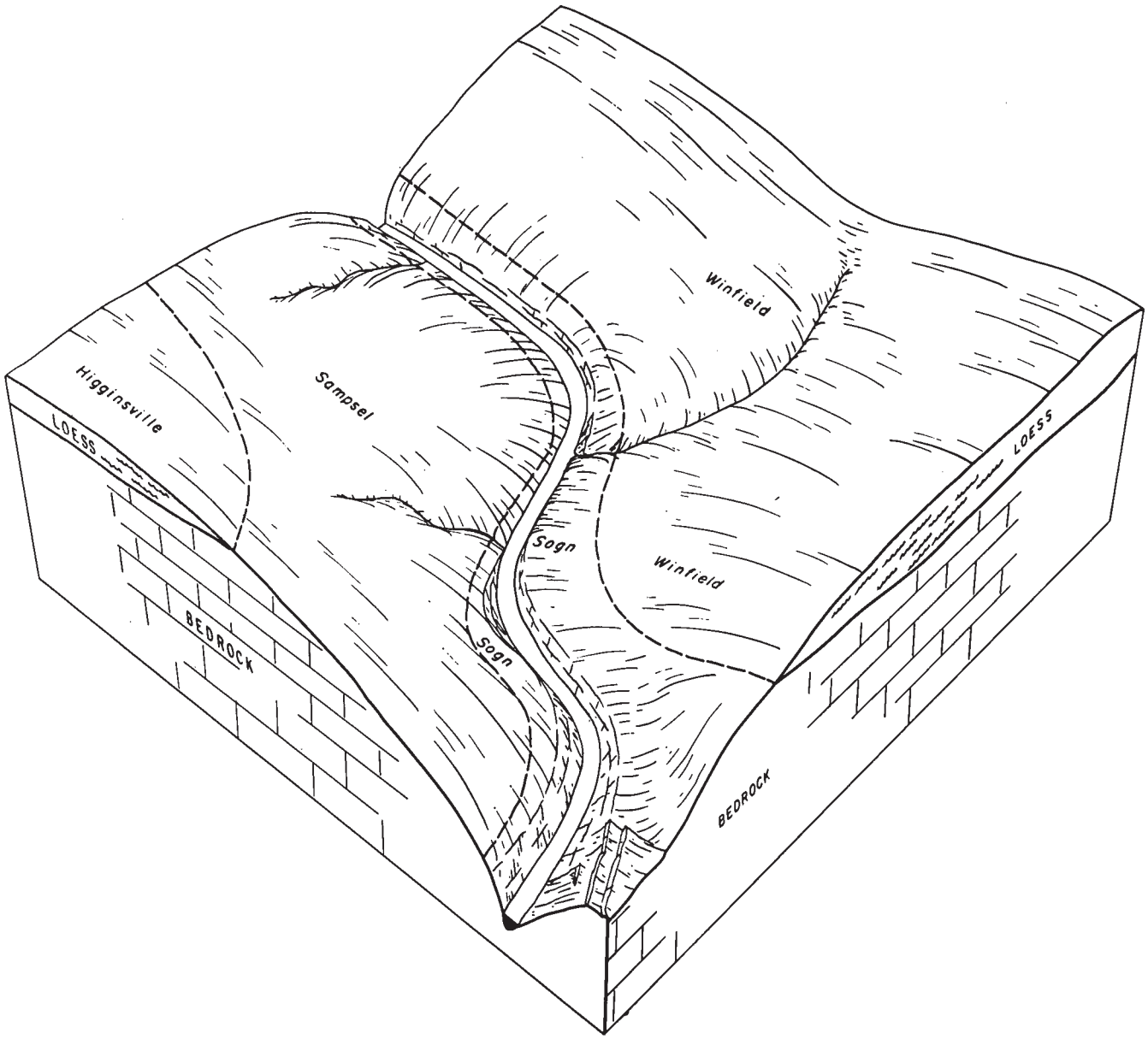

Figure 9.—**Relationship of soils in association 5 and the underlying material.**

alluvium that was deposited by slack water. Beneath the alluvium is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is black silty clay to clay about 12 inches thick. The subsoil is about 23 inches of black clay that has a few dark-gray mottles in the lower part. The underlying material, extending to a depth of more than 60 inches, is mottled black and dark-gray clay with many lime concretions.

Permeability is very slow, natural fertility is high, and available water capacity is moderate. Wetness and high content of clay make the production of cultivated crops difficult. The acreage of these soils in the county is very small. These soils are used mostly for cultivated crops and pasture.

Representative profile of Booker silty clay (1 percent slopes), in a cornfield 2 miles south of Wellington; in the center of sec. 27, T. 50 N., R. 28 W.:

Ap—0 to 5 inches, black (10YR 2/1) silty clay; strong, medium, granular structure; firm; many roots; neutral; abrupt, smooth boundary.

A12—5 to 12 inches, black (10YR 2/1) clay; strong, fine, angular blocky structure; very firm; common roots; shiny faces of peds; neutral; gradual, smooth boundary.

B21—12 to 24 inches, black (10YR 2/1) clay; strong, fine and medium, angular blocky structure; very firm; few roots; shiny faces of peds; neutral; gradual, smooth boundary.

B22—24 to 35 inches, black (10YR 2/1) clay; few, fine, distinct dark-gray (5Y 4/1) mottles; strong, fine and coarse, angular blocky structure; very firm; neutral; gradual, wavy boundary.

Figure 10.—**Winfield soils formed in 3 or more feet of windblown material over limestone.**

C—35 to 66 inches, mottled black (10YR 2/1) and dark-gray (5Y 4/1) clay; strong, fine and medium, subangular blocky structure; very firm; many lime concretions; moderately alkaline.

The Ap horizon ranges from clay to silty clay.
Booker soils have a finer textured A horizon than the associated Bremer and Moniteau soils.

Booker silty clay (Bo).—This nearly level soil is on low benches along small tributaries of the Missouri River. Areas are 3 to 20 acres in size.

Included with this soil in mapping were very small areas of sloping soils on bench escarpments. In some areas erosion has removed some or all of the original surface layer from these escarpments.

The soil is only moderately well suited to cultivated crops. Wetness is a major hazard. Erosion is also a hazard in places. Management that includes drainage and erosion-control practices is needed. Capability unit IIIw–14.

Bremer Series

The Bremer series consists of deep, poorly drained, loamy soils on small stream terraces. Slopes are 1 to 5 percent. These soils formed under tall grasses in 3 or more feet of alluvium. Beneath the alluvium is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is black, friable silt loam about 17 inches thick. The subsoil, in sequence from the top, is 9 inches of black silty clay loam; 11 inches of very dark gray silty clay; 11 inches of mottled dark-gray and gray silty clay; and 12 inches of gray silty clay loam.

Permeability is slow to moderately slow, and natural fertility and available water capacity are high. Bremer soils are well suited to cultivated crops, pasture, trees, and wildlife. They are used mostly for cultivated crops.

Representative profile of Bremer silt loam, 1 to 5 percent slopes, 3½ miles north and 2 miles west of Higgins-

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Blackoar and Otter silt loams	40, 750	10. 1	Marshall silt loam, 9 to 14 percent slopes, severely eroded	4, 100	1. 0
Booker silty clay	430	. 1	McGirk silt loam, 2 to 5 percent slopes	1, 800	. 5
Bremer silt loam, 1 to 5 percent slopes	4, 350	1. 1	McGirk silt loam, 5 to 9 percent slopes, eroded	3, 200	. 8
Colo silty clay loam	4, 400	1. 1	Minden silt loam, 1 to 5 percent slopes	12, 900	3. 2
Dockery silt loam	300	(1)	Modale silt loam	520	. 1
Haynie silt loam	4, 100	1. 0	Moniteau silt loam, 1 to 4 percent slopes	580	. 1
Higginsville silt loam, 5 to 9 percent slopes	4, 100	1. 0	Myrick silty clay	1, 250	. 3
Higginsville silt loam, 5 to 9 percent slopes, eroded	60, 000	14. 9	Nodaway silt loam	3, 550	. 9
Higginsville silt loam, 9 to 14 percent slopes, eroded	3, 250	. 8	Polo silt loam, 5 to 9 percent slopes, eroded	3, 850	1. 0
Higginsville silty clay loam, 5 to 9 percent slopes, severely eroded	2, 850	. 7	Polo silt loam, 9 to 14 percent slopes, eroded	1, 500	. 4
Hodge loamy fine sand	1, 800	. 5	Ray silt loam	760	. 2
Kennebec silt loam	7, 600	1. 9	Riverwash	1, 100	. 3
Knox silt loam, 2 to 5 percent slopes	3, 500	. 9	Sampsel silty clay loam, 2 to 5 percent slopes	510	. 1
Knox silt loam, 5 to 9 percent slopes, eroded	8, 600	2. 1	Sampsel silty clay loam, 5 to 9 percent slopes, eroded	20, 250	5. 0
Knox silt loam, 9 to 14 percent slopes, eroded	2, 900	. 7	Sampsel silty clay loam, 5 to 9 percent slopes, severely eroded	3, 450	. 9
Knox silt loam, 9 to 14 percent slopes, severely eroded	6, 000	1. 5	Sampsel silty clay loam, 9 to 14 percent slopes, eroded	1, 550	. 4
Knox silt loam, 14 to 20 percent slopes, eroded	3, 000	. 7	Sarpy fine sand	375	. 1
Knox silt loam, 14 to 20 percent slopes, severely eroded	2, 200	. 5	Snead silty clay loam, 9 to 14 percent slopes, eroded	1, 900	. 5
Knox silt loam, 20 to 25 percent slopes, eroded	5, 500	1. 4	Sogn silty clay loam, 5 to 14 percent slopes	2, 250	. 6
Knox silt loam, 20 to 25 percent slopes, severely eroded	1, 800	. 4	Sogn silty clay loam, 14 to 25 percent slopes	3, 800	. 9
Leslie silt loam, 2 to 5 percent slopes	2, 400	. 6	Waldron silty clay loam	2, 200	. 5
Leslie silt loam, 5 to 9 percent slopes, eroded	2, 600	. 6	Waubonsie and Haynie soils	2, 300	. 6
Leta silty clay	3, 700	. 9	Winfield silt loam, 2 to 5 percent slopes	6, 800	1. 7
Macksburg silt loam, 0 to 5 percent slopes	27, 000	6. 7	Winfield silt loam, 5 to 9 percent slopes, eroded	16, 600	4. 1
Macksburg silt loam, 2 to 5 percent slopes, eroded	1, 800	. 4	Winfield silt loam, 9 to 14 percent slopes, eroded	7, 700	1. 9
Mandeville silt loam, 4 to 9 percent slopes, eroded	1, 750	. 4	Winfield silt loam, 14 to 20 percent slopes, eroded	1, 300	. 3
Mandeville silt loam, 9 to 14 percent slopes, eroded	1, 000	. 3	Winfield silty clay loam, 5 to 9 percent slopes, severely eroded	2, 850	. 7
Marshall silt loam, 2 to 5 percent slopes	45, 750	11. 3	Winfield silty clay loam, 9 to 14 percent slopes, severely eroded	2, 800	. 7
Marshall silt loam, 5 to 9 percent slopes, eroded	27, 500	6. 8	Zook silty clay loam	540	. 1
Marshall silt loam, 5 to 9 percent slopes, severely eroded	1, 500	. 4	Water	3, 200	. 8
Marshall silt loam, 9 to 14 percent slopes, eroded	5, 800	1. 4	Mine pits and dumps	445	. 1
			Total	404, 160	100. 0

[1] Less than 0.1 percent.

ville, 900 feet east of county road and 30 feet north of fence row; in the SE¼SE¼SW¼ of sec. 15, T. 50 N., R. 26 W.:

Ap—0 to 7 inches, black (10YR 2/1) silt loam; moderate, fine, granular structure; friable; many roots; slightly acid; abrupt, smooth boundary.

A12—7 to 17 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; friable; many roots; slightly acid; clear, smooth boundary.

B1t—17 to 26 inches, black (10YR 2/1) silty clay loam; moderate, fine, subangular blocky structure; firm; common roots; strongly acid; clear, smooth boundary.

B21t—26 to 37 inches, very dark gray (10YR 3/1) light silty clay; moderate, fine, angular blocky structure; firm; common roots; few black concretions; medium acid; gradual, smooth boundary.

B22t—37 to 48 inches, mottled dark-gray (10YR 4/1) and gray (10YR 5/1) light silty clay; strong, medium, angular blocky structure; firm; few roots; very dark gray (10YR 3/1) coatings on faces of peds; few yellowish-brown (10YR 5/6) stains; few black concretions; strongly acid; gradual, smooth boundary.

B3—48 to 60 inches, gray (10YR 6/1) silty clay loam; weak, coarse, subangular blocky structure; firm; dark-gray (10YR 4/1) coatings on faces of peds and in root channels; few yellowish-brown stains; medium acid.

The A horizon ranges from black to very dark gray. The solum ranges from 3½ to 5 feet in thickness.

Bremer soils have a darker colored A horizon than the associated Moniteau soils.

Bremer silt loam, 1 to 5 percent slopes (BrB).—This soil is on stream terraces in tracts of 3 to 50 acres that are downslope from Higginsville, Marshall, and Minden soils.

Included with this soil in mapping were small areas of eroded or steeper Bremer soils.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. Erosion is a major hazard in some places, and wetness, caused by poor surface drainage, is a major hazard in other places. Management that includes both erosion-control and drainage practices is needed. Capability unit IIw–2.

Colo Series

The Colo series consists of deep, poorly drained, nearly level, loamy soils on bottom lands that are along streams. These soils formed under tall grasses in 3 or more feet

of alluvium. Beneath the alluvium is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is silty clay loam about 29 inches thick. The upper 5 inches is very dark brown and the lower 24 inches is black. The underlying material, extending to a depth of 60 inches, is very dark gray silty clay loam.

Permeability is moderately slow, and available water capacity and natural fertilty are high.

Colo soils are well suited to cultivated crops, but they are somewhat slow to dry after rainy periods. They are very well suited to pasture, trees, and wildlife habitat. They are used mostly for cultivated crops.

Representative profile of Colo silty clay loam in a field of clover 1.3 miles south of junction of National Interstate Highway 70 and State Route 13, 775 feet east of State Route 13, and 100 feet north of private road; in the SW¼ of sec. 1, T. 48 N., R. 26 W.:

Ap—0 to 5 inches, very dark brown (10YR 2/2) silty clay loam; weak, fine, granular structure; firm; many roots; neutral; abrupt, smooth boundary.

A12—5 to 29 inches, black (10YR 2/1) silty clay loam; strong, fine, angular blocky structure; firm; few roots; many, small, soft concretions; common dark reddish-brown (5YR 3/3) stains on faces of peds and in old root channels; slightly acid; clear, smooth boundary.

AC—29 to 60 inches, very dark gray (10YR 3/1) silty clay loam; strong, fine, angular blocky structure; firm; few, large, hard, dark concretions and many, small, soft concretions; common dark reddish-brown (5YR 3/3) stains on faces of peds; slightly acid.

The A horizon ranges from silty clay loam to heavy silt loam.

Colo soils have a finer textured A horizon than the associated Kennebec, Blackoar, and Otter soils.

Colo silty clay loam (Co).—This nearly level soil is on bottom lands that are along small streams. Areas are 3 to more than 100 acres in size.

Included with this soil in mapping were small areas of Kennebec, Bremer, Blackoar, and Otter soils.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. Wetness is a major hazard, and drainage is needed in some places. Capability unit IIw–1.

Dockery Series

The Dockery series consists of deep, somewhat poorly drained, nearly level, loamy soils on bottom lands along the Missouri River. These soils formed under hardwood trees in 3 or more feet of alluvium.

In a representative profile the surface layer is very dark grayish-brown silt loam about 9 inches thick. It is underlain by about 33 inches of silt loam. The upper 11 inches of this underlying material is dark grayish brown; the next 12 inches is mottled light brownish gray and very dark grayish brown; next is 10 inches of light brownish gray, mottled dark brown. The lower 8 inches is very dark gray silty clay loam mottled dark brown.

Permeability is moderate to moderately slow, and natural fertility and available water capacity are high. Dockery soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops.

Representative profile of Dockery silt loam in a cultivated field, 800 feet northeast of Waterloo and about 500 feet north of old highway 24; near the center of SE¼ SE¼SE¼ of sec. 17, T. 50 N., R. 28 W.:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; very friable; common roots; medium acid; clear, smooth boundary.

C1—9 to 20 inches, dark grayish-brown (10YR 4/2) silt loam; fine, granular structure; very friable; few roots; many pores; neutral; clear, smooth boundary.

C2—20 to 32 inches, mottled light brownish-gray (10YR 6/2) and very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; very friable; few roots; many pores; neutral; clear, smooth boundary.

C3—32 to 42 inches, light brownish-gray (10YR 6/2) silt loam; common, fine and medium, distinct, dark-brown (7.5YR 3/2) mottles; moderate, fine, granular structure; friable; neutral; clear, smooth boundary.

C4—42 to 60 inches, very dark gray (10YR 3/1) silty clay loam; few, fine, faint, dark-brown mottles; moderate, fine, granular structure; firm; neutral.

The Ap horizon ranges from silt loam to light silty clay loam. The C horizon is typically silt loam or light silty clay loam, but lenses, less than 6 inches in diameter, of coarser or finer textured material are common.

Dockery soils have a finer textured A horizon than the associated Hodge and Sarpy soils. Dockery soils have a coarser textured A horizon than the associated Leta and Myrick soils.

Dockery silt loam (Do).—This nearly level soil is on bottom lands in tracts of 10 to 200 acres along the Missouri River.

Included with this soil in mapping were a few very small areas of other soils common to the bottom lands along the Missouri River.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. It has a minor wetness hazard and is subject to overflow and flooding. Capability unit IIw–1.

Haynie Series

The Haynie series consists of deep, nearly level, moderately well drained to well drained, loamy soils on bottom lands of the Missouri River. These soils formed in 4 or more feet of very recent alluvium. Vegetation has had little effect on the formation of these soils.

In a representative profile the surface layer is dark grayish-brown silt loam about 9 inches thick. The underlying material, extending to a depth of 60 inches, is stratified dark grayish-brown and very dark gray silt loam.

Permeability is moderate, and natural fertility and available water capacity are high. Haynie soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops, and for a limited acreage of pasture or trees.

Representative profile of Haynie silt loam in cultivated field 1½ miles northwest of Wellington and about 200 feet south of drainage ditch; in SW. corner of the NE¼SE¼ of sec. 9, T. 50 N., R. 28 W.:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, very fine, granular structure; very friable; moderately alkaline; clear, smooth boundary.

C1—9 to 38 inches, dark grayish-brown (10YR 4/2) silt loam that is stratified with common, thin, 1/8-inch lenses of very dark gray (10YR 3/1) and that contains some spots of dark reddish-brown (5YR 3/4) silt

loam; weak, very fine, granular structure; very friable; moderately alkaline; gradual, smooth boundary.
C2—38 to 60 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, subangular blocky structure; friable; moderately alkaline; discontinuous, clayey strata.

Haynie soils range from very fine sandy loam to coarse silt loam to a depth of 3 feet.

Haynie soils have a coarser textured A horizon than the associated Leta, Myrick, and Waldron soils.

Haynie silt loam (Ha).—This nearly level soil is on bottom lands in tracts of 3 to 300 acres or more along the Missouri River.

Included with this soil in mapping were a few small areas of other soils that are common on bottom lands along the Missouri River.

This soil is suited to cultivated crops, pasture, trees, and wildlife habitat. It has no major hazards, but is subject to overwash and flooding. Capability unit I–1.

Higginsville Series

The Higginsville series consists of deep, somewhat poorly drained, loamy soils on ridgetops and hillsides on uplands. Slopes are 5 to 14 percent. These soils formed under tall prairie grasses in loess that is more than 8 feet thick in most places. Beneath the loess is limestone, shale, or sandstone.

In a representative profile the surface layer is black silt loam about 10 inches thick. The subsoil is about 31 inches of silty clay loam. The upper 9 inches is dark gray and very dark gray and is mottled grayish brown in the lower part; the next 13 inches is dark grayish brown, dark yellowish brown, and grayish brown; and the lower 9 inches is mottled gray and yellowish brown. The underlying material is gray silty clay loam mottled with faint yellowish brown.

Permeability is slow, and natural fertility and available water capacity are high. Small wet spots or seepy areas are somewhat common on the Higginsville soils. These spots occur mainly during wet periods and they dry slowly.

Higginsville soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops and pasture.

Representative profile of Higginsville silt loam, 5 to 9 percent slopes, in a cornfield 4 miles west and 1 mile north of Higginsville, 120 feet east and 520 feet north of the center of the NW¼ of sec. 33, T. 50 N., R. 26 W.:

Ap—0 to 7 inches, black (10YR 2/1) silt loam; moderate, fine, granular structure; friable; common roots; slightly acid; abrupt, smooth boundary.
A12—7 to 10 inches, black (10YR 2/1) silt loam; moderate, fine, granular structure; friable; common roots; slightly acid; clear, smooth boundary.
B1t—10 to 14 inches, very dark gray (10YR 3/1) silty clay loam, very dark grayish brown (10YR 3/2) kneaded; moderate, medium, granular structure; friable; common roots; medium acid; clear, smooth boundary.
B21t—14 to 19 inches, very dark gray (10YR 3/1) silty clay loam, very dark grayish brown (10YR 3/2) kneaded; common, fine, faint, grayish-brown mottles; moderate, medium, subangular blocky structure; firm; common roots; common, hard, black concretions; medium acid; clear, smooth boundary.
B22t—19 to 32 inches, mottled dark grayish-brown (10YR 4/2), dark yellowish-brown (10YR 4/4), and grayish-brown (10YR 5/2) silty clay loam; moderate, medium, subangular blocky structure; firm; common roots; thin discontinuous clay films on most ped surfaces and dark grayish-brown (10YR 4/2) coatings on faces of peds; many, hard, black concretions; strongly acid; gradual, smooth boundary.
B3t—32 to 41 inches, mottled gray (10YR 5/1) and yellowish-brown (10YR 5/4) silty clay loam; weak, medium, subangular blocky structure; firm; many, hard, black concretions; dark-gray (10YR 4/1) coatings in old root channels; medium acid; gradual, smooth boundary.
C—41 to 87 inches, gray (10YR 5/1) silty clay loam; common, medium, faint, yellowish-brown mottles; massive; firm; common, hard, black concretions; medium acid.

The A horizon ranges from black to very dark gray.

Higginsville soils have a finer textured B horizon than the associated Macksburg soils, and they are steeper than the nearby Marshall and Minden soils.

Higginsville silt loam, 5 to 9 percent slopes (HgC).—This soil is on hillsides in tracts of 3 to 25 acres. Areas are downslope from gently sloping Marshall, Macksburg, and Minden soils and upslope from Sampsel soils, or they are adjacent to soils on bottom lands that are along streams. This soil has the profile described as representative for the series. Slopes are either concave or convex.

Included with this soil in mapping were a few small areas of Marshall, Minden, and Macksburg soils and very small areas where the soil is gently sloping or strongly sloping.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIIe–2.

Higginsville silt loam, 5 to 9 percent slopes, eroded (HgC2).—This soil is on hillsides in tracts of 3 to 150 acres. Areas are downslope from gently sloping Marshall, Macksburg, and Minden soils and upslope from Sampsel soils, or they are adjacent to soils on bottom lands that are along streams. Most slopes are convex, but some are concave.

This soil has a profile similar to the one described as representative for the series, except that erosion has removed much of the original black silt loam surface layer, and plowing has mixed the remaining part of the surface layer with some of the upper part of the very dark gray silty clay loam that originally was part of the subsoil.

Included with this soil in mapping were a few small areas where the soil is uneroded and a few small areas of Sampsel soils.

This soil is moderately well suited to cultivated crops and well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIIe–2.

Higginsville silt loam, 9 to 14 percent slopes, eroded (HgD2).—This soil is on hillsides in tracts of 3 to 30 acres. Areas are downslope from sloping Higginsville soils and upslope from Sampsel soils, or they are adjacent to soils on bottom lands. Most slopes are convex, but some are concave.

This soil has a profile similar to that described as representative for the series, but erosion has removed much of the black silt loam surface layer. Plowing has mixed the remaining part of the original surface layer with the very dark gray silty clay loam that originally was the upper part of the subsoil.

Included with this soil in mapping were a few small areas of sloping Higginsville soils and a few very small areas of severely eroded Higginsville soils.

This soil is somewhat poorly suited to cultivated crops and well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–5.

Higginsville silty clay loam, 5 to 9 percent slopes, severely eroded (HnC3).—This soil is on hillsides in tracts of 3 to 30 acres. Areas are downslope from gently sloping Marshall, Macksburg, and Minden soils and upslope from Sampsel soils, or they are adjacent to soils on bottom lands. Most slopes are convex, but some are concave.

This soil has a profile similar to that described as representative for the series, but erosion has removed the black silt loam surface layer, and the very dark gray silty clay loam that was originally the upper part of the subsoil is now at the surface.

Included with this soil in mapping were a few small areas of uneroded Higginsville soil and a few small areas of Sampsel soils.

This soil is poorly suited to cultivated crops but is moderately well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–5.

Hodge Series

The Hodge series consists of deep, nearly level, somewhat excessively drained, sandy soils on bottom lands of the Missouri River. These soils formed under tall grasses in 4 or more feet of alluvium.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 7 inches thick. The underlying material, extending to a depth of 60 inches, is stratified, grayish-brown loamy fine sand.

Permeability is rapid. Natural fertility and available water capacity are low. Hodge soils are moderately well suited to cultivated crops and pasture. They are well suited to trees and wildlife habitat. They are used mostly for cultivated crops and pasture.

Representative profile of Hodge loamy fine sand in a field that formerly was cultivated, 8 miles west of Lexington and 1 mile north of the Missouri River, at a point about 100 feet north of road and 50 feet west of fence (hedge); in the SW. corner of sec. 33, T. 51 N., R. 28 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak granular structure; very friable; neutral; calcareous; clear, smooth boundary.

C—7 to 60 inches, grayish-brown (10YR 5/2) loamy fine sand; weak granular structure; very friable; moderately alkaline; calcareous.

The A horizon ranges from grayish brown to pale brown and from fine sand to light fine sandy loam.

Hodge soils have a coarser textured A horizon than the associated Dockery, Haynie, Leta, Ray, and Waldron soils.

Hodge loamy fine sand (Ho).—This nearly level soil is in tracts of 5 to 100 acres on bottom lands of the Missouri River.

Included with this soil in mapping were small areas of other soils common to bottom lands along the River.

This soil is moderately well suited to cultivated crops and pasture. It is well suited to trees and wildlife habitat. Drought is a major hazard, but soil blowing also is a hazard in some seasons. This soil is subject to flooding. Capability unit IIIs–1.

Kennebec Series

The Kennebec series consists of deep, moderately well drained, nearly level, loamy soils on bottom lands that are along streams. These soils formed under grasses in 3 or more feet of alluvium. Beneath the alluvium is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is silt loam to a depth of 36 inches. The upper 14 inches is very dark brown and the lower 22 inches is very dark grayish brown. Below this, black silt loam extends to a depth of 60 inches.

Permeability is moderate, and natural fertility and available water capacity are high. Kennebec soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops and pasture.

Representative profile of Kennebec silt loam (1 percent slopes) in a plowed field 5½ miles south of Higginsville, 50 feet south of farm road and 1,200 feet east of Highway 13; in SE¼SW¼ of sec. 1, T. 48 N., R. 26 W.:

Ap—0 to 6 inches, very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; friable; many roots; many worm castings; neutral; abrupt, smooth boundary.

A12—6 to 14 inches, very dark brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; few roots; slightly acid; gradual, smooth boundary.

A13—14 to 36 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; few roots; slightly acid; abrupt, smooth boundary.

A14b—36 to 60 inches, black (10YR 2/1) silt loam; strong, medium, granular structure; friable; slightly acid.

Kennebec soils have a darker colored A horizon than the associated Nodaway soils.

Kennebec silt loam (Ke).—This nearly level soil is on bottom lands in tracts of 3 to 200 acres or larger that are along small streams.

Included with this soil in mapping were a few small areas of Nodaway soils.

This soil is well suited to cultivated crops, pasture, trees, or wildlife habitat. It has no major hazards; however, it is subject to infrequent flooding. Capability unit I–1.

Knox Series

The Knox series consists of deep, well-drained, loamy soils on ridges and hillsides on uplands. Slopes range from 2 to 25 percent, but slopes of 5 to 20 percent are most common. These soils formed under deciduous hardwoods in 10 to 90 or more feet of loess. Beneath the loess is limestone, shale, or sandstone bedrock. Gullies, some of which are 40 or more feet deep, are numerous.

In a representative profile the surface layer is very dark grayish-brown silt loam about 6 inches thick. The subsoil is about 38 inches thick. The upper 8 inches is dark-brown silt loam, the next 8 inches is dark-brown silty clay loam, and the lower 22 inches is dark-brown

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silt loam. The underlying material is silt loam, extending to a depth of 93 inches. It is dark brown in the upper 9 inches and yellowish brown in the lower 40 inches.

Permeability is moderate, and natural fertility and available water capacity are high. Knox soils are well suited to cultivated crops if slopes are not too steep. They are well suited to pasture, orchards, trees for woodland, and wildlife habitat. They are used in about equal proportions for cultivated crops, orchards, pasture, and woodland trees.

Representative profile of Knox silt loam, 5 to 9 percent slopes, eroded, in a field of corn one-half mile south of Napoleon and 100 feet northwest of turn in road; in SE¼SW¼ of sec. 24, T. 50 N., R. 29 W.:

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; many roots; mildly alkaline; abrupt, smooth boundary.

B1—6 to 14 inches, dark-brown (10YR 4/3) silt loam, weak, fine, subangular blocky structure; friable; common roots; few fine pores; neutral; clear, smooth boundary.

B2t—14 to 22 inches, dark-brown (10YR 4/3) silty clay loam; moderate, medium, subangular blocky structure; friable; many roots; few fine pores; thin discontinuous clay films on faces of peds; neutral; clear, smooth boundary.

B3—22 to 44 inches, dark-brown (10YR 4/3) silt loam; weak, coarse, subangular blocky structure; friable; common roots; few fine pores; very pale brown (10YR 7/3) silt coatings on faces of peds; neutral; gradual, smooth boundary.

C1—44 to 53 inches, dark-brown (10YR 4/3) silt loam; massive; friable; few roots; few fine pores; slightly acid; clear, smooth boundary.

C2—53 to 93 inches plus, yellowish-brown (10YR 5/4) silt loam; massive; firm; medium acid.

The Ap horizon ranges from very dark grayish-brown to dark-brown silt loam and, where severely eroded, dark-brown silty clay loam. Sheet erosion ranges from none to severe but is dominantly moderate and severe.

Knox soils lack the mottled B horizon of the associated Winfield soils. They have a lighter colored Ap horizon than the associated Marshall soils.

Knox silt loam, 2 to 5 percent slopes (KnB).—This soil is on ridgetops in tracts of 3 to 80 acres that are upslope from the sloping Knox soils. Slopes are convex.

Included with this soil in mapping were a few small areas of Knox soils that are eroded or that are more sloping than this soil.

This soil is well suited to cultivated crops, orchards, pasture, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIe–1.

Knox silt loam, 5 to 9 percent slopes, eroded (KnC2).—This soil is on hillsides in tracts of 5 to 100 acres that are downslope from gently sloping Knox soils and upslope from strongly sloping Knox soils. This soil has the profile described as representative for the series. Slopes are convex.

Included with this soil in mapping were a few small areas that have had the surface and subsurface layers removed by erosion. In these areas, the surface layer ranges from silt loam to silty clay loam.

This soil is well suited to cultivated crops, orchards, pasture, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed (fig. 11). Capability unit IIIe–1.

Knox silt loam, 9 to 14 percent slopes, eroded (KnD2).—This soil is on hillsides in tracts of 3 to 70 acres that are downslope from sloping Knox soils and upslope from moderately steep and steep Knox soils. Slopes are convex. This soil has a profile similar to that described as representative for the series, but erosion has removed much or all of the very dark grayish-brown silt loam surface layer.

Included with this soil in mapping were a few small areas of sloping or moderately steep Knox soils.

This soil is moderately well suited to cultivated crops and orchards and is well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–1.

Knox silt loam, 9 to 14 percent slopes, severely eroded (KnD3).—This soil is on hillsides in tracts of 3 to 60 acres that are downslope from sloping Knox soils and upslope from moderately steep and steep Knox soils. Slopes are convex. This soil has a profile similar to that described as representative for the series, but erosion has removed most of the original surface layer, and the dark-brown silt loam that was originally the upper part of the subsoil is exposed at the surface. In some places, erosion has removed this part also and has exposed the dark-brown silty clay loam part of the subsoil.

Included with this soil in mapping were a few small areas of sloping or moderately steep Knox soils and some very small areas of Knox soils that are gullied.

This soil is somewhat poorly suited to cultivated crops and orchards. It is well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–4.

Knox silt loam, 14 to 20 percent slopes, eroded (KnE2).—This soil is on hillsides in tracts of 3 to 200 acres. Areas are downslope from strongly sloping Knox soils and upslope from steep Knox soils, or they are adjacent to bottom lands along streams or rivers. Slopes are convex. This soil has a profile similar to that described as representative for the series, but erosion has removed much or all of the original dark grayish-brown surface layer, and the dark-brown silt loam subsoil is exposed in places.

Included with this soil in mapping were a few small areas of uneroded Knox soils and small areas of strongly sloping or steep Knox soils.

This soil is poorly suited to intensively cultivated crops; however, it is well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit VIe–1.

Knox silt loam, 14 to 20 percent slopes, severely eroded (KnE3).—This soil is on hillsides in tracts of 3 to 80 acres. Areas are downslope from strongly sloping Knox soils and upslope from steep Knox soils, or they are adjacent to bottom lands along streams or rivers. Slopes are convex. This soil has a profile similar to that described as representative for the series, but erosion has removed most of the original surface layer, and the dark-brown silt loam that originally was the upper part of the subsoil is exposed at the surface. In places, erosion has also removed the upper part of the subsoil, and the dark-

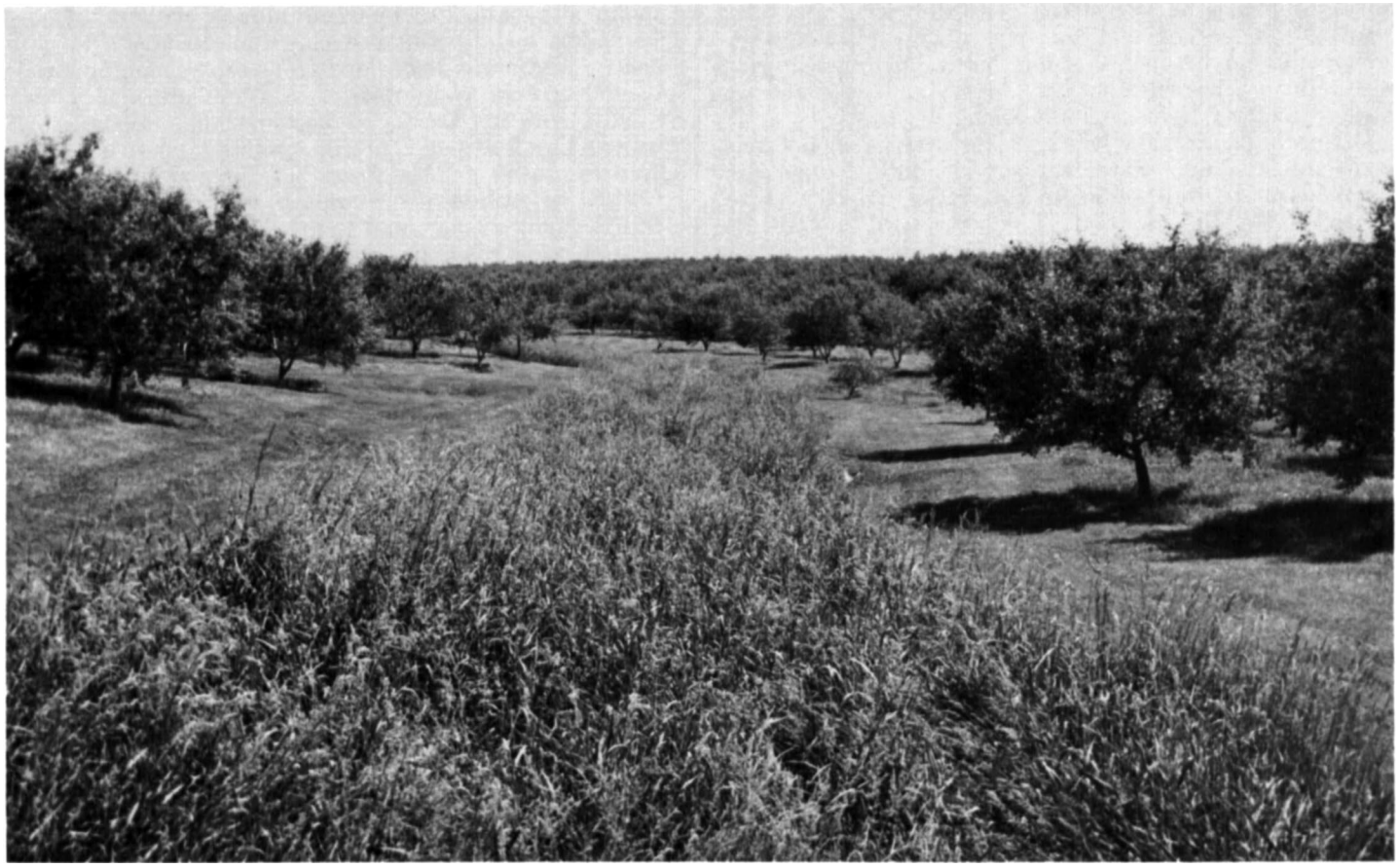

Figure 11.—Reed canarygrass waterway in apple orchard on Knox soils helps control erosion.

brown silty clay loam that originally was the lower part of the subsoil is at the surface.

Included with this soil in mapping were small areas of Knox soils that are gullied.

This soil is unsuited to cultivated crops; however, it is moderately well suited to orchards and is well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit VIe–4.

Knox silt loam, 20 to 25 percent slopes, eroded (KnF2).—This soil is on hillsides in tracts of 3 to 300 acres. Areas are downslope from moderately steep Knox soils and upslope from steep Sogn soils, or they are adjacent to bottom lands along streams or rivers. Slopes are convex. This soil has a profile similar to that described for the series, but erosion has removed the original very dark grayish-brown silt loam surface layer, and the dark-brown silt loam that originally was a part of the subsoil is exposed at the surface.

Included with this soil in mapping were some small areas of moderately steep Knox soils.

This soil is well suited to trees and wildlife habitat and moderately well suited to pasture. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit VIIe–1.

Knox silt loam, 20 to 25 percent slopes, severely eroded (KnF3).—This soil is on the sides and very narrow bottoms of large gullies and deep ravines. Areas are long and narrow and are adjacent to areas of Knox soils that have other slope gradients and that differ in degrees of erosion.

This soil has a profile similar to that described as representative for the series, but erosion has removed the surface layer, and the dark-brown silt loam that originally was part of the subsoil is exposed at the surface.

This soil is poorly suited to pasture. It is well suited to wildlife habitat or quality trees. Steep slopes, however, make harvesting of timber difficult. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit VIIe–4.

Leslie Series

The Leslie series consists of deep, somewhat poorly drained, loamy soils on ridges and hillsides on uplands. Slopes range from 2 to 9 percent. These soils formed under mixed tall grasses and deciduous trees in 6 or more feet of loess. Beneath the loess is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is very dark grayish-brown silt loam about 12 inches thick. The subsurface layer is about 7 inches of silt loam. It is dark grayish brown in the upper 4 inches and grayish brown in the lower 3 inches. The subsoil, in sequence from the

top, is 3 inches of very dark grayish-brown silty clay loam; 14 inches of mottled dark-gray and yellowish-brown silty clay; 6 inches of mottled light brownish-gray and yellowish-brown silty clay loam; and 34 inches or more of mottled light-gray silt loam.

Permeability is slow, natural fertility is moderately high, and available water capacity is high. Leslie soils are moderately well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops and pasture.

Representative profile of Leslie silt loam, 2 to 5 percent slopes, in a formerly cultivated field 6 miles south of Mayview, at a point 85 feet north and 100 feet east of the SW. corner of sec. 12, T. 48 N., R. 27 W.:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable; common roots; few, fine, soft, dark concretions; medium acid; abrupt, smooth boundary.

A12—7 to 12 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine and medium, granular structure; friable; common roots; few, fine, soft, dark concretions; medium acid; clear, smooth boundary.

A21—12 to 16 inches, dark grayish-brown (10YR 4/2) silt loam that has discontinuous streaks of very dark grayish brown (10YR 3/2); moderate, thin, platy structure; friable; few roots; few, very fine, soft, dark concretions; medium acid; clear, smooth boundary.

A22—16 to 19 inches, grayish-brown (10YR 5/2) silt loam; common, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, very fine, subangular blocky structure; friable; few roots; light-gray (10YR 7/1) coatings on peds; common, fine, dark concretions; strongly acid; clear, smooth boundary.

B1—19 to 22 inches, very dark grayish-brown (10YR 3/2) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/4) mottles; moderate, fine, subangular blocky structure; friable; few roots, light-gray (10YR 7/1) coatings in old root channels; common, fine, dark concretions; strongly acid; clear, smooth boundary.

B21t—22 to 36 inches, mottled dark-gray (10YR 4/1) and yellowish-brown (10YR 5/6) silty clay; moderate, fine, subangular blocky structure; firm; few roots; common dark concretions; continuous clay films; medium acid; clear, smooth boundary.

B22t—36 to 42 inches, mottled light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) silty clay loam; firm; common, small and large, dark concretions; neutral; clear, smooth boundary.

B3—42 to 76 inches, mottled light-gray (10YR 6/1) and yellowish-brown (10YR 5/6) silt loam; firm; common dark concretions; neutral.

Leslie soils have a lighter colored surface layer than the associated Macksburg soils. They have a darker colored Ap horizon than the associated McGirk soils. Leslie soils have a thick A2 horizon that is not present in the associated Winfield soils.

Leslie silt loam, 2 to 5 percent slopes (LeB).—This soil is on ridgetops and hillsides in tracts of 4 to 50 acres that are downslope from gently sloping Macksburg soils and upslope from sloping Leslie soils. Slopes are convex. This soil has the profile described as representative for the series.

Included with this soil in mapping were a few small areas of Macksburg soils and very small areas of nearly level or sloping Leslie soils.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIe–5.

Leslie silt loam, 5 to 9 percent slopes, eroded (LeC2).—This soil is on hillsides and ridgetops in tracts of 3 to 50 acres. Areas are downslope from gently sloping Leslie soils and upslope from McGirk or Winfield soils, or they are adjacent, in places, to bottom lands along small streams. This soil has a profile similar to that described as representative for the series but has a thinner surface layer. In a few places erosion has removed most of the original surface layer, and mottled, gray and yellowish-brown silty clay is exposed at the surface.

Included with this soil in mapping were small areas of Winfield and McGirk soils and gently sloping and strongly sloping Leslie soils.

This soil is moderately well suited to cultivated crops and pasture and well suited to trees and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIIe–5.

Leta Series

The Leta series consists of deep, somewhat poorly drained, nearly level, clayey soils on bottom lands along the Missouri River. These soils formed in 3 or more feet of recent, stratified alluvium. Vegetation has had little effect on the formation of these soils.

In a representative profile the surface layer is about 13 inches thick. It is very dark gray silty clay in the upper 8 inches and very dark grayish-brown silty clay loam in the lower 5 inches. The underlying material is dark-gray silty clay in the upper 12 inches and stratified, grayish-brown very fine sandy loam extending below that to a depth of 60 inches.

Permeability is moderately slow, natural fertility is moderately high, and available water capacity is moderate. Leta soils are moderately well suited to cultivated crops; however, fieldwork is somewhat difficult during wet periods. These soils are well suited to pasture, trees, and wildlife habitat. They are used mostly for cultivated crops.

Representative profile of Leta silty clay in a cultivated field, 2 miles west of Lexington, north of the Missouri River, at a point 200 feet east of farm road in the NW. corner of the SE¼SW¼ of sec. 31, T. 51 N., R. 27 W.:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silty clay; weak, fine, granular structure; firm; moderately alkaline; abrupt, smooth boundary.

A12—8 to 13 inches, very dark grayish-brown (2.5Y 3/2) silty clay loam; moderate, medium, subangular blocky structure; firm; mildly alkaline; clear, smooth boundary.

C1—13 to 25 inches, dark-gray (10YR 4/1) silty clay; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; moderate, medium, subangular blocky structure; firm; mildly alkaline; clear, smooth boundary.

C2—25 to 60 inches, grayish-brown (10YR 5/2) very fine sandy loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; mildly alkaline.

The A horizon and upper part of the C horizon range from silty clay loam to silty clay. The lower part of the C horizon is silt loam or coarser material.

Leta soils have a finer textured A horizon than the associated Dockery, Haynie, Hodge, and Waubonsie soils.

Leta silty clay (Lt).—This nearly level soil is in tracts of 5 to 400 or more acres on bottom lands along the Mis-

souri River. Included in mapping were a few small areas of other soils that are common to bottom lands along the Missouri River.

This soil is suited to cultivated crops, pasture, trees, and wildlife habitat. It dries somewhat slowly after rainy periods. Capability unit IIw–2.

Macksburg Series

The Macksburg series consists of deep, somewhat poorly drained, loamy soils on ridgetops and hillsides on uplands. Slopes range from 0 to 5 percent, but slopes of 3 to 5 percent are most common. These soils formed under tall grasses in 8 or more feet of loess. Beneath the loess is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is black silt loam about 15 inches thick. The subsoil is about 29 inches thick. The upper 6 inches is very dark gray silty clay loam; the next 11 inches is very dark grayish-brown and dark-brown silty clay loam; the next 7 inches is very dark gray, grayish-brown, and yellowish-brown silty clay loam; and the lower 5 inches is very dark gray, yellowish-brown, and light-gray silt loam. The underlying material is mixed yellowish-brown and light-gray silt loam.

Permeability is moderately slow, and natural fertility and available water capacity are high. Macksburg soils are very well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops.

Representative profile of Macksburg silt loam, 0 to 5 percent slopes, in a cultivated field 1½ miles east and 1½ miles south of Odessa, 250 feet north and 100 feet east of SW. corner of SW¼ of sec. 8, T. 48 N., R. 27 W.:

Ap—0 to 8 inches, black (10YR 2/1) silt loam; moderate, fine, granular structure; friable; few roots; neutral; abrupt, smooth boundary.

A12—8 to 15 inches, black (10YR 2/1) silt loam; moderate, very fine, subangular blocky structure; friable; few roots; medium acid; gradual boundary.

B1t—15 to 21 inches, very dark gray (10YR 3/1) light silty clay loam; few, fine, faint, dark-brown mottles; moderate, very fine, subangular blocky structure; friable; few roots; few dark concretions; strongly acid; gradual boundary.

B21t—21 to 32 inches, mixed very dark grayish-brown (10YR 3/2) and dark-brown (10YR 4/3) silty clay loam, dark grayish brown (2.5Y 4/2) kneaded; strong, fine, subangular blocky structure; firm; few roots; thin discontinuous clay films; very dark gray (10YR 3/1) coatings on organic stains on vertical surfaces of peds, cleavage planes, and cracks; strongly acid; gradual, smooth boundary.

B22t—32 to 39 inches, mixed very dark gray (10YR 3/1), grayish-brown (10YR 5/2), and yellowish-brown (10YR 5/6) light silty clay loam; weak, coarse, blocky structure; firm; few roots; common dark concretions; vertical surfaces of old cracks and ped surfaces have very dark gray (10YR 3/1) organic stains; medium acid; gradual, smooth boundary.

B3—39 to 44 inches, mixed very dark gray (10YR 3/1), yellowish-brown (10YR 5/6), and light-gray (10YR 7/2) silt loam; weak, coarse, subangular blocky structure; very dark gray (10YR 3/1) organic stains in old cracks; thin patchy clay films; common dark concretions; medium acid; clear, smooth boundary.

C—44 to 61 inches, mixed yellowish-brown (10YR 5/6) and light-gray (10YR 7/2) silt loam; massive; friable; common concretions; slightly acid.

The A horizon ranges from black in uneroded areas to very dark gray in eroded areas.

Macksburg soils are coarser textured in the lower part of the B horizon than the associated Higginsville soils. They have more gray and less brown in the A and B horizons than the associated Marshall soils.

Macksburg silt loam, 0 to 5 percent slopes (MaB).—This soil is in tracts of 3 to 130 acres that are upslope from sloping Higginsville soils. It has the profile described as representative for the series.

Included with this soil in mapping were very small areas of Higginsville soils.

This soil is very well suited to cultivated crops, pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIe–5.

Macksburg silt loam, 2 to 5 percent slopes, eroded (MaB2).—This soil is on ridgetops in tracts of 3 to 75 acres or more that are upslope from sloping Higginsville soils. Slopes are convex.

This soil has a profile similar to that described as representative for the series, but erosion has removed part of the original black silt loam surface layer. Plowing has mixed some of the very dark gray light silty clay loam of the upper part of the subsoil with the remaining part of the surface layer. A few very small areas are severely eroded.

This soil is moderately well suited to cultivated crops and well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIIe–5.

Mandeville Series

The Mandeville series consists of moderately deep, well drained to moderately well drained, loamy soils on hillsides on uplands. Slopes range from 4 to 14 percent, but slopes of 4 to 9 percent are most common. These soils formed under deciduous hardwoods in 26 to 50 inches of residuum. Beneath the residuum is interbedded sandy shale and limestone bedrock.

In a representative profile the surface layer is dark-brown silt loam about 5 inches thick. The subsoil, in sequence from the top, is 4 inches of dark-brown and grayish-brown silty clay loam; 5 inches of brown and yellowish-brown silty clay loam; 5 inches of mottled grayish-brown and yellowish-brown silt loam; and 5 inches of mottled gray, yellowish-brown, and dark-gray silt loam. The underlying material, extending to a depth of 26 inches, is mottled gray, brownish-yellow, and dark-gray silt loam that has a few fragments of sandy shale and limestone. Below this is interbedded sandy shale and limestone.

Permeability is moderate, and natural fertility and available water capacity are low. Mandeville soils are only moderately suited to cultivated crops; however, they are well suited to pasture, trees, and wildlife habitat. They are used mostly for cultivated crops and pasture, in about equal proportions. To a limited extent, they are also used for trees and wildlife habitat.

Representative profile of Mandeville silt loam, 4 to 9 percent slopes, eroded, in a meadow 3 miles south and 3 miles west of Odessa, approximately 200 feet north of

road and 75 feet west of hedgerow; in the SE. corner of SW¼SE¼ of sec. 16, T. 48 N., R. 28 W.:

Ap—0 to 5 inches, dark-brown (10YR 4/3) silt loam; weak, very fine, granular structure; friable; common roots; slightly acid; abrupt, smooth boundary.

B21t—5 to 9 inches, mixed dark-brown (10YR 4/3) and grayish-brown (10YR 5/2) silty clay loam; moderate, very fine, angular blocky structure; firm; few roots; slightly acid; clear, smooth boundary.

B22t—9 to 14 inches, mixed brown (10YR 5/3) and yellowish-brown (10YR 5/4) silty clay loam; weak, fine, subangular blocky structure; firm; few roots; common, very small dark concretions; neutral; clear, smooth boundary.

B31—14 to 19 inches, mottled grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; firm; few, thin patchy clay films; common to numerous, very small, dark concretions; few small fragments of weathered sandy shale; mildly alkaline; clear, smooth boundary.

B32—19 to 24 inches, mottled gray (10YR 6/1), yellowish-brown (10YR 5/4), and dark-gray (10YR 4/1) silt loam; moderate, fine, subangular blocky structure; firm; few roots; common, small, dark concretions; few fragments of weathered sandy shale; mildly alkaline; clear, smooth boundary.

C—24 to 26 inches, mottled gray (10YR 6/1), brownish-yellow (10YR 6/6), and dark-gray (10YR 4/1) silt loam; moderate, medium, subangular blocky structure; hard; few dark concretions; few fragments of weathered sandy shale; few fragments of limestone; mildly alkaline; abrupt, smooth boundary.

R—26 inches, interbedded sandy shale and limestone.

The A horizon is commonly silt loam, but ranges to loam in some places.

Mandeville soils have a lighter colored A horizon than the associated Snead soils.

Mandeville silt loam, 4 to 9 percent slopes, eroded (MdC2).—This soil is on hillsides in tracts of 5 to 40 acres or more. Areas are downslope from Winfield, Leslie, and Sampsel soils and upslope from Sogn soils, or they are adjacent to bottom lands along small streams. This soil has the profile described as representative for the series. Slopes are convex.

Included with this soil in mapping were small areas of Winfield and Sogn soils.

This soil is moderately suited to cultivated crops and well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control measures is needed. Capability unit IVe–7.

Mandeville silt loam, 9 to 14 percent slopes, eroded (MdD2).—This soil is on hillsides in tracts of 5 to 30 acres or more. Areas are downslope from Winfield and sloping Mandeville soils and are upslope from Sogn soils, or they are adjacent to bottom lands along small streams.

Included with this soil in mapping were a few small areas where the surface layer is loam.

This soil is well suited to pasture, trees, or wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit VIe–7.

Marshall Series

The Marshall series consists of deep, well-drained, loamy soils on ridges and hillsides on uplands. Slopes range from 2 to 14 percent, but slopes of 2 to 9 percent are most common.

These soils formed under tall prairie grasses in loess that in most places is more than 8 feet thick. Beneath the loess is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is about 17 inches thick. The upper 6 inches is very dark brown silt loam; the next 7 inches is black silt loam; and the lower 4 inches is very dark grayish-brown light silty clay loam. The subsoil is silty clay loam about 31 inches thick. The upper 17 inches is dark brown and the lower 14 inches is dark yellowish brown. The underlying material, extending to a depth of more than 60 inches, is yellowish-brown silt loam.

Permeability is moderate, and natural fertility and available water capacity are high. Marshall soils are well suited to cultivated crops, pasture, trees, and wildlife habitat (fig. 12). They are used mostly for cultivated crops and pasture.

Representative profile of Marshall silt loam, 2 to 5 percent slopes, in a cultivated field 2 miles south of Dover, approximately 50 feet north of T. road; in the SW¼SE¼NE¼ of sec. 6, T. 50 N., R. 25 W.:

Ap—0 to 6 inches, very dark brown (10YR 2/2) silt loam; weak, fine, granular structure; friable; common roots; neutral; clear boundary.

A12—6 to 13 inches, black (10YR 2/1) silt loam, very dark brown (10YR 2/2) crushed; moderate, very fine, subangular blocky structure; friable; common roots; slightly acid; clear, smooth boundary.

A3—13 to 17 inches, very dark grayish-brown (10YR 3/2) light silty clay loam; strong, fine, subangular blocky structure; friable; common roots; medium acid; clear, smooth boundary.

B21—17 to 27 inches, dark-brown (10YR 3/3) light silty clay loam that has a few very dark grayish-brown (10YR 3/2) peds; weak, very fine, subangular blocky structure; friable; common roots; medium acid; clear, smooth boundary.

B22—27 to 34 inches, dark-brown (10YR 3/3) silty clay loam, dark brown (10YR 3/3) crushed; a few very dark grayish-brown (10YR 3/2) peds; weak, fine, subangular blocky structure; friable; common roots; medium acid; clear, smooth boundary.

B23—34 to 48 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; common roots; medium acid; clear, smooth boundary.

C1—48 to 69 inches, yellowish-brown (10YR 5/4) silt loam; moderate, very fine, subangular blocky structure and weak, fine, platy structure; firm; common roots; many small pores and old root channels, some filled with dark yellowish-brown material; few black concretions; slightly acid; clear, smooth boundary.

C2—69 to 75 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, fine, granular structure; firm; common roots; many fine pores; black concretions; medium acid; clear, smooth boundary.

C3—75 to 103 inches, yellowish-brown (10YR 5/4) silt loam; common, fine, distinct, very pale brown (10YR 7/3) mottles; moderate, very fine, subangular blocky structure and weak, fine, platy structure; firm; common roots in upper part to few roots in lower part; many small pores; common black concretions; slightly acid.

The A horizon ranges from very dark brown to black silt loam or silty clay loam.

Marshall soils have less mottling in the B horizon than the associated Minden soils. They have a coarser textured B horizon than the associated Higginsville and Macksburg soils. They have a thicker dark A horizon than the associated Knox soils.

Marshall silt loam, 2 to 5 percent slopes (MhB).—This soil is on ridgetops and hillsides in tracts of 40 to 300

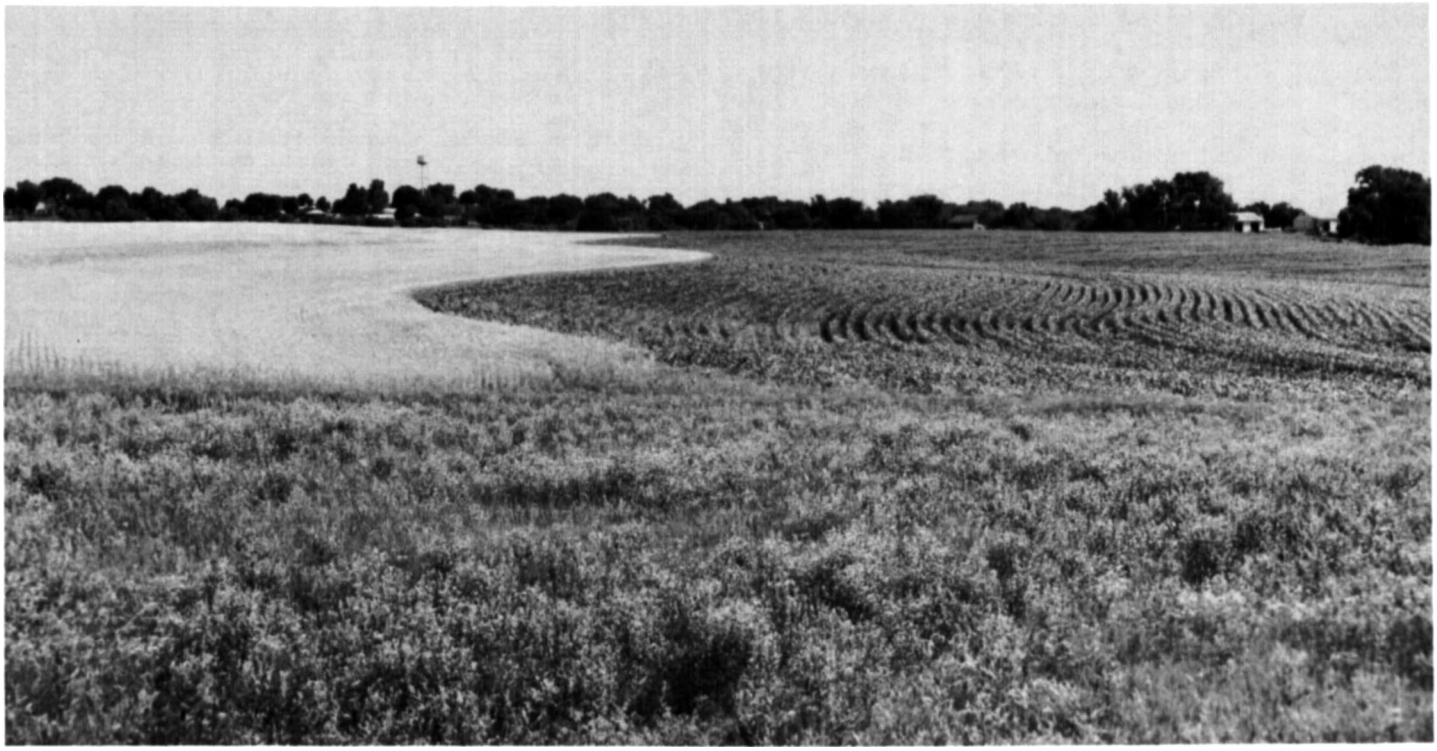

Figure 12.—**Cultivated crops, pasture, and trees on Marshall soils.**

acres or more that are upslope from sloping Marshall, Minden, Knox, and Higginsville soils. This soil has the profile described as representative for the series. Slopes are convex.

Included with this soil in mapping were a few small areas of Minden and Knox soils.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIe–1.

Marshall silt loam, 5 to 9 percent slopes, eroded (MhC2).—This soil is on hillsides in tracts of 15 to 100 acres that are downslope from gently sloping Marshall soils and upslope from Minden, Higginsville, and Knox soils. Slopes are convex.

This soil has a profile similar to that described as representative for the series, but erosion has removed the very dark brown surface layer and the black upper part of the subsoil. Plowing has mixed some of the former upper part of the light silty clay loam subsoil with the remaining very dark grayish-brown light silty clay loam that was originally the lower part of the surface layer.

Included with this soil in mapping were a few small tracts of Minden, Higginsville, and Knox soils.

This soil is moderately well suited to cultivated crops and well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIIe–1.

Marshall silt loam, 5 to 9 percent slopes, severely eroded (MhC3).—This soil is on hillsides in tracts of 3 to 20 acres that are downslope from gently sloping Marshall soils and upslope from Minden, Higginsville, and Knox soils. Slopes are convex.

This soil has a profile similar to that described as representative for the series, but erosion has removed all of the surface and subsurface layers, and the dark-brown silty clay loam that originally was the upper part of the subsoil is now at the surface.

Included with this soil in mapping were a few very small areas of Higginsville, Minden, and Knox soils.

This soil is moderately well suited to cultivated crops and well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–4.

Marshall silt loam, 9 to 14 percent slopes, eroded (MhD2).—This soil is on hillsides in tracts of 3 to 50 acres or more that are downslope from sloping Marshall soils and upslope from Higginsville and Knox soils. Slopes are convex.

This soil has a profile similar to that described as representative for the series, but erosion has removed the very dark brown surface layer and the black upper part of the subsurface layer. Plowing has mixed some of the light silty clay that was originally the upper part of the subsoil with the remaining very dark grayish-brown light silty clay loam that was formerly the subsurface layer.

Included with this soil in mapping were a few very small areas of Higginsville and Knox soils.

The soil is moderately well suited to cultivated crops and well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that in-

cludes erosion-control practices is needed. Capability unit IVe–1.

Marshall silt loam, 9 to 14 percent slopes, severely eroded (MhD3).—This soil is on hillsides in tracts of 3 to 30 acres or larger that are downslope from sloping Marshall soils and upslope from Knox soils. Slopes are convex.

This soil has a profile similar to that described as representative for the series, but erosion has removed all of the surface and subsurface layers and the dark-brown silty clay loam that was originally the upper part of the subsoil is now at the surface.

Included with this soil in mapping were a few small areas of moderately steep Marshall soils.

This soil is moderately suited to cultivated crops. It is well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–4.

McGirk Series

The McGirk series consists of deep, somewhat poorly drained, loamy soils on uplands. These soils are on the tops and ends of ridges and on hillsides that are low lying. Slopes are 2 to 9 percent, but slopes of 4 to 8 percent are most common. These soils formed under deciduous hardwoods in loess colluvium and in 3 or more feet of alluvium. Beneath this material is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsurface layer is light brownish-gray silt loam about 4 inches thick. The subsoil is about 33 inches thick. The upper 11 inches is dark grayish-brown silty clay loam; the next 11 inches is dark grayish-brown silty clay; and the lower 11 inches is gray silty clay loam. The underlying material, extending to a depth of 88 inches, is light-gray silt loam.

Permeability is slow to very slow, natural fertility is somewhat low, and available water capacity is high. McGirk soils are moderately well suited to cultivated crops. They are well suited to pasture, trees, and wildlife habitat.

Representative profile of McGirk silt loam, 2 to 5 percent slopes, in a cultivated field 3½ miles south and 6 miles east of Odessa; 300 feet east and 20 feet north of SW. corner of sec. 13, T. 48 N., R. 27 W.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable; common roots; slightly acid; abrupt, smooth boundary.

A2—8 to 12 inches, light brownish-gray (10YR 6/2) silt loam; weak, medium, platy structure; friable; few small black concretions; few roots; very strongly acid; abrupt, smooth boundary.

B21t—12 to 23 inches, dark grayish-brown (10YR 4/2) silty clay loam; moderate, fine, subangular blocky structure; firm; common roots; grayish-brown (10YR 5/2) coatings on faces of peds; few small black concretions; very strongly acid; clear, smooth boundary.

B22t—23 to 34 inches, dark grayish-brown (10YR 4/2) silty clay; weak, fine, subangular blocky structure; very firm; few roots; thin clay films on faces of peds; dark yellowish-brown (10YR 4/4) stains; few, small, black concretions; strongly acid; clear, smooth boundary.

B23t—34 to 45 inches, gray (10YR 5/1) silty clay loam; many, fine, distinct, dark-brown (7.5YR 4/4) mottles; weak, medium, subangular blocky structure; firm; few roots; dark-gray (10YR 4/1) coatings in old root channels; few, small, black concretions; medium acid; clear, smooth boundary.

C1—45 to 83 inches, light-gray (10YR 6/1) silt loam; massive; firm; dark reddish-brown (5YR 3/4) and yellowish-red (5YR 4/8) stains; very dark gray (10YR 3/1) coatings in upper part of root channels and very dark gray (10YR 3/1) and dark-gray (10YR 4/1) coatings in lower part of root channels; common, small, black concretions; slightly acid; clear, smooth boundary.

C2—83 to 88 inches, light-gray (10YR 6/1) silt loam; streaks of very dark gray (10YR 3/1); massive; firm; few, fine, faint, yellowish-brown stains; slightly acid; abrupt, smooth boundary.

C3—88 to 91 inches, dark-gray (10YR 4/1) silty clay loam; weak, fine, subangular blocky structure; firm; dark reddish-brown (5YR 3/4) stains; few, small, black concretions; slightly acid; clear, smooth boundary.

C4—91 to 108 inches, gray (10YR 5/1) light silty clay loam; massive; firm; dark reddish-brown (5YR 3/4) stains; few, small, black concretions; slightly acid.

The Ap horizon ranges from dark grayish-brown silt loam to light brownish-gray silt loam or light silty clay loam.

McGirk soils have a lighter colored A horizon than the associated Higginsville, Leslie, and Minden soils. They have a light brownish-gray A2 horizon that is not present in the associated Winfield and Mandeville soils.

McGirk silt loam, 2 to 5 percent slopes (MkB).—This soil is on ridgetops, low-lying hillsides, and ends of ridges. Tracts are 3 to 80 acres in size and are downslope from gently sloping Macksburg, Leslie, and Minden soils and upslope from sloping Winfield, Sogn, and McGirk soils. Slopes are mostly convex, but some are concave. This soil has the profile described as representative for the series.

Included with this soil in mapping were a few small areas of gently sloping Leslie, Higginsville, and Minden soils and of sloping McGirk soils.

This soil is moderately well suited to cultivated crops. It is well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIe–2.

McGirk silt loam, 5 to 9 percent slopes, eroded (MkC2).—This soil is on low-lying hillsides in tracts of 3 to 80 acres. Areas are downslope from sloping Higginsville and Leslie soils, and upslope from Mandeville and Winfield soils and other soils that are common on bottom lands along streams.

This soil has a profile similar to that described as representative for the series, but erosion has removed much or all of the surface layer, and plowing has mixed the light brownish-gray silt loam, that was formerly the subsurface layer, with the dark grayish-brown silty clay loam that was originally the upper part of the subsoil. In a few small areas, erosion has removed the surface layer, and the dark grayish-brown silty clay loam that was originally the upper part of the subsoil is now at the surface.

Included with this soil in mapping were a few small areas of Mandeville and Winfield soils.

This soil is somewhat poorly suited to cultivated crops and is well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that in-

cludes erosion-control practices is needed. Capability unit IIIe–2.

Minden Series

The Minden series consists of deep, moderately permeable, somewhat poorly drained, loamy soils on ridgetops and hillsides on uplands. Slopes range from 1 to 5 percent, but slopes of 3 to 5 percent are most common. These soils formed under tall prairie grasses in 8 or more feet of loess in most places. Beneath the loess is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is about 24 inches thick. The upper 20 inches is very dark brown silt loam and the lower 4 inches is very dark grayish-brown silty clay loam. The subsoil is about 25 inches thick. In sequence from the top, the upper 6 inches is dark-brown silty clay loam; the next 13 inches is dark grayish-brown silt loam; and the lower 6 inches is gray silt loam. The underlying material is gray silt loam.

Permeability is moderate, and natural fertility and available water capacity are high. Minden soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops and pasture.

Representative profile of Minden silt loam, 1 to 5 percent slopes, in a cornfield, 1 mile north and 3 miles west of Higginsville; in the center of NE¼NW¼ of sec. 33, T. 50 N., R. 26 W.:

Ap—0 to 6 inches, very dark brown (10YR 2/2), silt loam; moderate, fine, granular structure; friable; many roots; medium acid; clear, smooth boundary.

A12—6 to 20 inches, very dark brown (10YR 2/2) silt loam; moderate, fine, granular structure; friable; common roots; many fine pores; medium acid; clear, smooth boundary.

A3—20 to 24 inches, very dark grayish-brown (10YR 3/2) light silty clay loam; weak, fine, subangular blocky structure; friable; common roots; strongly acid; clear, smooth boundary.

B21—24 to 30 inches, dark-brown (10YR 3/3) light silty clay loam, brown (10YR 4/3) crushed; moderate, fine, subangular blocky structure; friable; common roots; strongly acid; gradual, smooth boundary.

B22—30 to 43 inches, dark grayish-brown (10YR 4/2) silt loam; common, medium, distinct, grayish-brown (10YR 5/2) mottles that become more numerous with depth; moderate, medium, subangular blocky structure; firm; few roots; dark-gray (10YR 4/1) coatings on faces of peds, along root channels, and in pores; medium acid; clear, smooth boundary.

B3—43 to 49 inches, gray (10YR 5/1) silt loam; yellowish-brown (10YR 5/6) stains; massive; firm; few black concretions; dark-gray (10YR 4/1) coatings in root channels and pores; medium acid; clear, smooth boundary.

C—49 to 78 inches, gray (10YR 5/1) silt loam; yellowish-brown (10YR 5/6) stains; massive; few black concretions; medium acid.

The Ap horizon of Minden soils ranges from very dark brown silt loam in uneroded areas to very dark grayish-brown light silty clay loam in eroded areas.

Minden soils have more mottling in the B horizon than the associated Marshall soils. They have more brown in the A and B horizons than the associated Higginsville and Macksburg soils.

Minden silt loam, 1 to 5 percent slopes (MnB).—This soil is on ridgetops and hillsides in tracts of 3 to 200 acres. Areas are downslope from Marshall and Macksburg soils in some places and are upslope from Higginsville soils or sloping Minden soils. Slopes are convex.

Included with this soil in mapping were a few small areas of Macksburg and Higginsville soils.

This soil is very well suited to cultivated crops, pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIe–2.

Modale Series

The Modale series consists of deep, slowly permeable, moderately well drained to somewhat poorly drained, nearly level, loamy soils on bottom lands along the Missouri River. These soils formed in recent alluvium.

In a representative profile the surface layer is very dark grayish-brown silt loam about 8 inches thick. The next layer is about 16 inches of silt loam that is very dark grayish-brown in the upper 10 inches and dark grayish-brown in the lower 6 inches. The underlying material, extending to a depth of 60 inches, is stratified dark grayish-brown silty clay.

Modale soils are high in natural fertility, have high available water capacity, and are well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops.

Representative profile of Modale silt loam, 2 miles north and three-fourths of a mile west of Wellington, north of the Missouri River, 200 feet east and 25 feet north of the SW. corner of the E½SW¼ of sec. 5, T. 50 N., R. 28 W.:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine, granular structure; friable; many roots; mildly alkaline; abrupt, smooth boundary.

C1—8 to 12 inches, very dark grayish-brown (2.5Y 3/2) silt loam; weak, fine, granular structure; friable; stratified; abundant roots; mildly alkaline; clear, smooth boundary.

C2—12 to 18 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium, granular structure; friable; stratified; moderately alkaline; clear, smooth boundary.

C3—18 to 24 inches, dark grayish-brown (10YR 4/2) light silt loam; moderate, fine, granular structure; friable; mildly alkaline; clear, smooth boundary.

IIC4—24 to 60 inches, dark grayish-brown (10YR 4/2) silty clay; moderate to strong, angular blocky structure; very firm; moderately alkaline.

The A horizon is as much as about 10 inches in thickness in places. It ranges from very dark gray to very dark grayish brown. These soils are typically silt loam to a depth of 18 to 30 inches and are silty clay or clay below the silt loam.

Modale soils have a finer textured A horizon than the associated Hodge and Sarpy soils. Modale soils have a coarser textured A horizon than the associated Leta, Myrick, and Waldron soils.

Modale silt loam (Mo).—This nearly level soil is on bottom lands along the Missouri River. Tracts are 25 to 200 acres in size.

Included with this soil in mapping were a few small areas of other soils that are common to the bottom lands along the Missouri River.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. During wet periods, however, it is somewhat slow to dry after rainy periods. Capability unit IIw–1.

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Moniteau Series

The Moniteau series consists of deep, poorly drained, loamy soils on terraces along streams. Slopes are 1 to 4 percent. These soils formed under deciduous hardwoods in 3 or more feet of alluvium. Beneath the alluvium is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsurface layer is light brownish-gray silt loam about 8 inches thick. The subsoil is about 45 inches thick. In sequence from the top, the upper 5 inches is dark grayish-brown silt loam; the next 12 inches is light brownish-gray silty clay loam; and the lower 28 inches is mottled very dark gray and very pale brown silty clay loam.

Permeability is slow, natural fertility is somewhat low, and available water capacity is high. Moniteau soils are moderately well suited to cultivated crops. They are well suited to pasture, trees, and wildlife habitat. These soils are used mainly for trees.

Representative profile of Moniteau silt loam, 1 to 4 percent slopes, in a pasture, 3½ miles east and 2 miles south of Odessa, 100 feet northeast of field gate and 50 feet northwest of fence along county road M; NE¼SW¼ SW¼ of sec. 10, T. 48 N., R. 27 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; many roots; few, fine, black concretions; slightly acid; clear, smooth boundary.

A2—7 to 15 inches, light brownish-gray (10YR 6/2) silt loam; moderate, very fine, subangular blocky structure; friable; few roots; few dark-brown to black concretions; common fine pores; very strongly acid; clear, smooth boundary.

B1—15 to 20 inches, dark grayish-brown (10YR 4/2) heavy silt loam; few, fine, distinct, pale-brown (10YR 6/3) mottles; moderate, very fine, subangular blocky structure; friable; few roots; few dark-brown to black concretions; very strongly acid; clear, smooth boundary.

B21t—20 to 32 inches, light brownish-gray (10YR 6/2) silty clay loam; common, fine, distinct, dark grayish-brown (10YR 4/2) and very dark grayish-brown (10YR 3/2) mottles; moderate, fine, subangular blocky structure; friable; few roots; light-gray (10YR 7/2) silt coatings on faces of peds; few fine concretions; strongly acid; clear, smooth boundary.

B22t—32 to 60 inches, mottled very dark gray (10YR 3/1) and very pale brown (10YR 7/3) silty clay loam; massive; firm; many brown to black concretions that become more numerous with depth; old root channels, some as much as one-half inch in diameter, are filled with light-gray (10YR 7/2) silt loam; strongly acid.

The Ap horizon ranges from dark grayish-brown silt loam to dark-brown heavy silt loam or silty clay loam.

Moniteau soils have a lighter colored A horizon than the associated Bremer soils.

Moniteau silt loam, 1 to 4 percent slopes (MtB).—This soil is on stream terraces in tracts of 3 to 50 acres that are downslope from Winfield, Leslie, and McGirk soils and adjacent to soils on bottom lands along streams.

Included with this soil in mapping were a few small areas of soils on bottom lands.

This soil is moderately well suited to pasture, trees, and wildlife habitat. Wetness is a major limitation, and management that includes drainage practices is needed. Capability unit IIIw–2.

Myrick Series

The Myrick series consists of deep, poorly drained, nearly level clayey soils on bottom lands along the Missouri River. These soils have a high water table. They formed under wetland grasses and trees in about 2 or more feet of clayey sediment.

In a representative profile the surface layer is very dark gray silty clay about 8 inches thick. The next layer is 5 inches of very dark gray silty clay mottled with yellowish brown and grayish brown. The underlying material is grayish-brown very fine sandy loam mottled and stained with yellowish brown. A variable water table is at a depth of about 32 inches.

Permeability is moderate, natural fertility is moderately high, and available water capacity is moderate. Myrick soils are moderately well suited to cultivated crops; however, their low position and the high water table can make cultivation impractical in some seasons. They are well suited to pasture, trees, and wildlife habitat. They are mostly used for cultivated crops and pasture.

Representative profile of Myrick silty clay in a cultivated field 4 miles north of Wellington, north of the Missouri River; on the south-central edge of NE¼SW¼ NW¼ of sec. 27, T. 51 N., R. 28 W.:

Ap1—0 to 5 inches, very dark gray (10YR 3/1) silty clay, very dark grayish brown (10YR 3/2) kneaded; weak, medium, subangular blocky structure; firm; common roots; moderately alkaline; abrupt, smooth boundary.

Ap2—5 to 8 inches, very dark gray (2.5Y 3/1) silty clay; weak, fine, granular and subangular blocky structure; firm; common roots; moderately alkaline; abrupt, smooth boundary.

ACg—8 to 13 inches, very dark gray (2.5Y 3/1) light silty clay that has some pockets of grayish-brown (2.5Y 5/2) silt loam or very fine sandy loam; few yellowish-brown (10YR 5/6) and grayish-brown (2.5Y 5/2) mottles; weak, medium, subangular blocky structure; firm; common roots; moderately alkaline; abrupt, smooth boundary.

IIC1g—13 to 21 inches, stratified grayish-brown (2.5Y 5/2) very fine sandy loam; few, medium, yellowish-brown (10YR 5/6) mottles; single grained; few roots; moderately alkaline; gradual, smooth boundary.

IIC2g—21 to 36 inches, stratified grayish-brown (2.5Y 5/2) very fine sandy loam; common, medium, yellowish-brown (10YR 5/6) mottles and stains along strata partings and along root channels; single grained; friable; few roots in upper part; moderately alkaline.

The A horizon ranges from black to very dark grayish-brown silty clay loam, silty clay, and clay.

Myrick soils have a high water table that is not present in the associated Dockery, Haynie, Hodge, and Sarpy soils.

Myrick silty clay (My).—This nearly level soil is on bottom lands along the Missouri River. Tracts are 25 to 300 acres or larger in size.

Included with this soil in mapping were a few small areas of other soils common to bottom lands of the Missouri River.

This soil is not suited to cultivated crops. The high water table and the low position of this soil can make cultivation difficult in most seasons. This soil is well suited to pasture, trees, and wildlife habitat. Wetness is a major limitation, and drainage may be needed. This soil is also subject to flooding. Capability unit Vw–1.

Nodaway Series

The Nodaway series consists of deep, moderately well drained, nearly level, loamy soils on bottom lands along streams. These soils formed under deciduous trees and grasses in 3 or more feet of alluvium. Beneath the alluvium is limestone, shale, or sandstone.

In a representative profile the surface layer is dark grayish-brown silt loam about 8 inches thick. The next layer is dark-gray and light brownish-gray silt loam about 47 inches thick. Below this, and extending to a depth of 70 inches, is black silt loam that has brown to dark-brown stains.

Permeability is moderate, and natural fertility and available water capacity are high. Nodaway soils are well suited to cultivated crops, trees, and wildlife habitat. They are used mostly for cultivated crops and pasture.

Representative profile of Nodaway silt loam (1 percent slopes) in a plowed field 3½ miles east and 1½ miles north of Concordia, 30 feet west of road and 200 feet north of Davis Creek ditch; in the NE¼SW¼ of sec. 25, T. 49 N., R. 24 W.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; many roots; slightly acid; abrupt, smooth boundary.

C—8 to 55 inches, stratified dark-gray (10YR 4/1) and light brownish-gray (10YR 6/2) silt loam; moderate, fine, platy structure; friable; many roots; slightly acid; smooth boundary.

A1b—55 to 70 inches, black (10YR 2/1) silt loam; strong, fine, angular blocky structure; firm; dark-brown (10YR 4/3) stains on faces of peds; medium acid.

The A horizon ranges from dark grayish brown to light brownish gray.

Nodaway soils have a lighter colored surface layer than the associated Kennebec soils.

Nodaway silt loam (No).—This nearly level soil is in tracts of 3 to 150 acres or more on bottom lands along small streams.

Included with this soil in mapping were a few small areas of Kennebec soils.

This soil is well suited to cultivated crops, pasture, trees, or wildlife habitat. It has no major hazard; however, it is subject to infrequent flooding (fig. 13). Capability unit I–1.

Otter Series

The Otter series consists of deep, poorly drained, nearly level, loamy soils on bottom lands along small streams, in all parts of the county. These soils formed under tall grasses in 3 or more feet of alluvium. Beneath the alluvium is limestone, shale, or sandstone bedrock.

In a representative profile the upper 9 inches of the surface layer is very dark grayish-brown silt loam. Below this, to a depth of about 60 inches, is very dark gray silt loam.

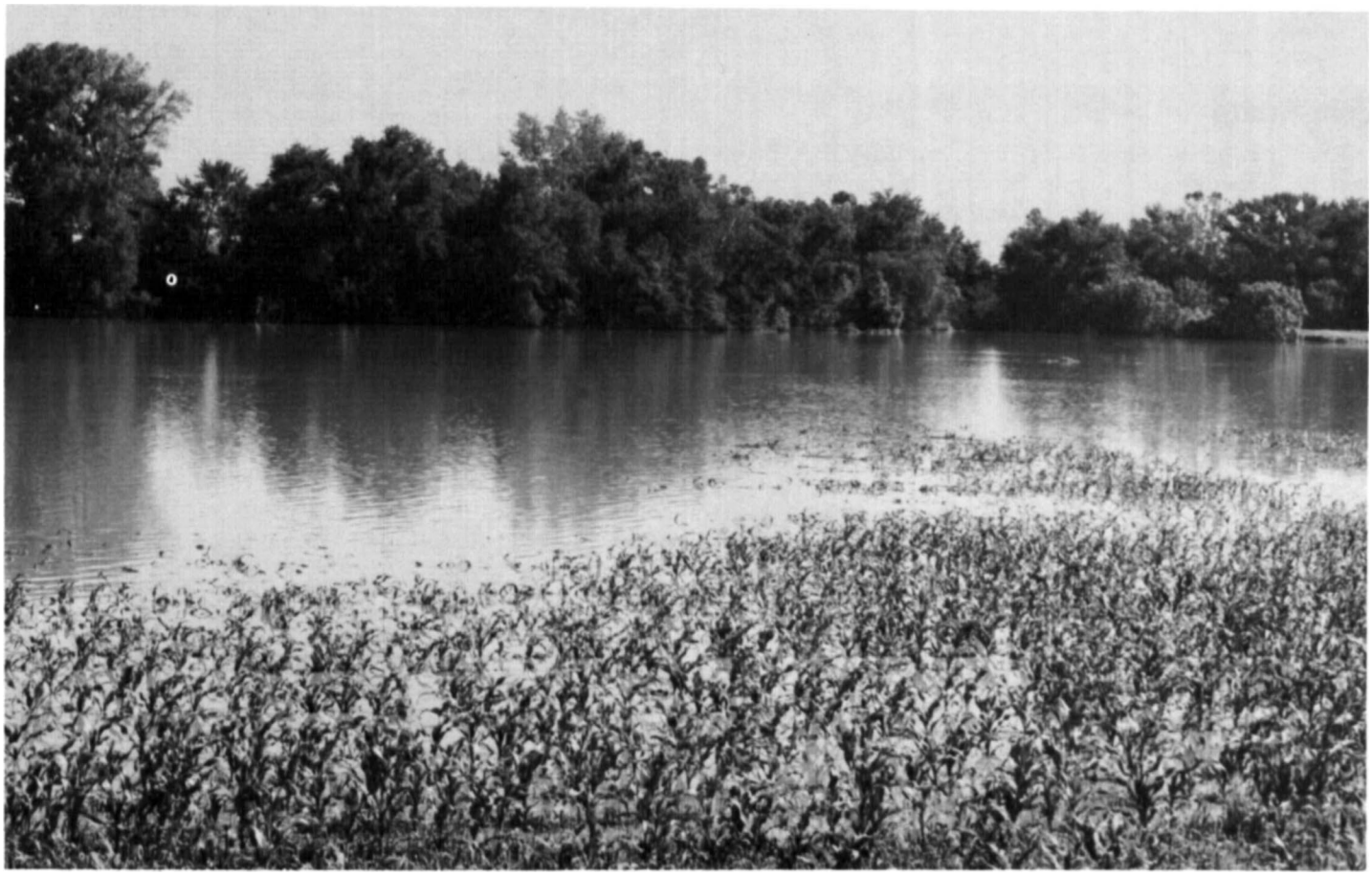

Figure 13.—**An infrequent flood on Nodaway silt loam.**

Permeability is moderate, and natural fertility and available water capacity are high. Otter soils are well suited to cultivated crops. They are very well suited to pasture, trees, and wildlife habitat. They are used mostly for cultivated crops.

In this county, Otter soils are mapped only with Blackoar soils.

Representative profile of Otter silt loam (1 percent slopes) in a soybean field 2½ miles northwest of Concordia, 500 feet south and 75 feet east of NW. corner; in the SW¼SW¼ of sec. 29, T. 49 N., R. 24 W.:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable; many roots; mildly alkaline; abrupt, smooth boundary.

A12—9 to 14 inches, very dark gray (10YR 3/1) silt loam; grayish brown (10YR 5/2) dry; moderate, medium, granular structure; friable; many roots; dark yellowish-brown (10YR 3/4) stains on peds; neutral; abrupt, smooth boundary.

A11b—14 to 35 inches, very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate, fine, granular structure; friable; few roots; strongly acid; gradual, smooth boundary.

A12b—35 to 60 inches, very dark gray (10YR 3/1) silt loam; strong, medium, granular structure; firm; dark yellowish-brown (10YR 4/4) stains; many, small, dark concretions; strongly acid.

The upper part of the A horizon is recently deposited alluvium. It ranges from very dark grayish brown to very dark gray. It is about 10 to 18 inches thick.

Otter soils are less clayey than the associated Blackoar soils.

Otter soils have a coarser textured A horizon than the associated Colo and Zook soils.

Polo Series

The Polo series consists of deep, well-drained, loamy soils on hillsides on uplands. Slopes are 5 to 14 percent. These soils formed under tall grasses in loess and the underlying residuum of limestone and shale. The combined thickness of these parent materials is about 7 feet. Beneath the residuum is shale or limestone bedrock.

In a representative profile the surface layer is silt loam about 13 inches thick; it is very dark grayish brown in the upper part and dark brown in the lower part. The subsoil is silty clay loam in the upper 50 inches. In sequence from the top, the upper 12 inches is dark brown; the next 8 inches is reddish brown; and the lower 30 inches is yellowish red mottled with light brownish gray in the lower part. Below this, and extending to a depth of 80 inches, is silty clay that is mottled pale brown and strong brown in the upper part and light gray, brownish yellow, and very dark gray in the lower part. The lower part contains limestone fragments and concretions.

Permeability is moderate, and natural fertility and available water capacity are high. Polo soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops and pasture.

Representative profile of Polo silt loam, 5 to 9 percent slopes, eroded, in a pasture 3 miles west and 3 miles north of Odessa, 100 feet west of road and 100 feet north of rock outcropping; in the NE¼NW¼ of sec. 21, T. 49 N., R. 28 W.:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) crushed; moderate, medium, granular structure; friable; many roots; slightly acid; abrupt, smooth boundary.

A12—7 to 13 inches, dark-brown (10YR 3/3) silt loam, dark grayish brown (10YR 4/2) crushed; weak, medium, granular structure; friable; common roots; medium acid; clear, smooth boundary.

B1t—13 to 17 inches, dark-brown (10YR 3/3) light silty clay loam; weak, fine, subangular blocky structure; friable; common roots; slightly acid; clear, smooth boundary.

B21t—17 to 25 inches, dark-brown (7.5YR 4/4) light silty clay loam; moderate, fine, subangular blocky structure; friable; common roots; thin, discontinuous, clay boundary.

B22t—25 to 33 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; common roots; thin discontinuous clay films; medium acid; clear, smooth boundary.

B23t—33 to 49 inches, yellowish-red (5Y 4/6) silty clay loam; moderate, medium, subangular blocky structure; firm; common roots; thin discontinuous clay films; gray (10YR 6/1) silt coats along root channels in lower part; very strongly acid; clear, smooth boundary.

B31—49 to 63 inches, yellowish-red (5YR 4/6) silty clay loam; few, medium, distinct, light brownish-gray (10YR 6/2) mottles; weak, coarse, subangular blocky structure; firm; few roots; few dark stains on ped surfaces; few discontinuous clay films; medium acid; clear, smooth boundary.

IIB32—63 to 73 inches, mottled pale-brown (10YR 6/3) and strong-brown (7.5YR 5/6) silty clay; weak, coarse, subangular blocky structure; firm; very dark brown (10YR 2/2) deposits on faces of some peds; few dark concretions; few small limestone fragments; slightly acid.

IIC—73 to 80 inches, mottled light-gray (10YR 7/2), brownish-yellow (10YR 6/8), and very dark gray (10YR 3/1) silty clay; few roots; few dark-colored concretions; many small limestone fragments; very strongly acid.

IIR—80 to 104 inches, shale.

The Ap horizon ranges from silt loam to silty clay loam.

Polo soils have a browner A horizon than the associated Sampsel soils.

Polo silt loam, 5 to 9 percent slopes, eroded (PoC2).—This soil is on hillsides in tracts of 3 to 50 acres that are downslope from gently sloping Minden and Marshall soils and upslope from Sampsel, Mandeville, and Sogn soils. It has the profile described as representative for the series. Slopes are convex.

Included with this soil in mapping were a few small areas of Minden and Marshall soils.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIIe–1.

Polo silt loam, 9 to 14 percent slopes, eroded (PoD2).—This soil is on hillsides in tracts of 3 to 30 acres that are downslope from sloping Marshall and Minden soils and upslope from Sampsel, Mandeville, and Sogn soils. Slopes are convex.

Included with this soil in mapping were a few small areas of Mandeville and Sampsel soils.

This soil is moderately well suited to cultivated crops. It is well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–1.

Ray Series

The Ray series consists of deep, well-drained, nearly level, loamy soils on bottom lands along the Missouri River. These soils formed in 3 or more feet of alluvium.

In a representative profile the surface layer is dark-brown silt loam about 10 inches thick. The subsoil is dark-brown silt loam about 29 inches thick. The underlying material, extending to a depth of 60 inches, is mottled very dark grayish-brown and grayish-brown silt loam.

Permeability is moderate, and natural fertility and available water capacity are high. Ray soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops.

Representative profile of Ray silt loam in a cornfield 1½ miles east and 2½ miles north of Dover, approximately 400 feet north of railroad track and 40 feet west of waterway; in the SE¼ of sec. 9, T. 51 N., R. 25 W.:

Ap--0 to 10 inches, dark-brown (10YR 4/3) silt loam; weak, very fine, granular structure; very friable; many roots; neutral; clear, smooth boundary.

B2—10 to 31 inches, dark-brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable; common roots; many fine pores and small holes; neutral; clear, smooth boundary.

B3—31 to 39 inches, dark-brown (10YR 4/3) silt loam; few, dark grayish-brown (2.5Y 4/2) mottles; weak, fine, subangular blocky structure; friable; few roots; many pores and small holes; neutral; clear, smooth boundary.

C—39 to 60 inches, mottled, very dark grayish-brown (10YR 3/2) and grayish-brown (10YR 5/2) silt loam; moderate, fine, subangular blocky structure; friable; neutral.

The Ap horizon ranges from silt loam to silty clay loam.

Ray soils have a finer textured A horizon than the associated Hodge, Sarpy, and Waubonsie soils. Ray soils have a coarser textured A horizon than the associated Leta and Myrick soils.

Ray silt loam (Ra).—This nearly level soil is on bottom lands along the Missouri River. Tracts are 3 to 200 acres in size.

Included with this soil in mapping were a few small areas of other soils common to bottom lands along the Missouri River.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. It has no major hazards but is subject to some overwash and flooding. Capability unit I–1.

Riverwash

Riverwash (Rw) is made up of coarse alluvial materials that were deposited on the flood plains of streams and, more commonly, of the Missouri River. These alluvial materials consist of rocks, gravel, and sand, and they are subject to frequent flooding.

At present this land type is generally not suited to farm use. It has value as a source of sand and gravel and has limited value for recreational uses. Capability unit VIIs–1.

Sampsel Series

The Sampsel series consists of deep, somewhat poorly drained, loamy soils on hillsides on uplands. Slopes range from 2 to 14 percent, but slopes of 5 to 9 percent are most common.

These soils formed under grasses in 4 or more feet of residuum of shale. In places, some loess is combined with the residuum of shale. Beneath the residuum or residuum and loess is shale, limestone, or sandstone bedrock.

In a representative profile the surface layer is black light silty clay loam about 12 inches thick. The subsoil is about 48 inches thick. In sequence from the top, it consists of 8 inches of mixed black, dark grayish-brown, and gray silty clay loam; 10 inches of grayish-brown silty clay; and 30 inches of gray silty clay.

Permeability is slow, and natural fertility and available water capacity are high. Sampsel soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops and pasture.

Representative profile of Sampsel silty clay loam, 5 to 9 percent slopes, eroded, in a cultivated field 9 miles south of Higginsville, on county line, 200 feet north of road and 200 feet east of gully in the SW. corner of sec. 20, T. 48 N., R. 25 W.:

Ap—0 to 8 inches, black (10YR 2/1) light silty clay loam; moderate, fine, granular structure; friable; many roots; medium acid; abrupt, smooth boundary.

A12—8 to 12 inches, black (10YR 2/1) light silty clay loam; strong, fine, granular structure; friable; many roots; medium acid; clear, smooth boundary.

B1—12 to 20 inches, mixed black (10YR 2/1), dark grayish-brown (10YR 4/2), and gray (10YR 5/1) silty clay loam; strong, very fine, angular blocky structure; friable; common roots; many dark concretions; slightly acid; clear, smooth boundary.

B21t—20 to 30 inches, grayish-brown (10YR 5/2) silty clay; few, fine, faint, brown mottles; strong, fine, angular blocky structure; firm; few roots; thick continuous clay films on faces of peds; many, small, black concretions; slightly acid; clear, smooth boundary.

B22t—30 to 40 inches, gray (10YR 5/1) silty clay; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; strong, fine, angular blocky structure; firm; patchy clay films on faces of peds; many black concretions; few small rock fragments; slightly acid; clear, smooth boundary.

B23t—40 to 60 inches, gray (N 5/0) silty clay; strong, fine, angular blocky structure; firm; discontinuous clay films; prominent yellowish-brown concretions; few small rock fragments; neutral.

The Ap horizon is silty clay loam or silt loam.

Sampsel soils have a blacker A horizon than the associated Polo soils.

Sampsel silty clay loam, 2 to 5 percent slopes (SaB).—This soil is on hillsides in tracts of 3 to 50 acres that are downslope from Minden and Macksburg soils. This soil has a profile similar to the one described as representative for the series, but is not eroded. Slopes are convex.

Included with this soil in mapping were a few small areas where the soil is eroded or severely eroded.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIe–5.

Sampsel silty clay loam, 5 to 9 percent slopes, eroded (SaC2).—This soil is on hillsides in tracts of 5 to 100 acres or more. This soil has the profile described as representative for the series. Slopes are convex.

Included with this soil in mapping were a few small areas of Macksburg soils and of uneroded Sampsel soils.

This soil is well suited to cultivated crops, pasture, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIIe–5.

Sampsel silty clay loam, 5 to 9 percent slopes, severely eroded (SaC3).—This soil is on hillsides in tracts of 3 to 30 acres or more that are downslope from Macksburg soils. Most slopes are convex, but some are concave.

This soil has a profile similar to that described as representative for the series, but erosion has removed the black surface layer; and the mixed black, dark grayish-brown, and gray silty clay loam that originally was the upper part of the subsoil is now at the surface.

Included with this soil in mapping were a few small areas of uneroded or less eroded Sampsel soils.

This soil is poorly suited to cultivated crops. It is moderately well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–8.

Sampsel silty clay loam, 9 to 14 percent slopes, eroded (SaD2).—This soil is on hillsides in tracts of 3 to 30 acres or more that are downslope from sloping Macksburg and Sampsel soils. Most slopes are convex, but in places they are concave.

Included with this soil in mapping were a few small areas of sloping Sampsel soils and of strongly sloping Higginsville soils.

This soil is somewhat poorly suited to cultivated crops. It is well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–8.

Sarpy Series

The Sarpy series consists of deep, nearly level, excessively drained, sandy soils on bottom lands along the Missouri River. These soils formed in 3 or more feet of alluvium.

In a representative profile the surface layer is dark grayish-brown fine sand about 7 inches thick. The underlying material, extending to a depth of 60 inches, is grayish-brown fine sand.

Permeability is very rapid, natural fertility is low, and available water capacity is very low. Sarpy soils are poorly suited to cultivated crops or pasture. They are moderately well suited to timber and wildlife habitat. They are used mostly for cultivated crops, but some areas are idle.

Representative profile of Sarpy fine sand, in a cultivated field in fallow, 4 miles east and 2½ miles north of Dover, in northeast corner of SE¼ of sec. 11, T. 51 N., R. 25 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) fine sand; single grain; loose; mildly alkaline; clear, smooth boundary.

C—7 to 60 inches, grayish-brown (10YR 5/2) fine sand; single grain; loose; neutral.

The Ap or A1 horizon ranges from fine sandy loam to sand. The C horizon ranges from loamy fine sand to sand. In places, this soil contains thin strata and lenses and small spherical bodies of finer textured material.

Sarpy soils have a coarser textured A horizon than the associated Dockery, Haynie, Leta, and Modale soils.

Sarpy fine sand (Sd).—This nearly level soil is on bottom lands along the Missouri River. Tracts are 3 to 75 acres in size.

Included with this soil in mapping were very small areas of other soils that are common to bottom lands along the Missouri River.

This soil is poorly suited to cultivated crops or pasture. It is moderately well suited to trees and wildlife habitat. Drought and soil blowing are major hazards, and management that includes soil blowing-control practices is needed. Capability unit IVs–1.

Snead Series

The Snead series consists of moderately deep, moderately well drained, loamy soils on hillsides on uplands. Slopes range from 9 to 14 percent. These soils formed under grasses in residuum of shale 15 to 32 inches thick. Beneath the residuum is shale, limestone, or sandstone bedrock.

In a representative profile the surface layer is very dark brown silty clay loam about 6 inches thick. The subsoil is about 26 inches thick. The upper 5 inches is very dark grayish brown silty clay loam mottled with brown grading to mixed olive and grayish silty clay in the lower 21 inches. The underlying material, extending to a depth of 34 inches, is pale-olive, partly weathered shale that contains white concretions and limestone fragments.

Permeability is slow, natural fertility is moderately high, and available water capacity is low. Snead soils are moderately well suited to cultivated crops if they are not too eroded or too strongly sloping. They are well suited to pasture, trees, and wildlife habitat. They are used mostly for pasture.

Representative profile of Snead silty clay loam, 9 to 14 percent slopes, eroded, in a pasture containing shrubs and trees, 1 mile south and one-half mile west of Aullville; 50 feet east of road in the SW. corner of the NW¼ NE¼ of sec. 32, T. 49 N., R. 25 W.:

Ap—0 to 6 inches, very dark brown (10YR 2/2) silty clay loam; moderate, fine, subangular blocky structure; friable; many roots; few small rock fragments; neutral; clear, smooth boundary.

B1—6 to 11 inches, very dark grayish-brown (10YR 3/2) silty clay loam; common, fine, distinct, brown (10YR 5/3) mottles; moderate, fine, subangular blocky structure; firm; many roots; common small rock fragments; slightly acid; clear, smooth boundary.

B21—11 to 14 inches, mixed very dark gray (10YR 3/1), dark grayish-brown (10YR 4/2), and yellowish-brown (10YR 5/4) silty clay loam; strong, medium, subangular blocky structure; firm; common roots; few small concretions; common small rock fragments; slightly acid; clear, smooth boundary.

B22—14 to 21 inches, mixed dark olive-gray (5Y 3/2), olive (5Y 5/4), and olive-brown (2.5Y 4/4) silty clay loam; strong, medium, subangular blocky structure; firm; few roots; common, medium, dark concretions; slick (soapy) feel; few small rock fragments; neutral; clear, smooth boundary.

B23—21 to 26 inches, mixed olive (5Y 4/3) and dark-gray (5Y 4/1) silty clay; strong, medium, angular blocky structure; very firm; few small rock fragments; neutral; clear, smooth boundary.

B3—26 to 32 inches, mixed dark olive-gray (5Y 3/2) and pale-olive (5Y 6/4) silty clay; strong, medium, angular blocky structure; very firm; few roots; neutral; clear, smooth boundary.

C—32 to 34 inches, pale-olive (5Y 6/3) partly weathered shale; massive (structureless), platy in places; common white concretions and limestone fragments; few roots; mildly alkaline.

The A horizon ranges from silt loam to silty clay.

Snead soils have a thinner solum than the associated Sampsel soils.

Snead silty clay loam, 9 to 14 percent slopes, eroded (SnD2).—This soil is on hillsides in tracts of 3 to 40 acres or more that are downslope from Sampsel, Macksburg, and Winfield soils. Slopes are convex or concave.

Included with this soil in mapping were a few small areas of Sampsel soils.

This soil is well suited to pasture, trees, or wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit VIe–11.

Sogn Series

The Sogn series consists of shallow, somewhat excessively drained, loamy soils on uplands. Slopes range from 5 to 25 percent. These soils formed under grasses and deciduous trees in residuum that is 4 to 20 inches thick. Beneath the shallow residuum is limestone or interbedded limestone, shale, or sandstone.

In a representative profile the surface layer is black silty clay loam about 5 inches thick. The underlying material is level-bedded limestone.

Permeability is moderate, natural fertility is low, and available water capacity is very low. Sogn soils are poorly suited to pasture or trees; however, they are moderately well suited to wildlife habitat if they are adjacent to areas of more productive soils. They are used mostly for pasture and trees.

Representative profile of Sogn silty clay loam, 5 to 14 percent slopes, in a wooded area 3½ miles south and 1¾ miles west of Bates City; 600 feet east and 300 feet north of the SW. corner of the NW¼ of sec. 22, T. 48 N., R. 29 W.:

A—0 to 5 inches, black (10YR 2/1) silty clay loam; moderate, medium, granular structure; friable; few limestone fragments on surface and in soil material; neutral; abrupt, smooth boundary.

R—5 inches, level-bedded limestone.

The A horizon ranges from 4 to 20 inches or less in thickness.

Sogn soils have a thinner solum than the associated Snead and Sampsel soils.

Sogn silty clay loam, 5 to 14 percent slopes (SoD).—This soil is on hillsides in tracts of 3 to 100 acres or more that are downslope from Sampsel, Snead, Winfield, and other soils on uplands. This soil is the one described as representative for the series. Slopes are convex or concave.

Included with this soil in mapping were exposed rock surfaces and very small ledges of limestone, shale, or sandstone.

This soil is poorly suited to pasture and moderately well suited to trees. It is moderately well suited to wildlife habitat if areas of more productive soils are adjacent. Drought is a major hazard, and management that includes fire-protection practices is needed. Capability unit VIIs–8.

Sogn silty clay loam, 14 to 25 percent slopes (SoF).—This soil is on hillsides in tracts of 3 to 50 acres or more that are downslope from strongly sloping Sogn soils. Slopes are convex or concave.

Included with this soil in mapping were limestone, shale, and sandstone ledges or small cliffs that range from 3 to 15 feet in height (fig. 14).

This soil is moderately suited to trees and moderately well suited to wildlife habitat if more productive soils are adjacent. Drought is a major hazard, and management that includes fire-protection practices is needed. Capability unit VIIs–8.

Waldron Series

The Waldron series consists of deep, somewhat poorly drained, nearly level, clayey soils on bottom lands along the Missouri River. These soils formed in 3 or more feet of recent sediment.

In a representative profile the surface layer is about 13 inches thick. The upper 4 inches is very dark grayish-brown silty clay loam containing very thin, pale-brown layers. The lower 9 inches is very dark grayish-brown silty clay. The underlying material, extending to a depth of 60 inches, is stratified very dark grayish-brown and very dark gray silty clay and silty clay loam.

Permeability is slow to moderately slow, natural fertility is moderately high, and available water capacity is high. Waldron soils are moderately well suited to cultivated crops and well suited to pasture, trees, and wildlife habitat. They are used mostly for cultivated crops.

Representative profile of Waldron silty clay loam in an idle field three-fourths of a mile north of Wellington; near the SW. corner of the NW¼NE¼NW¼ of sec. 15, T. 50 N., R. 28 W.:

A11—0 to 4 inches, very dark grayish-brown (10YR 3/2) silty clay loam, numerous very thin pale-brown strata (10YR 6/3); moderately alkaline; clear, smooth boundary.

A12—4 to 8 inches, very dark grayish-brown (10YR 3/2) silty clay, numerous light yellowish-brown (10YR 6/4) ped surfaces; moderate, medium, angular blocky structure; firm; moderately alkaline; clear, smooth boundary.

A13—8 to 13 inches, very dark grayish-brown (10YR 3/2) silty clay; massive; firm; moderately alkaline; clear, smooth boundary.

C1—13 to 23 inches, stratified, very dark grayish-brown (10YR 3/2) silty clay loam; weak, very fine, granular structure; friable; moderately alkaline; clear, smooth boundary.

C2—23 to 36 inches, stratified, dark-gray (10YR 4/1) silty clay; firm; moderately alkaline; clear, smooth boundary.

C3—36 to 60 inches, stratified, very dark grayish-brown (10YR 3/2) silty clay loam; few, fine, yellowish-red (5YR 5/8) mottles at a depth of 45 inches; massive; moderately alkaline.

The A horizon ranges from silty clay loam to silty clay and clay. In places, the C horizon contains strata, less than 6 inches thick, of coarser textured material.

Waldron soils have a finer textured A horizon than the associated Dockery, Haynie, Hodge, and Modale soils.

Waldron silty clay loam (Wa).—This nearly level soil is on bottom lands along the Missouri River in tracts of 10 to 300 acres or more.

Figure 14.—Pasture on a shallow Sogn soil that has exposed bedrock on the surface, ledges, and small cliffs that range from 3 to 15 feet in height.

Included with this soil in mapping were a few very small areas of other soils on bottom lands along the Missouri River.

This soil is moderately well suited to cultivated crops. It is somewhat slow to dry after rainy periods, however, and cultivation and harvest operations are difficult during some periods. This soil is well suited to pasture, trees, and wildlife habitat. Wetness is a major hazard, and the soil is subject to flooding. Capability unit IIw–2.

Waubonsie Series

The Waubonsie series consists of deep, nearly level, moderately well drained, sandy soils on bottom lands along the Missouri River. These soils formed in 4 or more feet of sandy or loamy alluvium.

In a representative profile the surface layer is dark-brown loamy sand 14 inches thick. The underlying material, extending to a depth of 24 inches, is sandy loam that is dark grayish brown in the upper 5 inches and is mottled light gray, dark reddish brown, weak red, and gray in the lower 5 inches. The material between the depths of 24 and 60 inches is mottled dark-gray and dark-brown silty clay loam.

Permeability is moderate, natural fertility is moderately high, and available water capacity is moderate. Waubonsie soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops.

Representative profile of Waubonsie loamy sand in an area of Waubonsie and Haynie soils, in a cultivated field 1 mile northwest of Wellington, north of the Missouri River; about 400 feet north of the levee and 260 feet east of the SW. corner of sec. 4, T. 50 N., R. 28 W.:

Ap—0 to 14 inches, dark-brown (10YR 4/3) loamy sand; single grain; loose; moderately alkaline; clear, smooth boundary.

C1—14 to 19 inches, stratified dark grayish-brown (2.5Y 4/2) sandy loam; weak, fine, granular structure; very friable; few roots; moderately alkaline; clear, smooth boundary.

C2—19 to 24 inches, mottled light-gray (10YR 6/1), dark reddish-brown (2.5YR 3/4), weak-red (2.5YR 4/2), and gray (10YR 5/1) fine sandy loam; weak, coarse, granular structure; friable; mildly alkaline; clear, smooth boundary.

IIC3—24 to 60 inches, mottled dark-gray (10YR 4/1) and dark-brown (10YR 3/3) silty clay loam; moderate, medium, granular structure; firm; few roots; mildly alkaline.

The A horizon is loam, sandy loam, or loamy sand.

Waubonsie soils have a coarser textured A horizon than the associated Leta, Modale, Myrick, and Ray soils.

Waubonsie and Haynie soils (Wb).—These nearly level soils are on bottom lands along the Missouri River in tracts of 3 to 50 acres or more. A representative profile of each soil is described under their respective series.

Included with these soils in mapping were very small areas of other soils on bottom lands of the Missouri River.

These soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. Wetness and drought are major hazards in some seasons. These soils are subject to flooding. Capability unit IIs–1.

Winfield Series

The Winfield series consists of deep, moderately well drained, loamy soils on ridgetops and hillsides on uplands. Slopes ranges from 2 to 20 percent, but slopes of 3 to 11 percent are most common. These soils formed under deciduous hardwoods in 3 or more feet of loess. The loess is underlain by limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil extends to a depth of 73 inches or more. The upper 7 inches is dark-brown silt loam; the next 20 inches is dark-brown silty clay loam; the next 12 inches is mottled dark yellowish-brown, yellowish-brown, and gray silty clay loam; and the lower 28 inches is gray silt loam mottled dark yellowish brown and yellowish brown.

Permeability is moderate, available water capacity is high, and natural fertility is moderately high. Winfield soils are moderately well suited to cultivated crops if slopes are not too steep. They are well suited to pasture, trees, and wildlife habitat. They are used mostly for cultivated crops and pasture.

Representative profile of Winfield silt loam, 2 to 5 percent slopes, in an alfalfa field 3 miles north and 2 miles west of Concordia, 550 feet east of east end of bridge and 75 feet south of road; in the NW¼SW¼ of sec. 19, T. 49 N., R. 24 W.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable; many roots; few worm casts; neutral; abrupt, smooth boundary.

B1—6 to 13 inches, dark-brown (10YR 4/3) silt loam; weak, fine, subangular blocky structure; friable; many roots; medium acid; clear, smooth boundary.

B21t—13 to 18 inches, dark-brown (10YR 4/3) silty clay loam; moderate, fine, subangular blocky structure; firm; few roots; medium acid; clear, smooth boundary.

B22t—18 to 24 inches, dark-brown (10YR 4/3) silty clay loam; few, medium, faint mottles of brown and dark brown; moderate, fine, subangular blocky structure; friable; few roots; many worm casts; strongly acid; gradual, smooth boundary.

B23t—24 to 33 inches, dark-brown (10YR 4/3) silty clay loam; few, fine, faint mottles of yellowish brown; moderate, medium, subangular blocky structure; firm; few roots; small black concretions; strongly acid; gradual, smooth boundary.

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B24t—33 to 45 inches, mottled dark yellowish-brown (10YR 4/4), yellowish-brown (10YR 5/4), and gray (10YR (5/1) silty clay loam; moderate, medium, subangular blocky structure; firm; few roots; small dark concretions; dark grayish-brown (10YR 4/2) coatings on ped surfaces; silt coatings that are white (10YR 8/2) dry and grayish brown (10YR 5/2) moist; medium acid; gradual, smooth boundary.

B3—45 to 73 inches, gray (10YR 6/1) heavy silt loam, mottled dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6); weak, medium, subangular blocky structure; friable; medium acid.

The Ap horizon ranges from dark grayish-brown silt loam to dark-brown silt loam or silty clay loam.

Winfield soils have a lighter colored A horizon than associated Marshall, Minden, and Macksburg soils. They are darker in the lower part of the A horizon than associated McGirk soils, and they have a thicker solum than the associated Mandeville soils.

Winfield silt loam, 2 to 5 percent slopes (WdB).—This soil is on ridgetops in tracts of 3 to 80 acres that are downslope from gently sloping Minden, Macksburg, and Marshall soils and upslope from sloping Winfield soils. It has the profile described as representative for the series. Slopes are convex.

Included with this soil in mapping were a few small areas of Marshall, Minden, Macksburg, and sloping Winfield soils.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIe–1.

Winfield silt loam, 5 to 9 percent slopes, eroded (WdC2).—This soil is on hillsides in tracts of 3 to 100 acres that are downslope from gently sloping Winfield soils and upslope from strongly sloping Winfield soils. It has a profile similar to the one described as representative for the series, but erosion has removed much of the original dark grayish-brown silt loam surface layer. Slopes are convex.

Included with this soil in mapping were a few small areas where the soil is uneroded and a few small areas of gently sloping or strongly sloping Winfield soils.

This soil is well suited to cultivated crops, pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IIIe–1.

Winfield silt loam, 9 to 14 percent slopes, eroded (WdD2).—This soil is on hillsides in tracts of 3 to 80 acres. Areas are downslope from sloping Winfield soils and upslope from moderately steep Winfield soils. They are adjacent to soils on bottom lands that are along streams. This soil has a profile similar to the one described as representative for the series, but erosion has removed much or all of the original dark grayish-brown silt loam surface layer. Slopes are convex.

Included with this soil in mapping were a few small areas of uneroded or sloping Winfield soils.

This soil is poorly suited to cultivated crops, but it is well suited to pasture, trees, and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–1.

Winfield silt loam, 14 to 20 percent slopes, eroded (WdE2).—This soil is on convex hillsides in tracts of 3 to 40 acres that are downslope from strongly sloping Winfield soils and adjacent to soils on bottom lands that are along streams. It has a profile similar to the one described

as representative for the series, but erosion has removed the original surface layer. Slopes are convex.

This soil is well suited to pasture, trees, or wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit VIe–1.

Winfield silty clay loam, 5 to 9 percent slopes, severely eroded (WfC3).—This soil is on hillsides in tracts of 3 to 100 acres. Areas are downslope from gently sloping Winfield soils and upslope from strongly sloping Winfield soils, or they are adjacent to soils on bottom lands that are along streams. Slopes are convex.

This soil has a profile similar to the one described as representative for the series, but erosion has removed the original surface layer, and the dark-brown silty clay loam that was originally the upper part of the subsoil is now at the surface.

This soil is poorly suited to cultivated crops, but it is moderately well suited to pasture, and it is well suited to trees and wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–4.

Winfield silty clay loam, 9 to 14 percent slopes, severely eroded (WfD3).—This soil is on hillsides in tracts of 3 to 50 acres that are downslope from sloping Winfield soils and adjacent to soils on bottom lands that are along streams. Slopes are convex.

This soil has a profile similar to the one described as representative for the series, but erosion has removed the original surface layer, and the dark-brown silty clay loam that was originally the upper part of the subsoil is now at the surface.

This soil is moderately well suited to pasture, and it is well suited to trees and to wildlife habitat. Erosion is a major hazard, and management that includes erosion-control practices is needed. Capability unit IVe–4.

Zook Series

The Zook series consists of deep, poorly drained, loamy, nearly level soils on bottom lands along streams in all parts of the county.

These soils formed under grasses in 3 or more feet of clayey alluvium. Beneath the alluvium is limestone, shale, or sandstone bedrock.

In a representative profile the surface layer is about 36 inches thick. The upper 18 inches is black silty clay loam, and the lower 18 inches is black silty clay. The underlying material, extending to a depth of 88 inches, is silty clay that is very dark gray in the upper 11 inches and black in the lower 41 inches.

Permeability is slow, and natural fertility and available water capacity are high. Zook soils are moderately well suited to cultivated crops, pasture, trees, and wildlife habitat. They are used mostly for cultivated crops and pasture.

Representative profile of Zook silty clay loam in an idle field 1 mile southwest of Aullville; 150 feet east and 100 feet north of SW. corner of the NW¼ SW¼ of sec. 29, T. 49 N., R. 25 W.:

Ap—0 to 10 inches, black (10YR 2/1) silty clay loam; weak, very fine, granular structure; friable; many roots; slightly acid; abrupt, smooth boundary.

A12—10 to 18 inches, black (10YR 2/1) light silty clay loam; moderate, fine, granular structure; friable; common roots; medium acid; clear, smooth boundary.

A3—18 to 36 inches, black (10YR 2/1) light silty clay; strong, coarse, subangular blocky structure; firm; few roots; few small dark concretions; slightly acid; clear, smooth boundary.

C1—36 to 47 inches, very dark gray (10YR 3/1) light silty clay; strong subangular blocky structure; firm; few roots; sheen on ped faces; few small dark concretions; neutral; clear, smooth boundary.

C2—47 to 88 inches, black (10YR 2/1) light silty clay; strong, coarse, angular blocky structure; few roots; sheen on faces of peds; few small dark concretions; neutral.

The A horizon ranges from medium silty clay loam to light silty clay.

Zook soils have a finer textured A horizon than the associated Kennebec and Blackoar soils.

Zook silty clay loam (Zo).—This nearly level soil is in tracts of 3 to 50 acres or more on bottom lands that are along small streams.

Included with this soil in mapping were a few small areas of Kennebec and Blackoar soils.

This soil is moderately well suited to cultivated crops, pasture, trees, and wildlife habitat. Wetness is a major hazard, and management that includes drainage practices is needed in some places. Capability unit IIw–2.

Use and Management of the Soils

This section defines the system of capability grouping and describes the use and management of the soils in each capability unit. It gives the estimated yields of principal crops and the engineering properties of the soils. Also discussed in this section are the recreational uses of soils, the use of soils as wildlife habitat, and the use of soils for woodland.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so 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 horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals in-

dicate progressively greater limitations and narrower choices for practical use, 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, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants. 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 largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes. (None in Lafayette County.)

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 to too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in Class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or IIIs–1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Lafayette County are described and suggestions for the use and management of the soils are given.

Management by capability units

A capability unit is made up of soils that have about the same limitations to use and susceptibility to damage, and that need about the same management. In the following pages each capability unit in the county is described, and management for each is suggested. The mention of the soil series represented in a unit does not mean that all the soils in the series are in the unit. The soils in each capability unit can be found by referring to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I–1

This unit consists of nearly level soils of the Haynie, Kennebec, Nodaway, and Ray series. These deep and loamy soils are on bottom lands. They are moderately permeable and are moderately well drained to well drained.

Soils in this unit are well suited to cultivated crops, pasture, trees, and wildlife habitat. Providing protection from infrequent to frequent flooding is a major concern of management. Adding manure and returning crop residue to the soil help to maintain the content of organic matter and to keep these soils in good tilth.

CAPABILITY UNIT IIe–1

This unit consists of gently sloping soils of the Knox, Marshall, and Winfield series. These deep and loamy soils are on uplands. They are moderately permeable and are well drained or moderately well drained.

Soils in this unit are well suited to cultivated crops, pasture, trees, and wildlife habitat. The hazard of erosion is a major concern of management. Growing winter cover crops and meadow crops and returning crop residue to the soil help to protect these soils. Continuous growth of hay and meadow crops is helpful in areas where mechanical erosion-control measures are not taken. Terraces, waterways, and contour farming also help to control runoff and erosion.

CAPABILITY UNIT IIe–2

This unit consists of gently sloping soils of the McGirk and Minden series. These deep and loamy soils are on uplands They are moderately permeable or slowly to very slowly permeable and are somewhat poorly drained.

Soils in this unit are well suited to cultivated crops, pasture, trees, and wildlife habitat. The hazard of erosion is a major concern of management. Growing winter cover crops and meadow crops and returning crop residue to the soil help to protect these soils from erosion. Continuous growth of hay and meadow crops is helpful in areas where mechanical erosion-control measures are not taken. Terraces, waterways, and contour farming also help to control runoff and erosion.

CAPABILITY UNIT IIe–5

This unit consists of gently sloping soils of the Leslie, Macksburg, and Sampsel series. These deep and loamy soils are on uplands. They are moderately slowly permeable and slowly permeable and are somewhat poorly drained.

Soils are well suited to cultivated crops, pasture, trees, and wildlife habitat. The hazard of erosion is a major concern of management. Growing winter cover crops, adding manure, and returning crop residue to the soil help to protect these soils from erosion. Continuous growth of hay and meadow crops is helpful in areas where mechanical erosion-control measures are not taken. Terraces, waterways, and contour farming also help to control runoff and erosion.

CAPABILITY UNIT IIw–1

This unit consists of nearly level soils of the Colo, Dockery, Modale, Blackoar, and Otter series. These deep and loamy soils are on bottom lands. They are moderately permeable to slowly permeable and are moderately well drained to poorly drained.

Soils in this unit are well suited to cultivated crops, pasture, trees, and wildlife habitat. Wetness caused by poor surface drainage and flooding is a major concern of management. The use of surface ditches, tiles, and upstream and local flood-control measures helps to protect these soils from wetness.

CAPABILITY UNIT IIw–2

This unit consists of nearly level soils of the Bremer, Leta, Waldron, and Zook series. These deep and clayey or loamy soils are on bottom lands. They are moderately slowly permeable to slowly permeable and are somewhat poorly drained to poorly drained.

Soils of this unit are well suited to cultivated crops, pasture, trees, and wildlife habitat. Wetness caused by poor surface drainage and flooding is a major concern of management. The use of surface ditches and upstream and local flood-control measures helps to protect these soils from wetness.

CAPABILITY UNIT IIs–1

This unit consists of nearly level Waubonsie and Haynie soils. These deep and sandy to loamy soils are on bottom lands. They are moderately permeable to slowly permeable and are moderately well drained to well drained.

Soils in this unit are well suited to cultivated crops, pasture, trees, and wildlife habitat. Drought is a major concern of management in dry seasons. Using irrigation helps to control drought.

CAPABILITY UNIT IIIe–1

This unit consists of sloping eroded soils of the Knox, Marshall, Polo, and Winfield series. These deep and loamy soils are on uplands. They are moderately permeable to moderately rapidly permeable and are well drained or moderately well drained.

Soils in this unit are well suited to cultivated crops, pasture, trees, and wildlife habitat. The hazard of erosion is a major concern of management. Erosion-control structures (fig. 15), growing winter crops and meadow crops, and returning crop residue to the soil help control erosion. Continuous growth of hay or pasture plants is helpful in areas where mechanical erosion-control measures are not taken. Terraces, waterways, and contour farming also help control runoff and erosion.

CAPABILITY UNIT IIIe–2

This unit consists of sloping Higginsville soils and sloping, eroded soils of the Higginsville and McGirk series. These deep and loamy soils are on uplands. They are slowly premeable or very slowly permeable and are somewhat poorly drained.

Soils in this unit are well suited or moderately well suited to cultivated crops and are well suited to pasture, trees, and wildlife habitat. The hazard of erosion is a major concern of management (fig. 16). Growing winter cover crops and meadow crops, returning crop residue to the soil; and using terraces, waterways, and contour farming help to control runoff and erosion. Continuous growth of hay and pasture plants is helpful in areas where mechanical erosion-control measures are not taken.

CAPABILITY UNIT IIIe–5

This unit consists of gently sloping eroded soils of the Macksburg series and sloping eroded soils of the Leslie and Sampsel series. These deep and loamy soils are on uplands. They are moderately slowly permeable and slowly permeable and are somewhat poorly drained.

Soils in this unit are moderately well suited to cultivated crops and are well suited to pasture, trees, and wildlife habitat. The hazard of erosion is a major concern of management. Growing winter cover crops and meadow crops, returning crop residue to the soil, and using terraces, waterways, and contour farming help to control runoff and erosion. Growth of corn, hay, or pasture plants is helpful in areas where mechanical erosion-control measures are not taken.

CAPABILITY UNIT IIIw–2

Only Moniteau silt loam, 1 to 4 percent slopes, is in this unit. This deep and loamy soil is on stream terraces. It is slowly permeable and is poorly drained.

The soil in this unit is moderately well suited to cultivated crops. It is slow to dry and somewhat difficult to manage when wet. It is well suited to pasture, trees, and wildlife habitat. The hazard of wetness is a major concern of management. The use of surface ditches for drainage helps to remove excess water.

CAPABILITY UNIT IIIw–14

Only Booker silty clay is in this unit. This deep and clayey soil is on stream terraces on small tributaries to the Missouri River. It is very slowly permeable and is very poorly drained.

The soil in this unit is moderately suited to cultivated crops, pasture, trees, and wildlife habitat. It is slow to dry and difficult to manage when wet. The hazard of wetness is a major concern of management. The use of surface ditches helps to remove excess water.

CAPABILITY UNIT IIIs–1

Only Hodge loamy fine sand is in this unit. This deep soil is on bottom lands. It is rapidly permeable and is somewhat excessively drained.

The soil in this unit is moderately well suited to cultivated crops and pasture. It is well suited to trees and wildlife habitat. The hazards of drought, soil blowing, and flooding are major concerns in management. Grow-

Figure 15.—**Erosion-control structure on Knox and Marshall soils.**

ing hay, meadow, and pasture crops or winter cover crops helps to protect this soil from soil blowing. Irrigation also helps to control soil blowing.

CAPABILITY UNIT IVe–1

This unit consists of strongly sloping eroded soils of the Knox, Marshall, Polo, and Winfield series. These deep and loamy soils are on uplands. They are moderately permeable and are well drained or moderately well drained.

Soils in this unit are somewhat poorly suited to cultivated crops. They are well suited to pasture, trees, and wildlife habitat. The hazard of erosion is a major concern of management. Growing meadow and hay crops much of the time helps protect these soils from erosion. Continuous growth of such crops is helpful in areas where mechanical erosion-control measures are not taken. Terraces, waterways, and contour farming help to control erosion and runoff in cultivated areas.

CAPABILITY UNIT IVe–4

This unit consists of strongly sloping severely eroded soils of the Knox, Marshall, and Winfield series and sloping severely eroded soils of the Marshall and Winfield series. These deep and loamy soils are on uplands. They are moderately permeable and are well drained or moderately well drained.

Soils in this unit are somewhat poorly suited to poorly suited to cultivated crops. They are well suited to pasture, trees, and wildlife habitat. The hazard of erosion is a major concern of management. Growing meadow and hay crops much of the time helps to protect these soils from erosion. Continuous growth of such crops is helpful in areas where mechanical erosion-control measures are

Figure 16.—Erosion on Higginsville soil.

not taken. Terraces, waterways, and contour farming help to control erosion and runoff in cultivated areas.

CAPABILITY UNIT IVe-5

This unit consists of sloping severely eroded and strongly sloping eroded soils of the Higginsville series. These deep and loamy soils are on uplands. They are slowly permeable and are somewhat poorly drained.

Soils in this unit are somewhat poorly suited to cultivated crops and are moderately well suited or well suited to pasture, trees, and wildlife habitat. The hazard of erosion is a major concern in management. Growing meadow and hay crops much of the time helps to protect these soils from erosion. Continuous growth of meadow and hay crops or pasture plants is helpful in areas where mechanical erosion-control measures are not taken. Terraces, waterways, and contour farming help to control erosion and runoff in cultivated areas.

CAPABILITY UNIT IVe-7

Only Mandeville silt loam, 4 to 9 percent slopes, eroded, is in this unit. This moderately deep soil is on uplands. It is moderately permeable and is moderately well drained to well drained.

The soil in this unit is moderately well suited to cultivated crops. It is well suited to pasture, trees, and wildlife habitat. The hazard of erosion is a major concern of management. Growing meadow and hay crops much of the time helps to protect this soil from erosion. Continuous growth of meadow and hay crops or pasture plants is helpful in areas where mechanical erosion-control measures are not taken. Waterways and contour farming help to control runoff and erosion in cultivated areas.

CAPABILITY UNIT IVe-8

This unit consists of sloping severely eroded and strongly sloping eroded soils of the Sampsel series. These deep and loamy soils are on uplands. They are slowly permeable and are somewhat poorly drained.

Soils in this unit are somewhat poorly suited to cultivated crops and are moderately well suited or well suited to pasture, trees, and wildlife habitat. The hazard of erosion is a major concern in management. Growing meadow and hay crops much of the time helps to protect these soils from erosion. Continuous growth of meadow and hay crops or pasture plants is helpful in areas where mechanical erosion-control measures are not taken. Terraces, waterways, and contour farming help control runoff and erosion.

CAPABILITY UNIT IVs-1

Only nearly level Sarpy fine sand is in this unit. This deep soil is on bottom lands. It is very rapidly permeable and is excessively drained.

The soil in this unit is poorly suited to cultivated crops or pasture. It is moderately well suited to trees or wildlife habitat. The hazards of drought and soil blowing are major concerns of management. Growing vegetative cover as much of the time as possible helps to protect this soil from soil blowing. Growth of trees, shrubs, and grasses is helpful in areas where mechanical erosion-control measures are not taken. The use of windbreaks helps to control soil blowing and drought.

CAPABILITY UNIT Vw-1

Only Myrick silty clay is in this unit. This deep soil is on bottom lands. It is moderately permeable and is poorly drained.

The soil in this unit is not suited to cultivated crops. It is well suited to pasture, trees, and wildlife habitat. It is slow to drain and difficult to manage when wet. The hazard of wetness is a major concern of management. The use of surface ditches helps to remove excess water, but the low position of this soil makes drainage very difficult or impossible in most areas.

CAPABILITY UNIT VIe-1

This unit consists of moderately steep eroded soils of the Knox and Winfield series. These deep and loamy soils are on uplands. They are moderately permeable and are well drained or moderately well drained.

Soils in this unit are not suited to cultivated crops. They are well suited to pasture, trees, and wildlife habitat. The hazard of erosion is a major concern in management. The use of permanent pasture that is protected from overgrazing and the use of trees that are protected from fire help to protect these soils from erosion.

CAPABILITY UNIT VIe-4

Only Knox silt loam, 14 to 20 percent slopes, severely eroded, is in this unit. This deep soil is on uplands. It is moderately permeable and is well drained.

Soil in this unit is not suited to cultivated crops. It is well suited to pasture, trees, and wildlife habitat. The hazard of erosion is a major concern in management. The use of permanent vegetative cover helps to protect this soil from erosion.

CAPABILITY UNIT VIe-7

Only Mandeville silt loam, 9 to 14 percent slopes, eroded, is in this unit. This deep soil is on uplands. It is moderately permeable and is well drained to moderately well drained.

Soil in this unit is not suited to cultivated crops. It is well suited to pasture, trees, and wildlife habitat. The hazard of erosion is a major concern in management. The use of permanent vegetative cover helps to protect this soil from erosion.

CAPABILITY UNIT VIe-11

Only Snead silty clay loam, 9 to 14 percent slopes, eroded, is in this unit. This deep soil is on uplands. It is slowly permeable and is moderately well drained.

Soil in this unit is not suited to cultivated crops. It is well suited to pasture, trees, and wildlife habitat. The hazard of erosion is a major concern in management. The use of permanent vegetative cover helps to protect this soil from erosion.

CAPABILITY UNIT VIIe-1

Only Knox silt loam, 20 to 25 percent slopes, eroded, is in this unit. This deep soil is on uplands. It is moderately permeable and is well drained.

Soil in this unit is not suited to cultivated crops. It is moderately well suited to pasture, and well suited to trees and wildlife habitat. The hazard of erosion is a major concern in management. The use of permanent vegetative cover helps to protect this soil from erosion.

CAPABILITY UNIT VIIe-4

Only Knox silt loam, 20 to 25 percent slopes, severely eroded, is in this unit. This deep soil is on uplands. It is moderately permeable and is well drained.

Soil in this unit is poorly suited to pasture. It is suited to trees or wildlife habitat. The hazard of erosion is a major concern in management. The use of permanent vegetative cover helps to protect this soil.

CAPABILITY UNIT VIIs-1

Only the land type Riverwash is in this unit.

This unit is not suitable for farming. It has limited potential for the development of wildlife habitat and as a source of sand and gravel.

CAPABILITY UNIT VIIs-8

This unit consists of Sogn silty clay loam, 5 to 14 percent slopes, and Sogn silty clay loam, 14 to 25 percent slopes. These shallow and loamy soils are on uplands. They are moderately permeable and are somewhat excessively drained.

Soils in this unit are poorly suited to pasture and moderately well suited to trees and wildlife habitat. The hazard of drought is the major concern in management. Fire protection practices are needed on these soils.

Estimated Yields

Table 2 gives the estimated average acre yields for some of the principal crops grown in Lafayette County. Yields are estimated averages for a 5- to 10-year period at two levels of management.

TABLE 2.—*Estimated average acre yields of principal crops under two levels of management*

[Yields in columns A are those to be expected under ordinary management; those in columns B, under improved management. Absence of yield indicates that the crop is not ordinarily grown on the soil]

Soil	Corn		Soybeans		Wheat		Alfalfa hay		Pasture	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*A.U.D.*[1]	*A.U.D.*[1]
Blackoar and Otter silt loams	64	86	27	38	28	40	2.8	3.9	120	180
Booker silty clay	52	74	20	30	20	28	2.0	3.7	110	170
Bremer silt loam, 1 to 5 percent slopes	56	82	24	35	22	35	2.7	4.2	120	180
Colo silty clay loam	56	82	22	34	22	36	2.8	4.1	120	170
Dockery silt loam	65	88	27	38	25	38	2.8	4.3	120	170
Haynie silt loam	67	88	27	39	30	43	3.2	4.8	120	200
Higginsville silt loam, 5 to 9 percent slopes	55	79	22	33	24	35	2.8	4.5	120	190
Higginsville silt loam, 5 to 9 percent slopes, eroded	53	75	21	31	22	33	2.6	4.1	115	180
Higginsville silt loam, 9 to 14 percent slopes, eroded	43	58	18	27	18	28	2.1	3.0	95	160
Higginsville silty clay loam, 5 to 9 percent slopes, severely eroded	45	62	15	27	15	28	1.8	2.6	80	140
Hodge loamy fine sand	51	72	21	32	26	38	3.4	4.2	75	160
Kennebec silt loam	74	96	28	40	30	43	3.2	4.8	125	210
Knox silt loam, 2 to 5 percent slopes	73	95	27	38	28	42	2.9	4.5	120	190
Knox silt loam, 5 to 9 percent slopes, eroded	55	81	23	33	26	39	2.8	4.5	120	190
Knox silt loam, 9 to 14 percent slopes, eroded	51	70	18	29	20	34	2.6	4.4	120	180
Knox silt loam, 9 to 14 percent slopes, severely eroded	45	62	18	25	20	28	2.1	3.0	95	160
Knox silt loam, 14 to 20 percent slopes, eroded	41	58	15	23	20	28	2.1	3.0	100	170
Knox silt loam, 14 to 20 percent slopes, severely eroded	------	------	------	------	------	------	------	------	70	110
Knox silt loam, 20 to 25 percent slopes, eroded	------	------	------	------	------	------	------	------	60	100
Knox silt loam, 20 to 25 percent slopes, severely eroded	------	------	------	------	------	------	------	------	50	90
Leslie silt loam, 2 to 5 percent slopes	53	75	22	30	20	28	2.6	3.9	90	90
Leslie silt loam, 5 to 9 percent slopes, eroded	47	65	18	27	18	27	2.5	3.8	100	160
Leta silty clay	56	82	22	34	20	32	2.8	4.1	120	170
Macksburg silt loam, 0 to 5 percent slopes	74	100	25	37	27	39	2.9	4.6	130	200
Macksburg silt loam, 2 to 5 percent slopes, eroded	65	90	27	39	28	42	2.8	4.5	130	200
Mandeville silt loam, 4 to 9 percent slopes, eroded	40	54	15	25	15	27	2.0	2.5	70	150
Mandeville silt loam, 9 to 14 percent slopes, eroded	------	------	------	------	------	------	------	------	60	120
Marshall silt loam, 2 to 5 percent slopes	79	105	33	45	35	47	3.5	5.2	140	220
Marshall silt loam, 5 to 9 percent slopes, eroded	63	87	24	35	28	40	2.8	4.2	125	180
Marshall silt loam, 5 to 9 percent slopes, severely eroded	55	80	22	30	26	38	2.6	4.0	120	170
Marshall silt loam, 9 to 14 percent slopes, eroded	54	78	20	28	26	38	2.2	3.8	120	180
Marshall silt loam, 9 to 14 percent slopes, severely eroded	45	62	15	24	17	26	1.8	2.8	95	160
McGirk silt loam, 2 to 5 percent slopes	45	69	20	29	20	29	2.4	3.4	100	160
McGirk silt loam, 5 to 9 percent slopes, eroded	31	46	16	24	16	22	1.5	2.2	80	140
Minden silt loam, 1 to 5 percent slopes	74	100	26	37	28	40	2.9	4.5	130	200
Modale silt loam	64	88	27	38	27	40	2.8	4.3	120	180
Moniteau silt loam, 1 to 4 percent slopes	50	69	20	29	20	29	2.3	3.4	100	160
Myrick silty clay	54	76	22	34	20	32	3.0	3.7	100	160
Nodaway silt loam	74	96	28	40	30	43	3.2	4.8	125	210
Polo silt loam, 5 to 9 percent slopes, eroded	57	78	23	31	26	38	2.4	4.0	115	180
Polo silt loam, 9 to 14 percent slopes, eroded	44	60	15	24	18	25	1.8	2.5	80	140
Ray silt loam	74	96	28	40	30	43	3.2	4.8	125	210
Riverwash	------	------	------	------	------	------	------	------	------	------
Sampsel silty clay loam, 2 to 5 percent slopes	55	80	25	36	25	38	2.6	4.4	120	190
Sampsel silty clay loam, 5 to 9 percent slopes, eroded	54	76	20	30	20	30	2.5	4.1	110	170
Sampsel silty clay loam, 5 to 9 percent slopes, severely eroded	39	52	18	25	18	25	1.5	2.8	70	110
Sampsel silty clay loam, 9 to 14 percent slopes, eroded	31	46	18	25	18	25	1.5	2.8	70	110
Sarpy fine sand	30	49	15	23	22	34	2.0	2.5	70	140
Snead silty clay loam, 9 to 14 percent slopes, eroded	------	------	------	------	------	------	------	------	65	110
Sogn silty clay loam, 5 to 14 percent slopes	------	------	------	------	------	------	------	------	50	90
Sogn silty clay loam, 14 to 25 percent slopes	------	------	------	------	------	------	------	------	30	60
Waldron silty clay loam	57	78	22	24	20	32	3.0	3.7	110	170
Waubonsie and Haynie soils	57	78	22	34	25	38	3.0	4.3	110	170
Winfield silt loam, 2 to 5 percent slopes	62	85	24	36	26	38	2.6	4.1	120	180
Winfield silt loam, 5 to 9 percent slopes, eroded	52	74	21	30	22	34	2.5	4.0	110	170
Winfield silt loam, 9 to 14 percent slopes, eroded	42	56	15	20	16	24	1.8	2.5	80	140
Winfield silt loam, 14 to 20 percent slopes, eroded	------	------	------	------	------	------	------	------	------	------
Winfield silty clay loam, 5 to 9 percent slopes, severely eroded	42	56	15	20	16	24	1.8	2.5	80	140
Winfield silty clay loam, 9 to 14 percent slopes, severely eroded	------	------	------	------	------	------	------	------	60	100
Zook silty clay loam	52	74	20	30	18	28	2.0	2.6	110	170

[1] Animal-Unit-Days is the number of days that one cow can be grazed on 1 acre without damage to the pasture.

The yields shown in columns A are predictions to be expected from the ordinary management most farmers in the county were using in 1965. Under this kind of management only about half the amount of lime and fertilizer shown to be needed by soil tests was applied. Crop residue was returned to the soil by leaving straw, stalks, and stubble in the field, by feeding livestock in the field, or by spreading barnyard manure.

The yields in columns B are predictions to be expected from improved management used by some farmers in Lafayette County in 1965. Under this system lime and fertilizer are applied in the amount shown to be needed by soil tests; crop residue is returned to the soils, minimum tillage is practiced; fieldwork is timely, adapted varieties of crops and seeding mixtures are used; surface drainage is improved where needed; and grazing is properly managed and weeds are cut in pastures.

Engineering Uses of the Soils [2]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigations systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 3 and 4, which show several estimated soil properties significant to engineering and interpretations for various engineering uses.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 3 and 4 and it can also be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists that is not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system used by the SCS engineers, Department of Defense, and others, and the AASHO system (*1*) adopted by the American Association of State Highway Officials.

In the Unified system (*8*) soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are 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 are designated by symbols for both classes; for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed 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. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided 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 engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The estimated classification, without group index numbers, is given in table 3 for all soils mapped in the survey area.

Estimated properties significant to engineering

Table 3 gives, for each soil series and land type, some of the soil characteristics significant in engineering and the engineering classification of the soil material in the principal horizons.

Permeability is estimated for uncompacted saturated soil material. The estimates are based on field observations and limited laboratory data.

[2] By CHARLES L. DICKERSON, agricultural engineer, Soil Conservation Service.

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TABLE 3.—*Estimated soil properties significant to engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series in the first column of this table. Absence of data indicates that the soil is too variable to be rated. The symbol < means less than; the symbol > means more than]

Soil series and map symbols	Depth from surface	Classification			Percentage passing sieve No. 200 (0.074 mm.)[1]	Permeability	Available water capacity	Reaction	Shrink-swell potential
		USDA texture	Unified	AASHO					
	Inches					*Inches per hour*	*Inches per inch of soil*	*pH*	
*Blackoar: Bk	0–72	Silt loam	ML or CL	A–4	85–95	0. 6–2. 0	0. 15–0. 18	5. 6–7. 3	Low.
For Otter part, see Otter series.									
Booker: Bo	0–5	Silty clay	CH	A–7–6	85–95	<0. 06	0. 13–0. 15	6. 6–7. 3	High.
	5–66	Clay	CH	A–7	85–95	<0. 06	0. 13–0. 15	6. 6–8. 4	High.
Bremer: BrB	0–17	Silt loam	ML or CH	A–4	85–95	0. 06–0. 6	0. 15–0. 18	6. 1–6. 5	Low.
	17–26	Silty clay loam	CL	A–6 or A–7	85–95	0. 06–0. 6	0. 15–0. 18	4. 5–5. 5	Moderate.
	26–48	Silty clay	CH	A–7	85–95	0. 06–0. 6	0. 15–0. 18	5. 1–6. 0	High.
	48–60	Silty clay loam	CL	A–6	85–95	0. 06–0. 6	0. 15–0. 18	5. 6–6. 0	Moderate.
Colo: Co	0–60	Silty clay loam	CL	A–6	85–95	0. 2–0. 6	0. 15–0. 18	6. 1–7. 3	Moderate.
Dockery: Do	0–42	Silt loam	ML or CL	A–4	85–95	0. 2–2. 0	0. 15–0. 18	5. 6–7. 3	Moderate.
	42–60	Silty clay loam	CL	A–6	85–95	0. 2–2. 0	0. 15–0. 18	6. 6–7. 3	Moderate.
Haynie: Ha	0–60	Silt loam	ML or CL	A–4	85–95	0. 6–2. 0	0. 15–0. 18	7. 4–8. 4	Low.
Higginsville: HgC, HgC2, HgD2, HnC3.	0–10	Silt loam	ML or CL	A–4	95–100	0. 6–2. 0	0. 18–0. 21	6. 1–6. 5	Low.
	10–87	Silty clay loam	CL	A–7	95–100	0. 06–0. 2	0. 15–0. 18	5. 1–6. 0	Moderate.
Hodge: Ho	0–7	Loamy fine sand	SM	A–2–4	15–30	6. 0–20. 0	0. 10–0. 14	6. 6–7. 8	Very low.
	7–60	Loamy fine sand	SM	A–2–4	15–30	6. 0–20. 0	0. 10–0. 14	6. 6–7. 8	Very low.
Kennebec: Ke	0–60	Silt loam	ML or CL	A–4	85–95	0. 6–2. 0	0. 15–0. 18	6. 1–7. 3	Low.

Knox: KnB, KnC2, KnD2, KnD3, KnE2, KnE3, KnF2, KnF3.	0–14	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	6. 6–7. 8	Low.
	14–22	Silty clay loam	CL or ML–CL	A–6 or A–7	85–95	0. 6–2. 0	0. 19–0. 21	6. 6–7. 3	Low.
	22–93	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	5. 6–7. 3	Low.
Leslie: LeB, LeC2	0–22	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	5. 1–6. 0	Low.
	22–36	Silty clay	CL	A–7	90–95	0. 06–0. 2	0. 15–0. 18	5. 6–6. 0	Moderate.
	36–42	Silty clay loam	CL	A–7	85–95	0. 06–0. 2	0. 19–0. 21	6. 6–7. 3	Moderate.
	42–76	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	6. 6–7. 3	Low.
Leta: Lt	0–8	Silty clay	CH	A–7	90–95	0. 2–0. 6	0. 15–0. 18	7. 9–8. 4	High.
	8–13	Silty clay loam	CL	A–7	85–95	0. 2–0. 6	0. 19–0. 21	7. 4–7. 8	Moderate.
	13–25	Silty clay	CL	A–7	90–95	0. 2–0. 6	0. 15–0. 18	7. 4–7. 8	High.
	25–60	Very fine sandy loam.	ML or SM	A–4	50–65	0. 6–2. 0	0. 08–0. 10	7. 4–7. 8	Low.
Macksburg: MaB, MaB2	0–15	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	6. 1–6. 5	Low.
	15–39	Silty clay loam	CL	A–7	85–95	0. 2–0. 6	0. 19–0. 21	5. 1–6. 0	Moderate.
	39–61	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	5. 6–6. 5	Low.
Mandeville: MdC2, MdD2	0–5	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	6. 1–6. 5	Low.
	5–14	Silty clay loam	CL or ML–CL	A–7	85–95	0. 6–2. 0	0. 19–0. 21	6. 1–7. 3	Moderate.
	14–26	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	7. 4–7. 8	Low.
Marshall: MhB, MhC2, MhC3, MhD2, MhD3.	0–13	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	6. 1–7. 3	Low.
	13–48	Silty clay loam	CL or ML–CL	A–7	85–95	0. 6–2. 0	0. 19–0. 21	5. 6–6. 0	Moderate.
	48–103	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	5. 6–6. 5	Low.
McGirk: MkB, MkC2	0–12	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	4. 5–6. 5	Low.
	12–23	Silty clay loam	CL	A–7	85–95	0. 2–0. 6	0. 19–0. 21	4. 5–5. 0	Moderate.
	23–34	Silty clay	CH	A–7	70–90	0. 06–0. 2	0. 18–0. 23	5. 1–5. 5	High.
	34–45	Silty clay loam	CL	A–7	85–95	0. 2–0. 6	0. 19–0. 21	5. 6–6. 0	Moderate.
	45–83	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	6. 1–6. 5	Low.
Minden: MnB	0–20	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	5. 6–6. 0	Low.
	20–30	Silty clay loam	CL or ML–CL	A–7	85–95	0. 6–2. 0	0. 19–0. 21	5. 1–5. 5	Moderate.
	30–78	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	5. 6–6. 0	Low.
Modale: Mo	0–24	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	7. 4–8. 4	Low.
	24–60	Silty clay	CH	A–7	90–95	0. 06–0. 2	0. 15–0. 18	7. 9–8. 4	High.

See footnote at end of table.

TABLE 3.—*Estimated soil properties significant to engineering*—Continued

Soil series and map symbols	Depth from surface	Classification			Percentage passing sieve No. 200 (0.074 mm.)[1]	Permeability	Available water capacity	Reaction	Shrink-swell potential
		USDA texture	Unified	AASHO					
	Inches					*Inches per hour*	*Inches per inch of soil*	*pH*	
Moniteau: MtB	0–20	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	4. 5–6. 5	Low.
	20–32	Silty clay	CH	A–7	90–95	0. 06–0. 2	0. 15–0. 18	5. 1–5. 5	High.
	32–60	Silty clay loam	CL	A–7	85–95	0. 2–0. 6	0. 19–0. 21	5. 1–5. 5	Moderate.
Myrick: My	0–13	Silty clay	CL	A–7	90–95	0. 6–2. 0	0. 12–0. 15	7. 4–7. 8	High.
	13–36	Very fine sandy loam.	ML	A–4	50–65	2. 0–6. 0	0. 15–0. 18	7. 4–7. 8	Low.
Nodaway: No	0–70	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	5. 6–6. 5	Low.
Otter Mapped only in undifferentiated unit with Blackoar soils.	0–60	Silt loam	ML or CL	A–4	85–95	0. 6–2. 0	0. 15–0. 18	5. 1–7. 8	Low.
Polo: PoC2, PoD2	0–13	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	5. 6–6. 5	Low.
	13–63	Silty clay loam	CL or ML–CL	A–7	85–95	0. 6–2. 0	0. 19–0. 21	4. 5–6. 5	Moderate.
	63–73	Silty clay	CH	A–7	90–95	0. 6–2. 0	0. 15–0. 18	6. 1–6. 5	High.
Ray: Ra	0–60	Silt loam	ML	A–4	70–90	0. 6–2. 0	0. 18–0. 23	6. 6–7. 3	Low.
Riverwash: Rw. Too variable to be rated.									

Sampsel: SaB, SaC2, SaC3, SaD2.	0–20	Silty clay loam	CL or ML–CL	A–7	85–95	0. 2–0. 6	0. 19–0. 21	5. 6–6. 5	Moderate.
	20–60	Silty clay	CH	A–7	90–95	0. 06–0. 2	0. 15–0. 18	6. 1–7. 3	High.
Sarpy: Sd	0–60	Fine sand	SP–SM	A–3	5–10	>20. 0	0. 04	6. 6–7. 8	Low.
Snead: SnD2	0–21	Silty clay loam	CL or ML–CL	A–7	85–95	0. 2–0. 6	0. 19–0. 21	6. 1–7. 3	Moderate.
	21–32	Silty clay	CH	A–7	75–95	0. 06–0. 2	0. 15–0. 18	6. 6–7. 3	High.
Sogn: SoD, SoF	0–5	Silty clay loam	CL	A–7	85–95	0. 6–2. 0	0. 19–0. 21	6. 6–7. 3	Moderate.
Waldron: Wa	0–4	Silty clay loam	CL or ML–CL	A–7	85–95	0. 06–0. 6	0. 19–0. 21	7. 9–9. 4	Moderate.
	4–13	Silty clay	CH	A–7	90–95	0. 06–0. 6	0. 15–0. 18	7. 9–8. 4	High.
	13–23	Silty clay	CH	A–7	85–95	0. 06–0. 6	0. 19–0. 21	7. 9–8. 4	High.
	23–36	Silty clay	CH	A–7	90–95	0. 06–0. 6	0. 15–0. 18	7. 9–8. 4	High.
	36–60	Silty clay loam	CL or ML–CL	A–7	85–95	0. 2–0. 6	0. 19–0. 21	7. 9–8. 4	Moderate.
*Waubonsie: Wb	0–14	Loamy sand	SM	A–2–4	15–30	6. 0–20. 0	0. 04–0. 06	7. 9–8. 4	Very low.
For Haynie part, see Haynie series.	14–19	Sandy loam	SM	A–2–4 or A–4	30–40	2. 0–6. 0	0. 10–0. 14	7. 9–8. 4	Very low.
	19–24	Fine sandy loam	SM or ML	A–4	40–55	2. 0–6. 0	0. 08–0. 10	7. 4–7. 8	Very low.
	24–60	Silty clay loam	CL or ML–CL	A–6	85–95	0. 6–2. 0	0. 19–0. 21	7. 4–7. 8	Moderate.
Winfield: WdB, WdC2, WdD2, WdE2, WfC3, WfD3.	0–13	Silt loam	ML or ML–CL	A–4	70–90	0. 6–2. 0	0. 18–0. 23	5. 6–7. 3	Low.
	13–45	Silty clay loam	CL or ML–CL	A–6	85–95	0. 6–2. 0	0. 19–0. 21	5. 1–6. 0	High.
	45–73	Silt loam	ML or ML–CL	A–4	70–90	0. 6–2. 0	0. 18–0. 23	5. 6–6. 0	Low.
Zook: Zo	0–18	Silty clay loam	CL	A–7–6	85–95	0. 2–0. 6	0. 19–0. 21	5. 6–6. 5	Moderate.
	18–88	Silty clay	CH	A–7	85–95	0. 06–0. 2	0. 15–0. 18	6. 1–7. 3	High.

[1] Percentages passing sieve No. 4 and sieve No. 10 are not given because 100 percent of all soils, except Snead and Sogn soils, passes the No. 10 sieve. About 95 percent of the Snead and Sogn soils passes the No. 10 sieve. Percentage passing sieve No. 40 is significant only for Hodge, Sarpy, and Waubonsie soils, and for this reason was omitted.

TABLE 4.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series in the first column of this table. Absence of data indicates

Soil series and map symbols	Suitability as source of—		Soil features affecting—		
	Topsoil	Road fill	Highway location	Farm ponds	
				Reservoir areas	Embankments
*Blackoar: Bk For Otter part, see Otter series.	Good	Poor: poorly drained	Subject to flooding.	Moderate permeability.	Fair to poor compaction characteristics.
Booker: Bo	Fair to poor: silty clay and clay surface layer.	Poor: high shrink-swell potential; very poorly drained.	Subject to flooding.	All features favorable.	High shrink-swell potential.
Bremer: BrB	Good	Fair to poor: high shrink-swell potential at a depth of 26 inches.	Subject to flooding.	Slow permeability when compacted.	High shrink-swell potential.
Colo: Co	Fair: silty clay loam surface layer.	Poor: moderate shrink-swell potential; high organic-matter content.	Subject to flooding.	Moderately slow permeability.	All features favorable.
Dockery: Do	Good	Fair: moderate shrink-swell potential; somewhat poorly drained.	Subject to flooding.	Moderate to moderately slow permeability.	All features favorable.
Haynie: Ha	Good	Good	Subject to flooding.	Moderate permeability.	All features favorable.
Higginsville: HgC, HgC2, HgD2, HnC3.	Fair: limited quantity of suitable material.	Fair: moderate shrink-swell potential; somewhat poorly drained.	Moderate shrink-swell potential.	All features favorable.	All features favorable.
Hodge: Ho	Poor: loamy fine sand surface layer.	Good	Subject to flooding.	Rapid permeability.	Sandy material; rapid seepage rate.
Kennebec: Ke	Good	Poor: poor bearing capacity; high compressibility.	Subject to flooding.	Moderate permeability.	High compressibility.
Knox:					
KnB, KnC2	Good	Fair to poor: poor compaction characteristics.	Gently sloping and sloping.	Moderate permeability.	Fair to poor compaction characteristics.
KnD2, KnD3, KnE2, KnE3, KnF2, KnF3.	Good	Fair to poor: poor compaction. characteristics.	Strongly sloping to steep.	Moderate permeability.	Fair to poor compaction characteristics.
Leslie: LeB, LeC2	Good	Fair: moderate shrink-swell potential.	Sloping	All features favorable.	All features favorable.
Leta: Lt	Fair: silty clay surface layer.	Poor: high shrink-swell potential.	Subject to flooding.	Moderate permeability in lower part.	High shrink-swell potential.

engineering properties of the soils

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions that properties of the soil are too variable to be rated for the stated purpose]

Soil features affecting—Continued				Limitations for sewage disposal	
Drainage for crops and pasture	Irrigation	Diversions	Waterways	Septic tanks	Sewage lagoons
Subject to flooding; high water table.	Poorly drained	Not needed	Not needed	Severe: subject to flooding.	Severe: subject to flooding.
Very slow permeability.	Very slow intake rate.	Not needed	Not needed	Severe: very slow permeability; subject to flooding.	Severe: subject to flooding.
Slow permeability; high water table.	Poorly drained	Not needed	Not needed	Severe: slow to moderately slow permeability; subject to flooding.	Severe: subject to flooding.
Moderately slow permeability.	Poorly drained	Not needed	Not needed	Severe: subject to flooding; moderately slow permeability.	Severe: subject to flooding.
Subject to flooding; high water table.	Somewhat poorly drained; subject to flooding.	Not needed	Not needed	Severe: subject to flooding; moderate to moderately slow permeability.	Severe: subject to flooding.
Not needed	All features favorable.	Not needed	Not needed	Severe: subject to flooding.	Severe: subject to flooding.
All features favorable.	Sloping and strongly sloping.	All features favorable.	Somewhat poorly drained.	Severe: slow permeability.	Severe: slopes.
Not needed	Low available water capacity; rapid intake rate.	Nearly level	All features favorable.	Severe: subject to flooding.	Severe: subject to flooding; rapid permeability.
Subject to flooding.	All features favorable.	Nearly level	All features favorable.	Severe: subject to flooding.	Severe: subject to flooding.
Not needed	Gently sloping and sloping.	Gently sloping and sloping.	Gently sloping and sloping.	Moderate: moderate permeability.	Moderate: moderate permeability.
Not needed	Strongly sloping to steep.	Strongly sloping to steep.	Strongly sloping to steep.	Severe: slopes	Severe: slopes.
Slow permeability	Gently sloping and sloping.	All features favorable.	Somewhat poorly drained.	Severe: slow permeability.	Severe: slopes.
Moderately slow permeability.	Moderate available water capacity; slow intake rate.	Nearly level	All features favorable.	Severe: subject to flooding.	Severe: subject to flooding.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—		Soil features affecting—		
	Topsoil	Road fill	Highway location	Farm ponds	
				Reservoir areas	Embankments
Macksburg: MaB, MaB2.	Good	Fair: moderate shrink-swell potential; somewhat poorly drained.	All features favorable.	All features favorable.	Fair to good compaction characteristics.
Mandeville: MdC2, MdD2.	Good	Fair: medium to high compressibility.	All features favorable.	Moderate permeability.	Fair compaction characteristics.
Marshall:					
MhB, MhC2, MhC3	Good	Fair: medium to high compressibility.	All features favorable.	Moderate permeability.	Fair compaction characteristics.
MhD2, MhD3	Good	Fair: medium to high compressibility.	Strongly sloping	Moderate permeability.	Fair compaction characteristics.
McGirk: MkB, MkC2	Fair: limited quantity of suitable material.	Poor: high shrink-swell potential.	Poor slope stability.	All features favorable.	High compressibility.
Minden: MnB	Good	Fair: moderate shrink-swell potential.	All features favorable.	Moderate permeability.	Fair to poor compaction characteristics.
Modale: Mo	Good in upper 2 feet, poor below; silty clay surface layer.	Fair in upper 2 feet, poor below; moderate and high shrink-swell potential.	Poor source of borrow material.	All features favorable.	High compressibility.
Moniteau: MtB	Good	Poor: high shrink-swell potential.	Subject to flooding.	All features favorable.	High compressibility.
Myrick: My	Fair: silty clay surface layer.	Poor: poorly drained	Subject to flooding; high water table.	All features favorable.	Fair to poor compaction characteristics; high water table.
Nodaway: No	Good	Poor: fair to poor compaction characteristics.	Subject to flooding.	Moderate permeability.	Poor compaction characteristics.
Otter Mapped only in an undifferentiated unit with Blackoar soils.	Good	Poor: poorly drained.	Subject to flooding.	Moderate permeability.	Fair to poor compaction characteristics.
Polo: PoC2, PoD2	Fair: limited quantity of suitable material.	Poor: high shrink-swell potential.	Sloping and strongly sloping.	All features favorable.	Medium to low shear strength.

properties of the soils—Continued

Soil features affecting—Continued				Limitations for sewage disposal	
Drainage for crops and pasture	Irrigation	Diversions	Waterways	Septic tanks	Sewage lagoons
Not needed	Gently sloping	All features favorable.	All features favorable.	Severe: moderately slow permeability.	Moderate: slopes.
Not needed	Bedrock below a depth of 26 inches.	Bedrock below a depth of 26 inches.	Low available water capacity.	Moderate to severe: moderate permeability; bedrock below a depth of 26 inches.	Moderate: slopes.
Not needed	Gently sloping to sloping.	All features favorable.	All features favorable.	Moderate: moderate permeability.	Moderate: slopes.
Not needed	Strongly sloping	All features favorable.	All features favorable.	Severe: slopes	Severe: slopes.
Slow to very slow permeability.	Gently sloping and sloping.	All features favorable.	All features favorable.	Severe: slow to very slow permeability.	Severe: slopes.
Not needed	Gently sloping	All features favorable.	All features favorable.	Moderate: moderate permeability.	Moderate: moderate permeability.
Not needed	High water table	Not needed	Not needed	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.
Subject to flooding; slow permeability.	Subject to flooding.	Not needed	Not needed	Severe: subject to flooding.	Severe: subject to flooding.
High water table	High water table	Not needed	Not needed	Severe: subject to flooding; high water table.	Severe: subject to flo ding; high water table.
Subject to flooding.	Subject to flooding.	Not needed	Not needed	Severe: subject to flooding.	Severe: subject to flooding.
Subject to flooding.	Poorly drained	Not needed	Not needed	Severe: subject to flooding.	Severe: subject to flooding.
Not needed	Sloping and strongly sloping.	All features favorable.	All features favorable.	Moderate: slopes	Severe: slopes.

TABLE 4.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—		Soil features affecting—		
	Topsoil	Road fill	Highway location	Farm ponds	
				Reservoir areas	Embankments
Ray: Ra	Good	Fair: medium to low shear strength.	Subject to flooding.	Moderate permeability.	Subject to piping.
Riverwash: Rw. Too variable to be rated.					
Sampsel: SaB, SaC2, SaC3, SaD2.	Fair: silty clay loam surface layer.	Fair: somewhat poorly drained.	Sloping and strongly sloping.	All features favorable.	High shrink-swell potential.
Sarpy: Sd	Poor: fine sand surface layer.	Good	Subject to flooding.	Very rapid permeability.	Medium to high susceptibility to piping.
Snead: SnD2	Fair: silty clay loam surface layer.	Poor: bedrock below a depth of 32 inches.	Bedrock below a depth of 32 inches.	Bedrock below a depth of 32 inches.	Bedrock below a depth of 32 inches.
Sogn: SoD, SoF	Poor: bedrock below a depth of 5 inches.	Poor: bedrock below a depth of 5 inches.	Bedrock below a depth of 5 inches.	Bedrock below a depth of 5 inches.	Bedrock below a depth of 5 inches.
Waldron: Wa	Poor: silty clay surface layer.	Fair: somewhat poorly drained.	Subject to flooding.	All features favorable.	High shrink-swell potential.
*Waubonsie: Wb. For Haynie part, see Haynie series.	Poor: loamy sand surface layer.	Fair: medium shear strength.	Subject to flooding.	Moderate permeability.	Medium to high susceptibility to piping.
Winfield: WdB, WdC2	Good	Fair: moderate shrink-swell potential.	Gently sloping to sloping	All features favorable.	Fair to poor compaction characteristics.
WdD2, WdE2, WfC3, WfD3.	Good	Fair: moderate shrink-swell potential.	Strongly sloping to moderately steep.	All features favorable.	Fair to poor compaction characteristics.
Zook: Zo	Fair: silty clay loam surface layer.	Poor: poorly drained.	Subject to flooding.	All features favorable.	Fair to poor compaction characteristics.

properties of the soils—Continued

Soil features affecting—Continued				Limitations for sewage disposal	
Drainage for crops and pasture	Irrigation	Diversions	Waterways	Septic tanks	Sewage lagoon
Subject to flooding.	Subject to flooding.	Not needed.	Not needed.	Severe: subject to flooding.	Severe: subject to flooding.
Slow permeability.	Gently sloping to strongly sloping; slow permeability.	High compressibility.	All features favorable.	Severe: slow permeability.	Severe: slopes.
Not needed.	Very low available water capacity; very rapid permeability.	Not needed.	Not needed.	Severe: subject to flooding.	Severe: subject to flooding; very rapid permeability.
Not needed.	Bedrock below a depth of 32 inches.	Bedrock below a depth of 32 inches.	Low available water capacity.	Severe: bedrock below a depth of 32 inches.	Severe: bedrock below a depth of 32 inches.
Not needed.	Bedrock below a depth of 5 inches.	Bedrock below a depth of 5 inches.	Very low available water capacity; bedrock below a depth of 5 inches.	Severe: bedrock below a depth of 5 inches.	Severe: bedrock below a depth of 5 inches.
Slow to moderately slow permeability.	Slow to moderately slow permeability.	Not needed.	Not needed.	Severe: subject to flooding.	Severe: subject to flooding.
Not needed.	Moderate available water capacity.	Not needed.	Not needed.	Severe: subject to flooding.	Severe: subject to flooding.
Not needed.	Gently sloping to sloping.	Gently sloping to sloping.	All features favorable.	Moderate: moderate permeability.	Moderate: slopes.
Not needed.	Strongly sloping to moderately sloping.	Strongly sloping to moderately steep.	All features favorable.	Severe: slopes.	Moderate: slopes.
Slow permeability.	Slow permeability.	Not needed.	Not needed.	Severe: subject to flooding.	Severe: subject to flooding.

Available water capacity is the capacity of a soil to hold water available for use by most plants. It is the difference between the amount of soil water at field capacity and the amount at wilting point. The estimates of available water capacity are based on data for similar soils.

The shrink-swell potential indicates the relative potential for volume change when the moisture content changes. It is estimated primarily on the basis of the amount and kind of clay in a soil. In general, a soil classified as CH and A–7 has a high shrink-swell potential. Soils with a low shrink-swell potential are clean sands and gravels (single-grain) and soils having a small amount of nonplastic to slightly plastic fine material.

Most soils in the survey area are deep enough that bedrock generally does not affect their use. Shale is at a depth of about 24 inches in the Mandeville soils and at a depth of about 32 inches in the Snead soils; limestone is at a depth of about 6 inches in the Sogn soils.

Depth to a seasonal high water table generally does not affect the use of soils in the survey areas. The Myrick soils, however, have a seasonal high water table at a depth of about 32 inches.

Engineering interpretations

Table 4 rates soils as a source of topsoil and road fill material and indicates major soil features affecting highway location. It also lists soil features affecting some engineering practices and indicates some limitations for sewage disposal uses.

In selecting soils for highway construction, the engineer investigates the likelihood of flooding, seepage, and landslides. He considers the presence of poor-quality material within or slightly below the subgrade. For example, a layer of highly plastic clay impedes internal drainage and affects the stability of the soil. Poor drainage, flooding, or a high water table affects the need for drainage or embankments.

Suitability of the soils of Lafayette County for the design and application of conservation practices, building foundations, irrigation systems, and sewage disposal are primarily affected by soil drainage, permeability, slope, overflow, wetness, and presence of rock. These properties are evaluated in table 4 for the soils of each series.

All of the soils located on flood plains in the county are subject to flooding. Even the soils on second bottoms or terraces are subject to some infrequent flooding. The extent of flooding varies with the rainfall pattern and extent to which local soil and water conservation practices are applied. Soils occurring in the uplands, particularly those having slopes of more than 7 to 8 percent, have an irregular dendritic slope pattern. Such a pattern requires considerable cutting and filling and restricts the suitability of the soil for parallel terrace construction. Only the small percentage of the county occupied by the soils of the Sogn, Snead, and Mandeville series, have rock or shale layers that interfere with normal use. Farm pond construction is generally well adapted to all soils except those containing stones in the solum and those subject to overflow.

Recreational Uses of the Soils

Recreation can be a primary use of certain areas, but it is more likely to be part of a multiple-use scheme for developing an area. Recreational enterprises are important segments of community development. Skillfull management is needed if the soils, water, plants, and wildlife are to provide opportunities for outdoor enjoyment and at the same time provide monetary gain for the landowner.

Lafayette County has many natural resources that offer opportunities for development of outdoor recreation. Some of these are boating and hunting in the wide Missouri River Valley, nature study and camping in the picturesque River Hills, horseback riding and pond fishing on the rolling prairie, and hunting and hiking in the scenic southwestern part of the county. In addition to these, there are a number of historical sites, such as Indian village sites, early town sites, and many old houses which offer a potential for recreational development.

Lafayette County is within minutes of Kansas City. National Interstate Highway 70 provides easy access to the county. It also brings in large numbers of travelers, especially in spring, in summer, and in fall.

Table 5 shows the estimated degree of limitation of each of the survey mapping units for stated recreational uses of the soils of Lafayette County. For *moderate* and *severe* limitations, the table lists the cause of such limitations. Following are the three degrees of limitations used in the table and their meanings:

Slight.—Limitations, if any, are of minor importance and are easy to overcome.

Moderate.—Limitations are of a magnitude to require careful planning, design, and management. The cost of measures to correct or overcome the limitations is an important consideration.

Severe.—Limitations are serious enough that the cost of corrective measures may be too high to justify the intended use. The soil or site is not suited to the intended recreational use.

The kinds of limitations are expressed in terms of soil characteristics or properties. As a rule, the properties that affect agricultural uses of soils are also the ones that affect recreational uses. For example, soils subject to flooding have limitations both for use for crops and for use for recreation. Flooding presents a serious limitation to use of soils intended for camping sites and for most recreational buildings. Where flooding is infrequent, the use of soils for hiking trails, nature study areas, or greenbelt open space may be only partially limited. Soils that are wet for a significant part of the season of use, even if not subject to flooding, are not well suited to use for campsites, recreational roads and trails, playgrounds, golf fairways, and picnic areas. Some droughty soils also have limitations, and stones in some soils are hazardous for certain uses. Some silty soils are excessively dusty, and some clayey soils remain sticky and slippery.

Slope also affects the recreational uses of soils. Steep slopes normally present severe hazards. Nearly level, well-drained, stone-free soils that are above the level ordinarily reached by overflow normally have little or no limitation for recreational use. Hard rock near the

TABLE 5.—*Limitations of the soils for stated recreational developments*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series in the first column of this table]

Soil series and map symbols	Picnic areas	Playgrounds	Camp areas	Paths and trails	Golf fairways
*Blackoar: Bk. For Otter part, see Otter series.	Severe: wetness	Severe: subject to flooding; wetness.	Severe: subject to flooding; wetness.	Severe: wetness	Severe: wetness.
Booker: Bo	Severe: wetness	Severe: subject to flooding; wetness.	Severe: subject to flooding; wetness.	Severe: wetness; silty clay surface layer.	Severe: wetness.
Bremer: BrB	Severe: wetness	Severe: subject to flooding; wetness.	Severe: subject to flooding; wetness.	Severe: wetness	Severe: wetness.
Colo: Co	Severe: wetness	Severe: subject to flooding; wetness.	Severe: subject to flooding; wetness.	Severe: wetness	Severe: wetness.
Dockery: Do	Moderate: subject to flooding; wetness.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: wetness	Moderate: subject to flooding.
Haynie: Ha	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Slight	Moderate: subject to flooding.
Higginsville:					
HgC, HgC2	Moderate: wetness	Moderate: slopes; wetness; slow permeability.	Moderate: wetness; slow permeability.	Moderate: wetness	Slight.
HgD2	Moderate: slopes; wetness.	Severe: slopes	Moderate: wetness; slow permeability.	Moderate: wetness	Moderate: slopes.
HnC3	Moderate: silty clay loam surface layer; wetness.	Severe: slopes	Moderate: slow permeability; silty clay loam surface layer; wetness.	Moderate: silty clay loam surface layer; wetness.	Slight
Hodge: Ho	Moderate: subject to flooding.	Severe: subject to flooding; loamy fine sand surface layer.	Severe: subject to flooding.	Moderate: loamy fine sand surface layer.	Moderate: subject to flooding.
Kennebec: Ke	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.
Knox:					
KnB, KnC2	Slight	Moderate: slopes	Slight	Slight	Slight.
KnD2, KnD3	Moderate: slopes	Severe: slopes	Moderate: slopes	Slight	Moderate: slopes.
KnE2, KnE3	Severe: slopes	Severe: slopes	Severe: slopes	Moderate: slopes	Moderate: slopes.
KnF2, KnF3	Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes.
Leslie:					
LeB	Moderate: wetness	Moderate: slow permeability; slopes; wetness.	Moderate: slow permeability; slopes; wetness.	Moderate: wetness	Slight.
LeC2	Moderate: wetness	Severe: slopes	Moderate: slow permeability; slopes; wetness.	Moderate: wetness	Slight.
Leta: Lt	Severe: silty clay surface layer.	Severe: subject to flooding; silty clay surface layer.	Severe: subject to flooding; silty clay surface layer.	Moderate: silty clay surface layer; wetness.	Moderate: flooding; silty clay surface layer.

TABLE 5.—*Limitations of the soils for stated recreational developments*—Continued

Soil series and map symbols	Picnic areas	Playgrounds	Camp areas	Paths and trails	Golf fairways
Macksburg: MaB, MaB2	Moderate: wetness	Moderate: moderately slow permeability; slopes; wetness.	Moderate: moderately slow permeability; wetness.	Moderate: wetness	Slight.
Mandeville:					
MdC2	Slight	Severe: slopes	Slight	Slight	Slight.
MdD2	Moderate: slopes	Severe: slopes	Moderate: slopes	Slight	Moderate: slopes.
Marshall:					
MhB	Slight	Moderate: slopes	Slight	Slight	Slight.
MhC2, MhC3	Slight	Severe: slopes	Slight	Slight	Slight.
MhD2, MhD3	Moderate: slopes	Severe: slopes	Moderate: slopes	Slight	Moderate: slopes.
McGirk:					
MkB	Moderate: wetness	Severe: moderately slow permeability.	Severe: moderately slow permeability.	Moderate: wetness	Slight.
MkC2	Moderate: wetness	Severe: moderately slow permeability; slopes.	Severe: moderately slow permeability.	Moderate: wetness	Slight.
Minden: MnB	Slight	Moderate: slopes	Slight	Slight	Slight.
Modale: Mo	Moderate: subject to flooding; wetness.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: wetness	Moderate: flooding.
Moniteau: MtB	Moderate: subject to flooding; wetness.	Severe: subject to flooding; wetness.	Severe: subject to flooding; wetness.	Severe: wetness	Severe: wetness.
Myrick: My	Severe: subject to flooding; wetness.	Severe: subject to flooding; wetness.	Severe: subject to flooding; wetness.	Severe: wetness	Severe: wetness.
Nodaway: No	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Slight	Moderate: subject to flooding.
*Otter. Mapped only in undifferentiated unit with Blackoar soils.	Severe: wetness	Severe: wetness	Moderate: wetness	Slight	Moderate: wetness.
Polo:					
PoC2	Slight	Moderate: slopes	Slight	Slight	Slight.
PoD2	Moderate: slopes	Severe: slopes	Moderate: slopes	Slight	Moderate: slopes.
Ray: Ra	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Slight	Moderate: subject to flooding.
Riverwash: Rw. Too variable to rate.					
Sampsel:					
SaB	Moderate: wetness	Moderate: slow permeability; slopes; wetness.	Moderate: slow permeability; silty clay loam surface layer; wetness.	Severe: wetness	Slight.
SaC2, SaC3	Moderate: wetness	Severe: slopes	Moderate: slow permeability; silty clay loam surface layer; wetness.	Severe: wetness	Slight.
SaD2	Moderate: slopes; wetness.	Severe: slopes	Moderate: slow permeability; silty clay loam surface layer; slopes.	Severe: wetness	Moderate: slopes.

TABLE 5.—*Limitations of the soils for stated recreational developments*—Continued

Soil series and map symbols	Picnic areas	Playgrounds	Camp areas	Paths and trails	Golf fairways
Sarpy: Sd	Severe: fine sand surface layer.	Severe: fine sand surface layer; subject to flooding.	Severe: fine sand surface layer; subject to flooding.	Severe: fine sand surface layer.	Severe: fine sand surface layer.
Snead: SnD2	Moderate: slopes; silty clay loam surface layer.	Severe: slopes	Moderate: slopes; slow permeability.	Slight	Slight.
Sogn:					
SoD	Moderate: slopes; silty clay loam surface layer.	Severe: slopes; shallow soil.	Moderate: slopes	Slight	Moderate: slopes.
SoF	Severe: slopes	Severe: slopes; shallow soil.	Severe: slopes	Severe: slopes	Severe: slopes.
Waldron: Wa	Moderate: subject to flooding; silty clay loam surface layer; wetness.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: silty clay loam surface layer; wetness.	Moderate: subject to flooding.
*Waubonsie: Wb For Haynie part, see Haynie series.	Moderate: subject to flooding; loamy sand surface layer.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: loamy sand surface layer.	Moderate: subject to flooding; loamy sand surface layer.
Winfield:					
WdB	Slight	Moderate: slopes	Slight	Slight	Slight.
WdC2	Slight	Severe: slopes	Slight	Slight	Slight.
WdD2	Moderate: slopes	Severe: slopes	Moderate: slopes	Slight	Moderate: slopes.
WdE2	Severe: slopes	Severe: slopes	Severe: slopes	Moderate: slopes	Moderate: slopes.
WfC3	Moderate: silty clay loam surface layer.	Severe: slopes	Moderate: silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Slight.
WfD3	Moderate: slopes; silty clay loam surface layer.	Severe: slopes	Moderate: slopes; silty clay loam surface layer.	Moderate: silty clay loam surface layer.	Moderate: slopes.
Zook: Zo	Severe: wetness	Severe: subject to flooding; wetness.	Severe: subject to flooding; wetness.	Severe: wetness	Moderate: subject to flooding.

surface is a hazard to the use of soils that require leveling, the establishment of vegetation, or the construction of roads and other facilities.

In table 5 the following soil properties have been considered in rating the soils for use as picnic areas, playgrounds, camp areas, paths and trails, and golf fairways: (1) wetness, as indicated by soil drainage, tendency to ponding, or the presence of a high water table; (2) permeability, as indicated by soil texture, structure, and color; (3) estimated frequency of flooding; (4) depth to rock; (5) texture of the surface layer and proportion of coarse fragments; and (6) slope. Soil properties that affect other soil uses, some of which are applicable to recreational development, are given in table 3 in the section "Engineering Uses of the Soils."

These properties were evaluated and the degree of soil limitation is shown in table 5 for the following recreational uses:

Picnic areas.—Ratings apply to community or individual type picnic areas for seasonal use. Such soil properties as presence of stones, susceptibility to flooding, and texture of the surface layer are most significant. The sustained growth of vegetation that is able to withstand heavy traffic is important.

Paths and trails.—Ratings apply to trails that are to areas to be developed for organized games, as baseball, football, badminton, and the like. Areas selected for this use are subject to intensive foot traffic, and the ability to support vegetation is important. Nearly level areas of well-drained soils that have a surface layer of texture and consistence that provide a firm surface are generally most suitable. Sites where the soil properties are less desirable require more expenditure for preparation and maintenance.

Camp areas.—The ratings apply to sites for tents and small camp trailers and the accompanying activities of outdoor living. Suitability of the soil to support vegetation that can withstand traffic is an important consideration.

Paths and trails.—Ratings apply to trails that are to be used for cross-country hiking, bridle paths, and nonintensive uses allowing random movement of people. It is assumed that such areas will require a minimum of excavation and of preparation of the site. Swamps, very

stony areas, and sand dunes are generally considered as presenting severe hazards to use for paths and trails.

Golf fairways.—Ratings apply to golf fairways between greens. It is assumed that on fairways a suitable kind of vegetation will be established. Rocks on the surface, steep slopes, flooding, shallowness to rock, and wetness are features that determine feasibility for establishing and maintaining fairways.

Use of the Soils as Wildlife Habitat

This section deals with the suitability of the soils of Lafayette County for growing plants that furnish food and cover for wildlife. It consists of (1) an explanation of the relationship between wildlife management and soils; (2) a table that rates the soils for elements of wildlife habitat and for habitat for classes of wildlife; and (3) definitions of the ratings, of habitat elements, and of classes of wildlife.

Successful management of wildlife on any tract involves having food, cover, and water available in a suitable combination. Lack of any of these necessities, an unfavorable balance between them, or inadequate distribution of them can seriously limit or make impossible the use of the tract as a habitat for the desired species of wildlife.

Information on soils is useful in creating, improving, or maintaining an environment that is suitable for providing food, cover, and water for wildlife. Most wildlife habitats are managed by planting suitable vegetation, by manipulating existing vegetation, or by a combination of these measures. Information on soils can also be useful in broad-scale planning for parks, nature areas, or other recreational developments having wildlife aspects.

Table 6 rates the soils of Lafayette County according to potential for the creation, improvement, or maintenance of eight elements of wildlife habitat, and also for their relative value as habitats for openland wildlife, woodland wildlife, and wetland wildlife.

In rating the soils for wildlife potential, major emphasis was given to the following soil characteristics and qualities: available water capacity, effective soil depth, hazard of flooding, reaction, slope, texture of the surface layer, and natural drainage or wetness.

Habitat elements

The seven habitat elements listed in table 6 are described in the following paragraphs:

Grain and seed crops are domestic grains or seed-producing annuals planted to produce food for wildlife. Examples are corn, sorghum, wheat, oats, soybeans, and millet.

Domestic grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted to furnish wildlife food and cover. Examples are fescue, brome, timothy, redtop, orchardgrass, reed canarygrass, clover, trefoil, alfalfa, and sericea lespedeza.

Wild herbaceous plants are native or introduced perennial grasses and forbs (weeds) that provide food and cover principally to upland forms of wildlife; and are mainly established through natural processes. Examples are bluestem, indiangrass, wheatgrass, wildrye, oatgrass, pokeweed, strawberry, lespedeza, wild beans, and dandelion.

Hardwood trees are nonconiferous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, twigs, or foliage used extensively as food by wildlife; and which commonly are established through natural processes but also may be planted. Examples are hawthorn, dogwood, viburnum, holly, honeysuckle, and roses.

Coniferous plants are cone-bearing trees and shrubs, primarily of importance to wildlife as cover, but which also may furnish food in the form of browse, seeds, or fruitlike cones; and which commonly are established through natural processes but also may be planted. Examples are pine, spruce, white-cedar, hemlock, balsam fir, redcedar, juniper, and yew.

Wetland plants are annual and perennial wild herbaceous plants in moist or wet sites, exclusive of submerged or floating aquatics, that produce food and cover mainly used by wetland forms of wildlife. Examples are smartweed, wild millet, bulrushes, reeds, and cattails.

Shallow-water areas are impoundments or excavations where water generally does not exceed a depth of 5 feet. Examples are low dikes and levees, shallow dugouts, level ditches, and devices for controlling the water level in marshy streams or channels.

Habitat potential ratings

The suitability ratings shown in table 6 are defined as follows:

Good means that the soil is above average for a wildlife habitat element or as a habitat for a given class of wildlife. A satisfactory habitat generally is easily created, or the habitat can be improved or maintained. There are few or no soil limitations to habitat management, and satisfactory results can be expected.

Fair means that the soil is about average for a habitat element or as a habitat for a given class of wildlife. A satisfactory habitat generally can be created, or the habitat can be improved or maintained. There are moderate soil limitations to management. Fairly frequent attention and moderate intensity of management may be required to obtain satisfactory results.

Poor means that the soil is below average for an element or as a habitat for a given class of wildlife. Soil limitations are rather severe, but a satisfactory habitat generally can be created, or the habitat can be improved or maintained. Results are uncertain. Management may be difficult and may require intensive effort.

Very poor means that the soil has severe limitations and that the creation, improvement, or maintenance of a satisfactory habitat is impractical under prevailing soil conditions. Unsatisfactory results are probable.

Classes of wildlife

The three classes of wildlife listed in table 6 are defined as follows:

Openland wildlife consists of birds and mammals that normally make their homes in cultivated fields and in pastures and meadows; on lawns; and in areas overgrown by grasses, herbs, and shrubs. Examples are quail, pheasant, meadowlark, field sparrow, redwinged blackbird, cottontail rabbit, red fox, and woodchuck.

Woodland wildlife consists of birds and mammals that normally make their homes in areas wooded with hard-

wood trees and shrubs; coniferous trees and shrubs; or mixtures of such plants. Examples are ruffed grouse, woodchuck, thrush, vireo, scarlet tanager, gray and red squirrels, gray fox, whitetailed deer, and raccoon.

Wetland wildlife consists of birds and mammals that normally make their homes in wet areas such as ponds, streams or ditches, marshes, and swamps. Examples are black duck, wood duck, rail, heron, shore birds, mink, muskrat, and beaver.

Use of the Soils as Woodland [3]

The native vegetation of Lafayette County consists of areas of scattered trees, thick woodland, and tall prairie grasses and other herbaceous plants. Tall prairie grasses and scattered trees grew on the gently sloping soils on broad upland ridgetops. Thick woodland stands grew on the strongly sloping to steep soils on upland hillsides. A mixture of herbaceous vegetation and woodland vegetation grew on the level or nearly level soils on bottom lands along rivers and other streams.

At the present time woodland in Lafayette County is mainly in areas of strongly sloping to steep soils on uplands. These areas, in most places, are long, narrow bands on hillsides that are adjacent to bottom lands along rivers and other streams. In other places the areas are irregular in shape and are on hillsides that have shallow, rocky soils or deep, badly gullied soils. There are 38,500 acres (7) of woodland, about 9.5 percent of the land area in the county, and almost every farm has a few trees (fig. 17).

Many of these small farm woodlots have top-quality hardwood trees, and the potential for high returns at minimum cost and management is good.

The suitability of soils in Lafayette County for use as woodland is discussed, by soil association, in the paragraphs that follow. The associations are described in detail in the section "General Soil Map."

Suitability for trees on the soils of association 1.—This association consists mainly of the Haynie and Leta soils. It makes up about 5 percent of the county. These soils are on bottom lands along the Missouri River. Only a small part of this association is used as woodland. Small areas of willows and cottonwoods grow close to the river. Pecan, sycamore, walnut and other kinds of trees are scattered throughout the association.

This soil association is well suited to the production of pulpwood, high-quality hardwood lumber, and walnut and pecan nuts. Black willow (*Salix nigra*), cottonwood, (*Populas deltoides*), pecan (*Carya illinoenis*), and black walnut (*Juglans nigra*) grow naturally.

The main hazards in this association are flooding and streams that change course.

Suitability for trees on the soils of association 2.—This association consists mainly of the Knox and Marshall soils. It makes up about 12 percent of the county. These soils are in the Missouri River Hills area. A somewhat large part of this area is used as woodland. These woodlands are small to large in size and consist of many species of trees and shrubs. They are on moderately steep to steep slopes that are commonly the sides of deep gullies or ravines that formed through erosion of deep wind-deposited soil material.

This soil association is very well suited to the production of high-quality hardwood lumber. Yellow-poplar (*Liriodendron tulipifera*) is well suited in some places. Black walnut (*Juglans nigra*) and northern red oak (*Quercus rubra*) are important species that grow naturally.

The main hazards in this association are erosion and steep slopes. Steep slopes make harvesting of timber difficult in some places.

Suitability for trees on the soils of association 3.—This association consists mainly of the Marshall and Higginsville soils. It makes up about 62 percent of the county. These soils are on prairies on uplands and along bottom lands of small streams. Only a small part of this association is used as woodland. The woodland areas are narrow bands mostly on the strongly sloping hillsides adjacent to bottom lands along small streams. This association also has many areas of scattered trees near farmsteads and in open fields or fence rows.

This association is well suited to the production of high-quality hardwood lumber but is mostly used for cultivated crops. Black walnut (*Juglans nigra*) and many species of hickory (*Carya sp.*) and white oak (*Quercus alba*) grow naturally.

The main hazard in this association is erosion.

Suitability for trees on the soils of association 4.—This association consists of the Blackoar, Otter, and Nodaway soils. It makes up about 3 percent of the county. It is on bottom lands along Davis Creek and Salt Creek. Only a very small part of the acreage is woodland. The wooded areas are mostly very small areas along old stream channels or in odd-shaped tracts cut off by stream bends and farm boundaries.

This soil association is very well suited to the production of pulpwood, but is mostly used for cultivated crops. It also is well suited to the production of high-quality hardwood lumber. Cottonwood (*Populus deltoides*), black walnut (*Juglans nigra*), and white oak (*Quercus alba*) grow naturally.

Suitability for trees on the soils of association 5.—This association consists mainly of the Winfield and Sampsel soils. It makes up about 18 percent of the county. It is on prairies on uplands and along bottom lands of small streams. A moderately large part of the acreage is in mixed timber. These wooded areas commonly are in narrow bands on strongly sloping hillsides adjacent to bottom lands along small streams or in irregularly shaped areas on the strongly sloping to steep hillsides where the soils are shallow and rocky.

This soil association is well suited or moderately well suited to the production of high-quality hardwood lumber. Black walnut (*Juglans nigra*), many species of hickory (*Carya sp.*), white oak (*Quercus alba*), post oak (*Quercus stellata*), and black oak (*Quercus velutina*) grow naturally.

The main hazards in this association are erosion and drought. Erosion is a hazard both in areas where the soils are deep and where the soils are shallow and rocky. Drought is a major hazard in areas where the soils are shallow and rocky, and in places it produces a somewhat lower quality of timber.

[3] By FRANCIS T. HOLT, woodland conservationist, Soil Conservation Service.

TABLE 6.—*Suitability of the soils for elements of wildlife*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees
Blackoar: Bk For Otter part, see Otter series.	Good	Fair: wetness	Good	Fair: wetness
Booker: Bo	Very poor: wetness	Poor: wetness	Poor: silty clay surface layer; wetness.	Poor: wetness
Bremer: BrB	Poor: wetness	Fair: wetness	Fair: wetness	Fair: wetness
Colo: Co	Good	Fair: wetness	Good	Fair: wetness
Dockery: Do	Good	Good	Good	Good
Haynie: Ha	Good	Good	Good	Good
Higginsville: HgC, HgC2, HgD2, HnC3.	Fair: slopes; wetness.	Good	Good	Good
Hodge: Ho	Poor: loamy fine sand surface layer.	Fair: loamy fine sand surface layer.	Good	Fair: somewhat excessively drained.
Kennebec: Ke	Good	Good	Good	Good
Knox:				
KnB	Good	Good	Good	Good
KnC2, KnD2, KnD3	Fair: slopes	Good	Good	Good
KnE2, KnE3, KnF2, KnF3	Poor: slopes	Fair: slopes	Good	Good
Leslie:				
LeB	Fair: wetness	Good	Good	Good
LeC2	Fair: wetness; slopes	Good	Good	Good
Leta: Lt	Fair: silty clay surface layer; wetness.	Fair: silty clay surface layer.	Fair: silty clay surface layer.	Good
Macksburg: MaB, MaB2	Fair: wetness	Good	Good	Good
Mandeville: MdC2, MdD2	Fair: slopes	Good	Good	Good
Marshall:				
MhB	Good	Good	Good	Good
MhC2, MhC3, MhD2, MhD3	Fair: slopes	Good	Good	Good
McGirk:				
MkB	Fair: wetness	Good	Good	Good
MkC2	Fair: wetness; slopes	Good	Good	Good
Minden: MnB	Fair: wetness	Good	Good	Good
Modale: Mo	Fair: wetness	Good	Good	Good

habitat and for classes of wildlife

Elements of wildlife habitat—Continued			Kinds of wildlife		
Coniferous plants	Wetland plants	Shallow-water areas	Openland	Woodland	Wetland
Fair: wetness	Good	Fair: moderate permeability.	Good	Fair	Fair.
Poor: wetness	Poor: silty clay surface layer.	Good	Poor	Poor	Fair.
Fair: wetness	Good	Good	Fair	Fair	Good.
Fair: wetness	Good	Fair: moderately slow permeability.	Good	Fair	Fair.
Good	Good	Fair: moderately slow permeability.	Good	Good	Fair.
Good	Poor: well drained	Very poor: well drained.	Good	Good	Very poor.
Good	Very poor: slopes	Very poor	Good	Good	Very poor.
Fair: somewhat excessively drained.	Very poor: somewhat excessively drained.	Very poor: rapid permeability.	Fair	Fair	Very poor.
Good	Poor: moderately well drained.	Very poor: moderately well drained.	Good	Good	Very poor.
Good	Poor: well drained	Very poor: slopes	Good	Good	Very poor.
Good	Very poor: slopes	Very poor: slopes	Good	Good	Very poor.
Good	Very poor: slopes	Very poor: slopes	Fair	Good	Very poor.
Good	Fair: somewhat poorly drained.	Poor: slopes	Good	Good	Poor.
Good	Poor: slopes	Very poor: slopes	Good	Good	Very poor.
Good	Poor: silty clay surface layer.	Fair: somewhat poorly drained.	Fair	Good	Poor.
Good	Poor: slopes	Very poor: slopes	Good	Good	Very poor.
Good	Very poor: slopes	Very poor: slopes	Good	Good	Very poor.
Good	Poor: well drained	Very poor: well drained	Good	Good	Very poor.
Good	Very poor: slopes	Very poor: slopes; well drained.	Good	Good	Very poor.
Good	Fair: slopes	Very poor: slopes	Good	Good	Poor.
Good	Poor: slopes	Very poor: slopes	Good	Good	Very poor.
Good	Poor: slopes	Very poor: slopes	Good	Good	Very poor.
Good	Good	Good	Good	Good	Good.

TABLE 6.—*Suitability of the soils for elements of wildlife*

Soil series and map symbols	Elements of wildlife habitat			
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous plants	Hardwood trees
Moniteau: MtB	Fair: wetness	Fair: wetness	Fair: wetness	Fair: wetness
Myrick: My	Very poor: wetness	Poor: wetness	Very poor: wetness	Very poor: wetness
Nodaway: No	Good	Good	Good	Good
Otter Mapped only in undifferentiated unit with Blackoar soils.	Poor: wetness	Fair: wetness	Fair: wetness	Fair: wetness
Polo: PoC2, PoD2	Fair: slopes	Good	Good	Good
Ray: Ra	Good	Good	Good	Good
Riverwash: Rw. Too variable to rate.				
Sampsel: SaB	Fair: wetness	Good	Good	Good
SaC2, SaC3, SaD2	Fair: wetness	Good	Good	Good
Sarpy: Sd	Very poor: very low available water capacity.	Poor: fine sand surface layer; excessively drained.	Poor: very low available water capacity.	Very poor: very low available water capacity.
Snead: SnD2	Fair: slopes	Good	Good	Good
Sogn: SoD, SoF	Very poor: low available water capacity.	Poor: low available water capacity.	Poor: low available water capacity.	Very poor: low available water capacity.
Waldron: Wa	Fair: wetness	Good	Good	Good
*Waubonsie: Wb	Poor: loamy sand surface layer.	Fair: loamy sand surface layer.	Good	Good
Winfield: WdB	Good	Good	Good	Good
WdC2, WdD2, WfC3, WfD3 WdE2	Fair: slopes Poor: slopes	Good Fair: slopes	Good Good	Good Good
Zook: Zo	Fair: subject to flooding.	Fair: wetness	Fair: wetness	Fair: wetness

habitat and for classes of wildlife—Continued

Elements of wildlife habitat—Continued			Kinds of wildlife		
Coniferous plants	Wetland plants	Shallow-water areas	Openland	Woodland	Wetland
Fair: wetness	Fair: slopes	Fair: slopes	Fair	Fair	Fair.
Very poor: wetness	Poor: silty clay surface layer.	Good	Very poor	Very poor	Fair.
Good	Poor: moderately well drained.	Poor: moderately well drained.	Good	Good	Poor.
Fair: wetness	Good	Fair: moderate permeability.	Fair	Fair	Fair.
Good	Very poor: slopes	Very poor: slopes	Good	Good	Very poor.
Good	Poor: well drained	Very poor: well drained	Good	Good	Very poor.
Good	Fair: somewhat poorly drained.	Fair: somewhat poorly drained.	Good	Good	Fair.
Good	Very poor: slopes	Very poor: slopes	Good	Good	Very poor.
Very poor: very low available water capacity.	Very poor: excessively drained.	Very poor: excessively drained.	Poor	Very poor	Very poor.
Good	Very poor: slopes	Very poor: slopes	Good	Good	Very poor.
Very poor: low available water capacity.	Very poor: slopes	Very poor: slopes	Poor	Very poor	Very poor.
Good	Fair: somewhat poorly drained.	Fair: somewhat poorly drained.	Good	Good	Fair.
Good	Poor: moderately well drained.	Poor: moderately well drained.	Fair	Good	Poor.
Good	Poor: moderately well drained.	Very poor: slopes	Good	Good	Very poor.
Good	Very poor: slopes	Very poor: slopes	Good	Good	Very poor.
Good	Very poor: slopes	Very poor: slopes	Fair	Good	Very poor.
Fair: wetness	Good	Good	Fair	Fair	Good.

Figure 17.—**Woodland on soils in association 3. Most farms have a few trees.**

Other uses of the soils for trees.—Soils of this county are used for ornamental plantings around homes, cemeteries, parks, and golf courses; for production of Christmas trees; and for planting of windbreaks for protection of farmsteads. Use of soils for trees is expected to increase as the need to improve the total environment becomes more critical. Where trees and shrubs are to be established, the suitability of the soils should be considered. Several soil series in Lafayette County are well suited to growing Christmas trees, but technical assistance is generally needed in planning.

Much of the existing woodland in this county does not indicate the potential of the soils for this use. Trees now grow only on soils that are not suited to the production of crops, or they are grown in conjunction with field crops or in pastures. Under good management many of the wooded areas are suited to high-quality hardwood timber.

The U.S. Forest Service records indicate that during the period 1947–59 the acreage in woodland and the yield per acre increased in the Missouri Prairie Region but decreased in Lafayette County.

Formation and Classification of Soils

This section discusses factors that have affected the formation of soils in Lafayette County. It also classifies soils into higher categories.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineral composition

of the parent material; (2) the climate under which the soil material accumulated and existed; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Generally, a long time is required for the development of distinct horizons.

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

Parent material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limits of the chemical and mineral composition of the soil. In Lafayette County, three kinds of parent material, alone or in combinations of two or more, have contributed to the formation of soils. These are residual or bedrock material, loessial or wind-deposited material, and alluvial or water-deposited material.

Residual material has weathered from limestone, sandstone, and shale to form the parent material of such soils as Mandeville, Snead, Sogn, and Sampsel.

Loess parent material, made up principally of silts, was transported into Lafayette County by wind. The Marshall soils formed in this material.

Alluvial parent material in Lafayette County is of local and regional origin. It is made up of silt, sand, clay, and gravel transported by water from uplands to the flood plains of streams. Soils such as the Sarpy, Hodge, and Modale formed in alluvium deposited by the Missouri River. Soils such as Blackoar, Colo, and Zook formed in parent material deposited by local streams.

Plant and animal life

Plants, animals, insects, bacteria, and fungi are important in the formation of soils. Increases in the content of organic matter and nitrogen in the soil, gains or losses in the content of plant nutrients, and alteration of structure and porosity are among the changes caused by living organisms.

Vegetation, particularly tall prairie grasses and deciduous forests, has affected the formation of soil in Lafayette County more than other living organisms. Most of the soils formed under tall prairie grasses, but some formed under deciduous forests.

Tall prairie grasses and other plants and animal life form soils that have a thick, dark-colored surface layer and high organic-matter content. A large part of the soils of Lafayette County are prairie soils. Examples of such soils are the Marshall and Higginsville soils.

Deciduous forests, and their associated plant and animal life, formed soils that have light-colored surface layers and low organic-matter content. Only a very small area of the soils in Lafayette County formed under forest vegetation alone; however, a large area of the soils formed under prairie vegetation and then under forest vegetation. Such soils have a surface layer that is lighter colored than prairie soils and somewhat darker than forest soils.

An example of soils in Lafayette County that were influenced by deciduous forest vegetation is the Knox series. The soils in the Knox series are somewhat lighter colored than those in the Marshall series, which formed under a cover of prairie grasses. The surface layer of the Knox soils is very dark gray and dark grayish brown, and the upper part of the subsoil is brown and dark yellowish brown. Marshall soils have a black to very dark brown surface layer. The upper part of the subsoil is very dark grayish brown and dark brown.

Climate

Climate, both long ago and recently, has been an important factor in the formation of the soils in Lafayette County. As a result of the climate of long ago, soil-forming materials were deposited in the county by ice and wind. More recent climate affected, either directly or indirectly, the development of the soils that formed from these and other materials. Geologic erosion, plant and animal life, and, in more recent time, accelerated erosion all have varied with the climate and all have influenced soil development.

Climate affects vegetation and in this way affects soils in the county. Pollen studies indicate that the climate during the Sangamon period (20,000 to 150,000 years ago) was cool and moist. This climate was favorable to the growth of coniferous vegetation. Pollen studies also indicate that two periods occurred in which the climate was decidedly semiarid. During these periods grass, which is able to withstand greater climatic extremes than trees, grew on these soils. The first such period occurred about 6,500 to 8,100 years ago; and the last, which was even drier, occurred during the last 6,500 years. The recent climatic period has favored grass vegetation. The great majority of the soils have dark-colored upper layers, which indicates that they developed under prairie vegetation. Examples are the Marshall, Higginsville, Polo, Sampsel, and Snead soils. Observations during mapping indicate that deciduous tree cover is increasing in the county. This indicates that the climate may again be becoming more humid.

Topography

Topography, or relief, affects soil formation through its influence on drainage, runoff, infiltration, and other related factors, including accelerated erosion. In areas that have about the same plant cover and rainfall, runoff is rapid on steep slopes and is slower or lacking in level areas. In areas where most of the water runs off, little water enters the soil and soils form slowly. In these areas soils horizons are indistinct and the solum is thin. The Snead soil is an example. In areas where little water runs off, or where it runs off slowly, more water enters and soils form rapidly. In these areas soil horizons are

distinct and the solum is thick. An example is the Higginsville soil.

Time

Time is necessary for soils to form from parent materials. In Lafayette County, soils that formed in residual and loessial material have had a long period of time in which soil development could take place. These soils have well-defined horizons and are referred to as old soils.

Soils that formed in alluvial material range from old soils to young soils, depending mainly on how long the period of time has been in which soil development could take place. The old soils are on stream terraces in material that has been in place for a long period of time. An example is the Moniteau soils, which have a silt loam surface layer and a silty clay loam subsurface layer. The young soils are adjacent to streams in recently deposited material that, in places, is still in the process of being deposited from year to year by flooding and overwashing. Kennebec soils are an example. They are silt loam throughout and show evidence of recent stratification. In places in Lafayette County, steep, rocky material has been exposed by geologic erosion. This material, although very old, has not had time to fully develop. The shallow Sogn soils are examples, as they include exposed bedrock surfaces, ledges, and small cliffs.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and revised later (*4*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties (*6*) and was adopted in 1965 (*3*). It is under continual study.

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable. The properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 7 shows the classification of each soil series of Lafayette County by family, subgroup, and order, according to the current system.

ORDER.—Ten soil orders are recognized. They are: Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols (*9*). The properties used to differentiate these soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different kinds of climate. Table 7 shows that the four soil orders in Lafayette County are Alfisols, Entisols, Inceptisols, and Mollisols.

Alfisols are soils that are medium to high in bases (base saturation at pH 8.2) and have gray to brown surface horizons and subsurface horizons of clay accumulation; usually moist, but during the warm season of the year some are dry part of the time.

Entisols are soils that have no pedogenic horizons.

Inceptisols are soils that have weakly differentiated horizons; materials in the soil have been altered or removed, but have not accumulated. These soils are usually moist, but during the warm season of the year some are dry part of the time.

Mollisols are soils that have nearly black, friable, organic-rich surface horizons high in bases; formed mostly in subhumid and semiwarm to cold climates.

SUBORDER.—Each order has been subdivided into suborders, primarily on the basis of the characteristics that seemed to produce classes that have the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUPS.—Suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that contain a pan that interferes with the growth of roots or movement of water. The features used are the self-mulching properties of clays, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 7, because it is the last word in the name of the subgroup.

SUBGROUP.—Great groups are divided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the great group.

FAMILY.—Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, and depth.

General Nature of the County

This section provides general information about Lafayette County. It briefly discusses the history, farming, natural resources, and climate. Agriculture statistics are from records of the U.S. Bureau of the Census.

TABLE 7.—*Soils classified according to the current system of classification*

Series	Family	Subgroup	Order
Blackoar	Fine-silty, mixed, noncalcareous, mesic	Fluventic Haplaquolls	Mollisols.
Booker	Very fine, montmorillonitic, noncalcareous, mesic	Vertic Haplaquolls	Mollisols.
Bremer	Fine, montmorillonitic, mesic	Typic Argiaquolls	Mollisols.
Colo	Fine-silty, mixed, noncalcareous, mesic	Cumulic Haplaquolls	Mollisols.
Dockery	Fine-silty, mixed, nonacid, mesic	Aquic Udifluvents	Entisols.
Haynie	Coarse-silty, mixed, calcareous, mesic	Typic Udifluvents	Entisols.
Higginsville	Fine-silty, mixed, mesic	Aquic Arguidolls	Mollisols.
Hodge	Sandy, mixed, mesic	Typic Udifluvents	Entisols.
Kennebec	Fine-silty, mixed, mesic	Cumulic Hapludolls	Mollisols.
Knox	Fine-silty, mixed, mesic	Mollic Hapludalfs	Alfisols.
Leslie	Fine, montmorillonitic, mesic	Argiaquic Argialbolls	Mollisols.
Leta	Clayey over loamy, montmorillonitic, mesic	Aquic Fluventic Hapludolls	Mollisols.
Macksburg	Fine, montmorillonitic, mesic	Aquic Argiudolls	Mollisols.
Mandeville	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Marshall	Fine-silty, mixed, mesic	Typic Hapludolls	Mollisols.
McGirk	Fine, montmorillonitic, mesic	Typic Ochraqualfs	Alfisols.
Minden	Fine-silty, mixed, mesic	Aquic Hapludolls	Mollisols.
Modale	Coarse-silty over clayey, mixed, calcareous, mesic	Aquic Udifluvents	Entisols.
Moniteau	Fine-silty, mixed, mesic	Typic Ochraqualfs	Alfisols.
Myrick	Clayey over loamy, montmorillonitic, calcareous, mesic	Fluventic Haplaquolls	Mollisols.
Nodaway	Fine-silty, mixed, nonacid, mesic	Typic Udifluvents	Entisols.
Otter	Fine-silty, mixed, noncalcareous, mesic	Cumulic Haplaquolls	Mollisols.
Polo	Fine, montmorillonitic, mesic	Typic Argiudolls	Mollisols.
Ray	Fine-silty, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols.
Sampsel	Fine, montmorillonitic, noncalcareous, mesic, sloping	Typic Argiaquolls	Mollisols.
Sarpy	Mixed, mesic	Typic Udipsamments	Entisols.
Snead	Fine, mixed, mesic	Aquic (Vertic) Hapludolls	Mollisols.
Sogn	Loamy, mixed, mesic	Lithic Haplustolls	Mollisols.
Waldron	Fine, montmorillonitic, mesic	Aquic Fluventic Hapludolls	Mollisols.
Waubonsie	Coarse-loamy over clayey, mixed, calcareous, mesic	Aquic Udifluvents	Entisols.
Winfield	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Zook	Fine, montmorillonitic, noncalcareous, mesic	Cumulic Haplaquolls	Mollisols.

History

Settlement of what is now Lafayette County started in 1815, and Lillard County was formed in 1820. Lillard County included all land between the Missouri River and the Osage River. In 1824 the name of the county was changed to Lafayette, in honor of the French general, and the present boundaries were established. The early settlements were along the Missouri River, because river traffic was important and provided the best method of transportation. The prairie areas were the last areas to be settled, because the sod was very difficult to break.

The first county seat was the small settlement of Mount Vernon near the mouth of Tabo Creek. In 1822 the site of Lexington was selected for the county seat, and the town was laid out. The Civil War Battle of Lexington took place at the northern edge of town.

According to census figures Lafayette County had a population of 30,006 in 1920, and 25,274 in 1960. Lexington, the largest town, had a population of 4,695 in 1920 and 4,845 in 1960. Higginsville had a population of 2,724 in 1920 and 4,003 in 1960. In 1920 the population of the county was 24.7 percent urban and 75.3 percent rural, and in 1960 it was 35 percent urban and 65 percent rural.

Farming has always been important in Lafayette County, and, according to the 1964 U.S. Census of Agriculture, there are 1,889 farms in the county. The average size of farms is 192 acres.

Soil is the most important and the most used natural resource in Lafayette County. Coal was important and was mined by the deep shaft method, but now very little coal is mined. The coal seams lie from 45 to 120 feet below the surface and range from 18 to 40 inches in thickness. Limestone is quarried in limited amounts, mainly for farming uses and for road material.

Climate [1]

Lafayette County has a typical continental climate characterized by frequent, and often extreme, changes in temperature, humidity, cloudiness, and winds, both from day to day and from year to year. For example, in winter it is not uncommon for the temperature to rise to 60° F. one day and to plunge to below 0° the next day.

The temperature and precipitation data given in table 8 are from the National Weather Service's Cooperative Station at Lexington, Missouri. These data are representative of the climate in Lafayette County.

The temperature exceeds 100° F. in about 6 years out of 10 years, for 3 or 4 days in a row. In 4 winters out of 5, the temperature drops below 0°. Although this condition seldom lasts more than a couple of days, there have been times when the temperature has dropped below 0° for 5 days or more in a row.

The average growing season is about 196 days. The term *growing season* is somewhat misleading because different plants can tolerate different temperatures. At night during periods of light wind, radiation freezes often occur, and temperatures in valleys and depressions

[1] By WARREN M. WISNER, climatologist for Missouri, National Weather Service, U.S. Department of Commerce.

are generally colder than those on level ground or along ridges. Table 9 shows the last date in spring and the first date in fall when specified temperatures can be expected. The data in table 9 are based on instrument readings taken 5 feet above ground. Frost can occur at ground level when the temperature at 5 feet above the ground is above freezing.

Precipitation averages over 38 inches a year and is mostly from thundershowers that occur during the growing season. Twenty-nine percent of the annual precipitation falls in spring, thirty-five percent falls in summer, and twenty-three percent falls in autumn. The wettest months are May and June, when the warm humid air from the Gulf of Mexico pushes the cooler continental air northward. Monthly extremes have ranged from no precipitation during October and November 1945 to 17.29 inches of precipitation during July 1951.

Violent storms often result from the clash between the warm, humid air mass from the Gulf of Mexico and the cooler continental air mass. Since 1915, 12 tornadoes have occurred in Lafayette County. Hail and damaging winds occur almost every year in some part of the county, but the greatest threat of hail is in spring when it is least damaging to crops

Relief

The relief of Lafayette County may be divided into three distinct kinds. Along the northern edge of the county is the wide bottom land area of the Missouri River. This area is level or nearly level and has the lowest elevation in the county. Adjacent to the Missouri River. This area is level or nearly level and has the low-commonly called the River Hills. Slopes range from level or nearly level on the ridgetops to steep on the hillsides. This area has many deep gullies and ravines caused by the eroding away of the deep wind-deposited soil material. The rest of the county is a plain where slopes range

TABLE 8.—*Temperature and precipitation data*

Month	Temperature							Precipitation					
	Average daily—			Two years in 10 will have at least 4 days with—		Extreme values		Average	One year in 10 will have—		Greatest daily rainfall	Snowfall	
	Maximum	Minimum	Mean	Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—	Maximum	Minimum		Less than—	More than—		Average	Greatest amount
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
January	38.5	19.9	29.2	59	−1	74	−14	1.61	0.41	3.72	2.07	5.1	18.3
February	42.9	22.7	32.8	63	5	79	−13	1.69	.73	2.45	1.60	4.6	13.6
March	52.1	30.9	41.5	75	13	87	−8	2.83	.57	4.55	2.64	5.6	23.0
April	65.9	43.8	54.9	83	30	91	16	3.58	1.93	5.99	3.48	.8	14.0
May	76.2	54.8	65.5	90	42	105	32	4.65	2.18	7.66	3.23	0	
June	86.2	64.8	75.5	99	54	107	44	5.54	1.38	10.26	4.50	0	
July	92.2	69.1	80.7	103	60	113	51	3.95	.84	6.98	6.85	0	
August	90.5	67.4	79.0	101	58	111	47	3.97	1.10	7.47	3.27	0	
September	82.6	58.4	70.5	97	45	106	32	3.64	.91	7.63	3.81	0	
October	71.1	47.4	59.3	86	33	96	23	2.92	.21	6.08	2.40	0	
November	53.5	33.0	43.2	72	16	88	3	2.13	.09	4.91	2.57	1.8	13.5
December	42.2	24.1	33.1	62	5	74	−9	1.83	.56	3.23	1.66	4.6	16.0
Year	66.3	44.8	55.5			113	−14	38.34	26.58	56.41	6.85	22.5	23.0

TABLE 9.—*Probabilities of last freezing temperatures in spring and first in fall*

Probability	Dates for given probability and temperature				
	32° F. or lower	28° F. or lower	24° F. or lower	20° F. or lower	16° F. or lower
Spring:					
1 year in 10 later than	April 24	April 16	April 9	April 1	March 24
2 years in 10 later than	April 19	April 11	April 3	March 26	March 18
5 years in 10 later than	April 11	April 2	March 24	March 16	March 7
Fall:					
1 year in 10 earlier than	October 9	October 21	October 26	October 30	November 12
2 years in 10 earlier than	October 16	October 26	November 2	November 6	November 18
5 years in 10 earlier than	October 26	November 3	November 13	November 18	November 29

from level or nearly level to sloping. Rising above this plain are a number of isolated hills and ridges where slopes range from gently sloping to moderately steep (fig. 18). These hills and ridges are at the highest elevation in the county. Cutting through the plain are many small to moderately large stream valleys where slopes range from level or nearly level on the valley floor to moderately steep on the sides of valleys.

Most of Lafayette County drains directly into the Missouri River at the northern edge of the county. Davis Creek, however, drains eastward into Blackwater Creek in Saline County.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Available water capacity (also termed 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 capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Figure 18.—**In the foreground are Higginsville soils on the plain. An isolated hill rises above the plain in the background.**

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

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 clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found 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 and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, 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 different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

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 some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

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

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

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 their thickness and arrangement in the soil profile.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of 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 these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid*.

pH value. A numerical means for designating acidity and alkalinity soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending 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 precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

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

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt tex-

tural class is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of a soil from the horizontal. Soils on bottom lands do not slope. In this survey, the classes of slope, in words and in percent, are:

Nearly level	0 to 2 percent
Gently sloping	2 to 5 percent
Sloping	5 to 9 percent
Strongly sloping	9 to 14 percent
Moderately steep	14 to 20 percent or more

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that 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.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes 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.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of the B horizon; has no depth limit.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

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 may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topsoil. A presumed 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 consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

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