United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Missouri Agricultural
Experiment Station

Soil Survey of Dallas County, Missouri

How To Use This Soil Survey

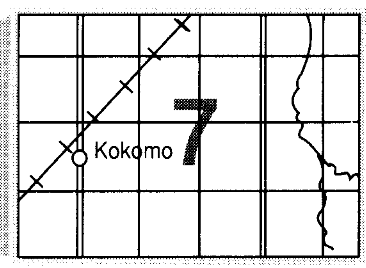
General Soil Map

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

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

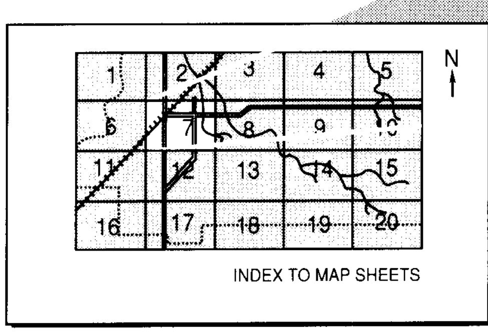
Detailed Soil Maps

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



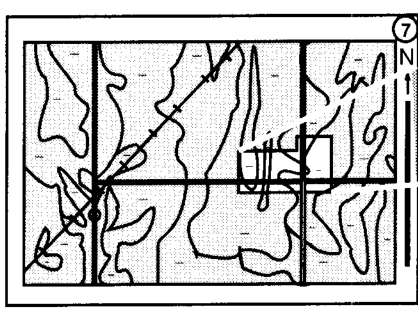
MAP SHEET

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

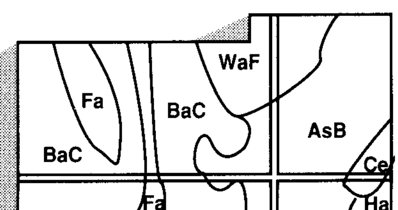


INDEX TO MAP SHEETS

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



MAP SHEET



AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1986. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This survey was made cooperatively by the Soil Conservation Service and the Missouri Agricultural Experiment Station. The Missouri Department of Natural Resources provided a soil scientist to assist with the fieldwork. The Soil and Water Conservation District provided funds to assist with soil investigations. This survey is part of the technical assistance furnished to the Dallas County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Bales of hay at the edge of an area of Hoberg silt loam, 2 to 5 percent slopes. An area of Ocie-Goss-Gatewood complex, 5 to 9 percent slopes, is in the background.

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Issued January 1991

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Summary of Tables

Foreword

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

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

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Soil Survey of Dallas County, Missouri

By Richard E. McBee, Soil Conservation Service

Fieldwork by Richard E. McBee and Harold E. Hughes, Soil Conservation Service, and Ellen J. Dettman and James A. Gross, Missouri Department of Natural Resources

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Missouri Agricultural Experiment Station

Dallas County is in south-central Missouri (fig. 1). The area of the county is 347,328 acres, or about 543 square miles. Buffalo, the county seat and largest city, is in the west-central part of the county.

Dallas County is mostly in the Ozark Border. The northeast corner of the county, however, is in the Ozark Highland Area of the East and Central General Farming and Forest Region of the United States. Farming is the main enterprise, although most of the enterprises in the county depend to a certain extent on off-farm income. The principal crops are used as forage for beef and dairy cattle. The county has large areas of woodland, and sales of wood products are fairly extensive.

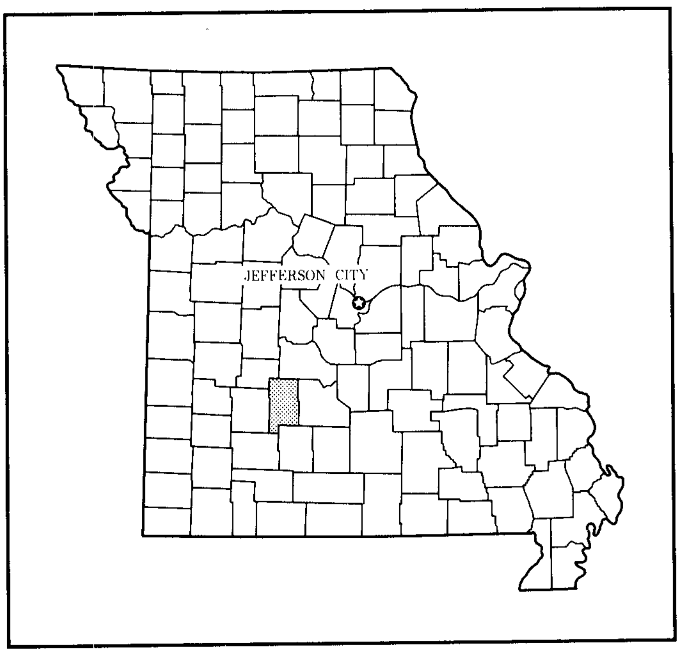

Figure 1.—Location of Dallas County in Missouri.

General Nature of the County

This section describes the climate, history and development, and relief and drainage in Dallas County.

Climate

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

Dallas County is hot in summer, especially at low elevations, and moderately cool in winter, especially on mountains and high hills. Rainfall is fairly heavy and is well distributed throughout the year. Snow falls nearly every winter, but the snow cover lasts only a few days.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Marshfield, Missouri, in the period 1951 to 1984. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 35 degrees F and the average daily minimum temperature is 24 degrees. The lowest temperature on record, which occurred at Marshfield on January 10, 1982, is -15 degrees. In summer, the average temperature is 76 degrees and the average daily maximum temperature is 87 degrees. The highest recorded temperature, which occurred on July 14, 1954, is 110 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 40.32 inches. Of this, 22 inches, or 55 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 4.68 inches at Marshfield on December 17, 1957. Thunderstorms occur on about 57 days each year.

The average seasonal snowfall is about 15 inches. The greatest snow depth at any one time during the period of record was 16 inches. On the average, 5 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 13 miles per hour, in spring.

History and Development

Dallas County was settled in the early 1830's by pioneers from Tennessee, Indiana, and Ohio and was organized in 1841. It was first called "Niangua" for the river within its borders *(15)*. In 1844, the county's name was changed to "Dallas" in honor of George M. Dallas, then Vice President-elect of the United States. The county lies in territory ceded by the Osage Indians in 1808 *(5, 6)*.

Buffalo was laid out in 1841 on "Buffalo Head Prairie," an extensive plain named for a buffalo skull landmark erected in 1833 by Mark Reynolds, who is generally believed to have been the first settler *(7)*. Urbana was established in the mid-1860's. Other communities established after the Civil War were Charity, Celt, Plad, Redtops, Tunas, Leadmine, Louisburg, Windyville, and Long Lane.

During the Civil War, nearly two-thirds of the citizens of Dallas County supported the Union, and the few Confederate sympathizers joined the army of the South. The county was overrun by scouting parties from both sides. Bushwhacking and cold-blooded assassinations were common.

From the late 1860's to the 1890's, zinc and lead were mined in the county. Experts have attested to the high quality of the lead mined since that time, but the location of the rich vein mined in the 1860's has been lost since its owner hid it in 1873 after being tricked into signing away his rights. One of the first veins of fuller's earth in the United States was discovered in 1882 and was worked briefly. Fuller's earth is a series of impure sands and clay used in "fulling" or cleaning wool of its grease. A serious blow to the county's economic future occurred when attempts to get a railroad failed.

Bennett Spring State Park in Dallas and Laclede Counties dates from 1924. It is named for Bennett Spring, which wells up an average of 71 million gallons daily *(22)*.

Relief and Drainage

Dallas County is entirely within the Salem Plateau subprovince of the Ozarks. It has a wide variety of surface features, which are the result of uplift, erosion, and deposition.

The eastern part of the county is drained by the Niangua River and its tributaries, while the more gently rolling western part is drained by the Pomme de Terre River and its tributaries. The water in the streams in the western part of the county flows many more miles by way of the Pomme de Terre and Osage Rivers before it reaches the same elevation as the Niangua River at its confluence with the Osage River a short distance to the north of Dallas County. Thus, the Niangua River has cut deeper into the bedrock in the eastern part of the county, resulting in steeper slopes and greater relief.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

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

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

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

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

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

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

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

The descriptions, names, and delineations of the soils identified on the general soil map of this county do not fully agree with those of the soils identified on the maps of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions. In some areas combining small acreages of similar soils that respond to use and management in much the same way is more practical than mapping these soils separately.

Soil Descriptions

1. Viraton-Ocie-Goss Association

Deep, gently sloping to steep, moderately well drained and well drained, silty, cherty and very cherty soils; on uplands

This association is on moderately dissected ridgetops and side slopes. Slopes range from 2 to 50 percent.

This association makes up about 55 percent of the survey area. It is about 31 percent Viraton and similar soils, 23 percent Ocie and similar soils, 15 percent Goss soils, and 31 percent soils of minor extent (fig. 2).

Viraton soils are moderately well drained and generally are on ridgetops and short, convex side slopes. Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is yellowish brown, very friable silt loam about 4 inches thick. The part of the subsoil above a fragipan is about 17 inches of strong brown, friable silt loam and firm silty clay loam and about 13 inches of mottled, very firm cherty silt loam. The fragipan is mottled, very firm and brittle very cherty silty clay loam about 15 inches thick. The part of the subsoil below the fragipan to a depth of about 60 inches is dark red, mottled, firm very cherty clay.

Ocie soils are moderately well drained and generally are on convex side slopes. Typically, the surface layer is dark grayish brown, friable cherty silt loam about 3 inches thick. The subsurface layer is brown and yellowish brown, firm very cherty silt loam about 22 inches thick. The subsoil extends to a depth of about 44 inches. The upper part is strong brown, firm very cherty silty clay loam, and the lower part is yellowish brown, light brownish gray, and red, very firm clay. The substratum extends to a depth of about 53 inches. It is mixed olive gray, light greenish gray, and yellowish red, very firm clay. Dolomite bedrock is at a depth of about 53 inches.

Goss soils are well drained and generally are on shoulder slopes and convex side slopes in areas below the Viraton soils. Typically, the surface layer is brown, friable cherty silt loam about 9 inches thick. The upper part of the subsoil is strong brown, firm cherty silty clay loam. The next part is yellowish red, firm very cherty silty clay loam to extremely cherty silty clay. The lower part to a depth of about 60 inches is multicolored, firm cherty clay.

Minor in this association are Cedargap, Gasconade, and Peridge soils and Rock outcrop. Cedargap soils are dark. They are on flood plains along small streams. Gasconade soils are shallow over dolomite bedrock and are somewhat excessively drained. Rock outcrop is intermingled with areas of the Gasconade soils. Peridge soils are on ridges and terraces. They have less chert

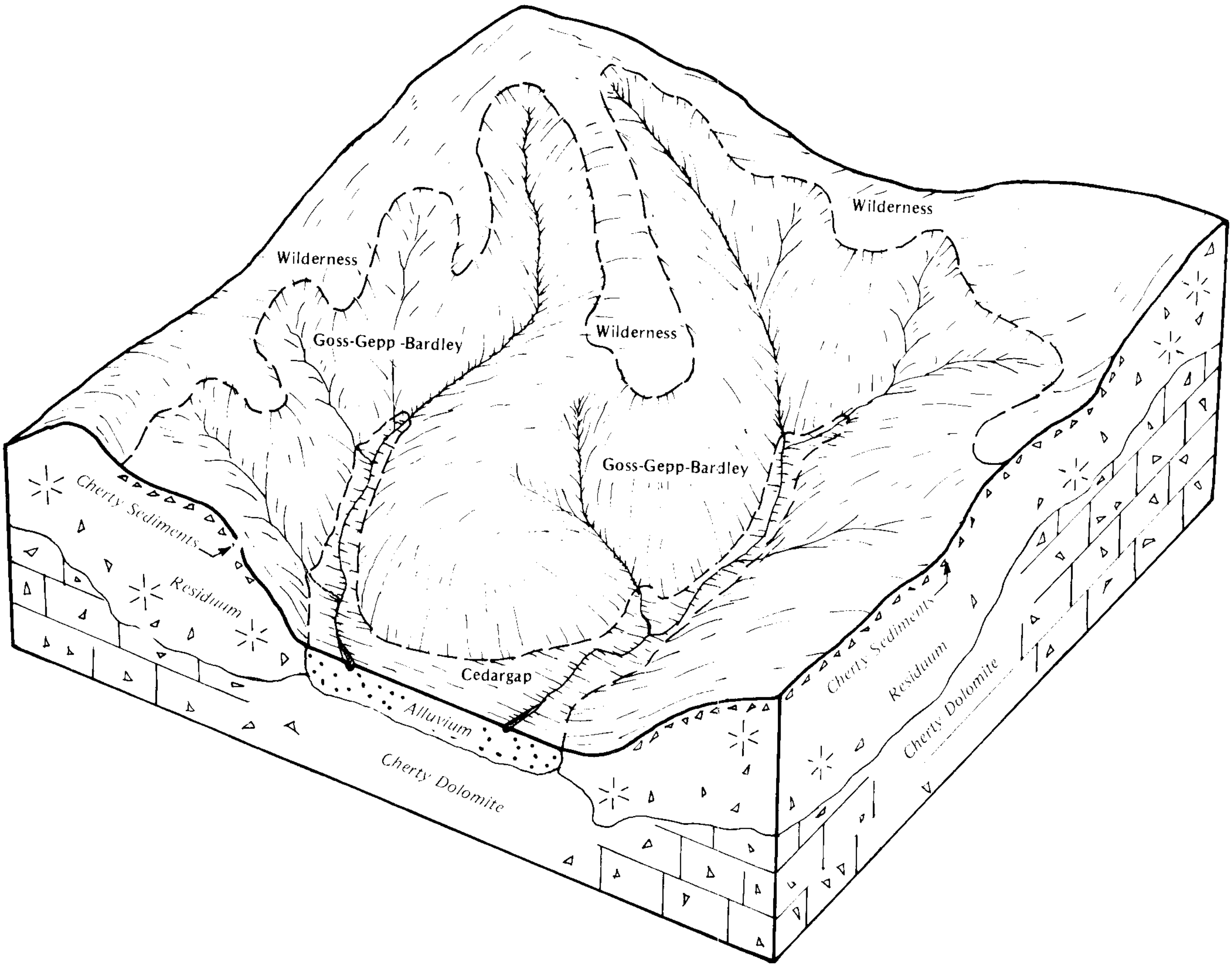

Figure 2.—Pattern of soils and parent material in the Viraton-Ocie-Goss association.

than the Ocie and Goss soils and do not have a fragipan.

About 65 percent of this association has been cleared and is used as pasture. Grasses and legumes are grown for pasture and hay. Erosion, slope, and droughtiness are the main management concerns.

The steeper areas of the Goss and Ocie soils are used for timber. The slope restricts the use of logging equipment, and erosion is a hazard along logging roads and skid trails. Restricted root penetration is a limitation if trees are planted on the Viraton soils.

This association is suited to building site development and sanitary facilities. The slope, slow permeability, and large stones are management concerns.

2. Goss-Gepp-Bardley Association

Deep and moderately deep, moderately sloping to steep, well drained, cherty and very cherty soils; on uplands

This association is on strongly dissected ridgetops and side slopes. Slopes range from 5 to 50 percent.

This association makes up about 15 percent of the survey area. It is about 36 percent Goss soils, 24 percent Gepp soils, 13 percent Bardley soils, and 27 percent soils of minor extent (fig. 3).

Goss soils are deep and generally are on narrow ridgetops and convex side slopes. Typically, the surface layer is brown, friable cherty silt loam about 8 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is brown and reddish brown, firm very cherty silty clay loam, and the lower part is red, dark red, and yellowish red, firm very cherty to extremely cherty clay.

Gepp soils are deep and generally are on narrow ridgetops and convex side slopes. Typically, the surface layer is brown, friable very cherty silt loam about 2 inches thick. The subsurface layer is pale brown, friable very cherty silt loam about 5 inches thick. The subsoil extends to a depth of about 65 inches or more. The upper part is red, firm silty clay loam, and the lower part is red and strong brown, firm cherty clay and clay.

Bardley soils are moderately deep and generally are on convex side slopes below areas of the Goss and Gepp soils. Typically, the surface layer is dark grayish brown, friable very cherty loam about 2 inches thick. The subsoil extends to a depth of about 24 inches. The upper part is yellowish red, firm cherty silty clay loam, and the lower part is red, firm clay. Hard interbedded layers of dolomite and sandstone are at a depth of about 24 inches.

Minor in this association are Cedargap, Gasconade,

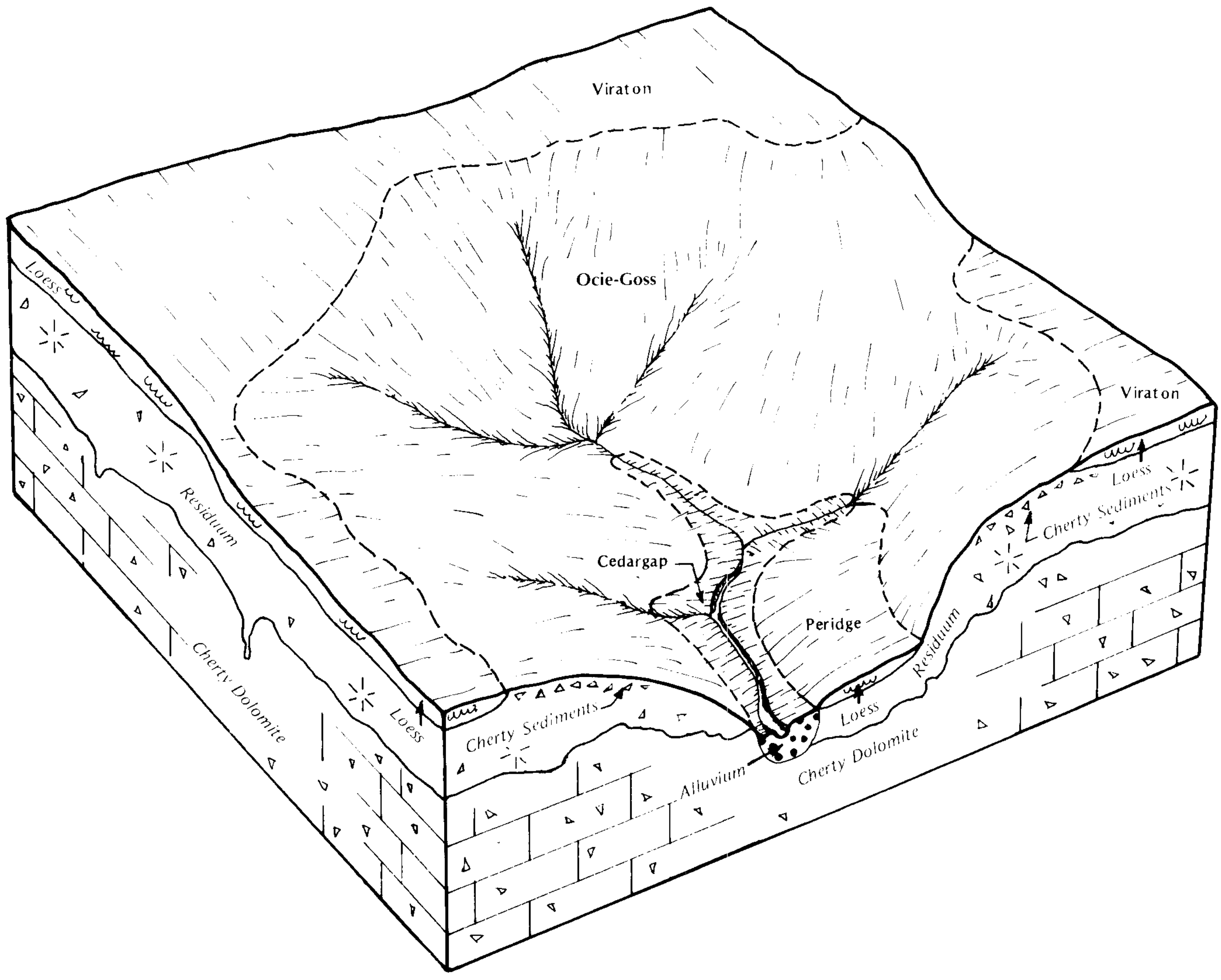

Figure 3.—Pattern of soils and parent material in the Goss-Gepp-Bardley association.

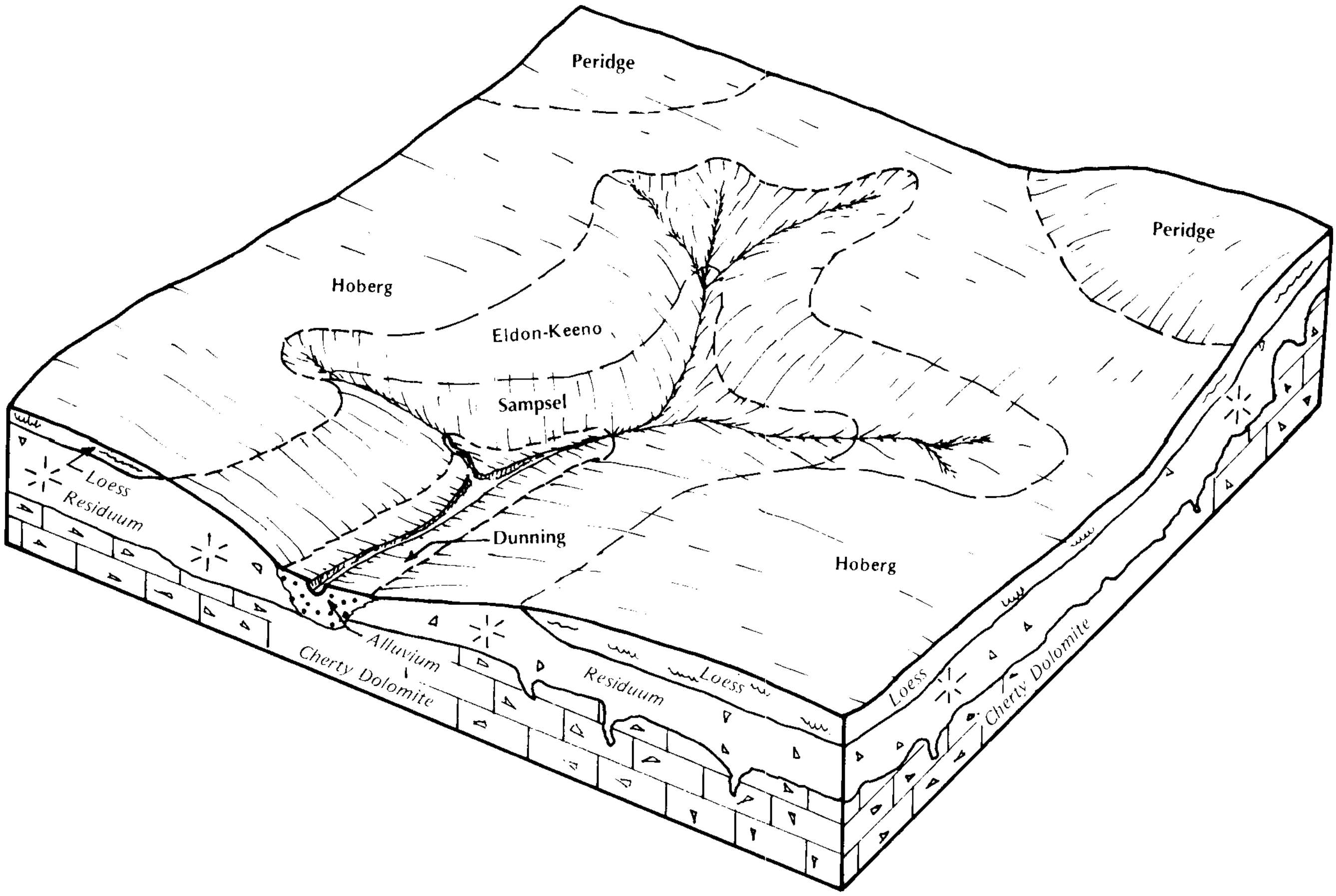

Figure 4.—Pattern of soils and parent material in the Hoberg-Sampsel-Peridge association.

and Wilderness soils and Rock outcrop. Cedargap soils are dark. They are on flood plains. Gasconade soils are shallow over dolomite bedrock and are somewhat excessively drained. Generally, they are in areas below the major soils and adjacent to areas of dolomite Rock outcrop. Wilderness soils are on narrow ridgetops. They have a fragipan.

About 20 percent of this association has been cleared and is used as pasture. Grasses and legumes are grown for pasture and hay. Overgrazing is the main management concern.

The steeper slopes in this association are uncleared. Oak and hickory are the dominant trees. The slope restricts the use of logging equipment, and erosion is a hazard along logging roads and skid trails. Seedling mortality also is a management concern.

This association generally is unsuitable for building site development and sanitary facilities because of the slope.

3. Hoberg-Sampsel-Peridge Association

Deep, very gently sloping to moderately sloping, moderately well drained, poorly drained, and well drained, silty soils; on uplands

This association is on ridgetops, side slopes, and the upper part of the head of drainageways on high, broad divides between the major drainage systems. Slopes range from 1 to 9 percent.

This association makes up about 12 percent of the survey area. It is about 28 percent Hoberg and similar soils, 16 percent Sampsel soils, 15 percent Peridge soils, and 41 percent soils of minor extent (fig. 4).

Hoberg soils are moderately well drained and generally are on broad ridgetops. Typically, the surface layer is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is friable silt loam about 13 inches thick. The upper part is very dark grayish brown, and the lower part is dark brown. The part of the subsoil above a fragipan is about 8 inches of dark yellowish brown, firm silty clay loam. The fragipan is red, very firm extremely cherty silty clay loam about 24 inches thick. The part of the subsoil below the fragipan to a depth of about 60 inches is red very cherty clay.

Sampsel soils are poorly drained and are at the head of drainageways. Typically, the surface layer is black, friable silt loam about 6 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 6 inches thick. The subsoil to a depth of 70 inches or more is silty clay loam. The upper part is very dark gray and firm; the next part is dark gray, mottled, and firm; and the lower part is mottled grayish brown and dark yellowish brown and is very firm.

Peridge soils are well drained and generally are on side slopes and ridgetops. Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil to a depth of 60 inches or more is silty clay loam. The upper part is brown and friable and yellowish red and firm, and the lower part is yellowish red, mottled, and firm.

Minor in this association are Dunning, Eldon, Gerald, Keeno, and Wilderness soils. Dunning soils are very poorly drained and are on the larger flood plains. Eldon, Keeno, and Wilderness soils are on side slopes and ridgetops. They have more chert fragments than the major soils. Also, Keeno and Wilderness soils have a fragipan. Gerald soils are somewhat poorly drained and are in concave areas on broad upland ridgetops. They have a fragipan.

The production of forage crops is the main enterprise in areas of this association. Seasonal wetness and susceptibility to erosion are management concerns.

This association is suited to building site development and sanitary facilities. Wetness, slow permeability, the slope, and the shrink-swell potential are management concerns.

4. Hobson-Bolivar-Basehor Association

Deep to shallow, gently sloping to strongly sloping, moderately well drained and well drained, loamy soils; on uplands

This association is on moderately dissected ridgetops and side slopes. Slopes range from 2 to 14 percent.

This association makes up about 6 percent of the survey area. It is about 43 percent Hobson and similar soils, 14 percent Bolivar soils, 12 percent Basehor soils, and 31 percent soils of minor extent (fig. 5).

Hobson soils are deep, are moderately well drained, and generally are on ridgetops. Typically, the surface layer is dark grayish brown, very friable loam about 4 inches thick. The subsurface layer is brown, very friable loam about 3 inches thick. The part of the subsoil above a fragipan is about 19 inches of light yellowish brown, very friable loam and brown and reddish brown, firm clay loam. The fragipan is about 16 inches of mottled strong brown, light gray, and reddish yellow, very firm fine sandy loam and strong brown, very firm sandy clay loam. The part of the subsoil below the fragipan to a depth of 60 inches is red, firm clay loam.

Bolivar soils are moderately deep, are well drained, and generally are on ridgetops and convex side slopes. Typically, the surface layer is brown, friable loam about 3 inches thick. The subsurface layer is yellowish brown, friable loam about 9 inches thick. The subsoil extends to a depth of about 27 inches. It is strong brown, firm clay loam. Hard, yellowish red sandstone bedrock is at a depth of about 27 inches.

Basehor soils are shallow, are well drained, and generally are on ridgetops and convex side slopes. Typically, the surface layer is dark brown, friable loam about 8 inches thick. The subsoil extends to a depth of about 15 inches. It is strong brown, friable loam. Hard, yellowish red sandstone bedrock is at a depth of about 15 inches.

The soils of minor extent include Gatewood, Goss, Ocie, Sampsel, Racket, and Wilderness soils. Gatewood, Goss, and Ocie soils are on the lower side slopes. They contain more clay than the major soils. Sampsel soils also contain more clay and are dark. They are at the head of drainageways. Racket soils are on flood plains. They are dark. Wilderness soils are on ridgetops and upper side slopes. They have more chert fragments than the major soils.

About 90 percent of this association has been cleared and is used as pasture. Grasses and legumes are grown for pasture and hay. A limited rooting depth, droughtiness, and erosion are the main management concerns.

The steeper areas of this association are uncleared. Post oak and eastern redcedar are the dominant trees. The limited rooting depth, seedling mortality, and the windthrow hazard are management concerns.

The Bolivar and Hobson soils are suited to building site development and sanitary facilities. The depth to bedrock, the slope, wetness, and slow permeability are management concerns. Because of the depth to sandstone bedrock, the Basehor soils generally are not used for building site development or onsite waste disposal.

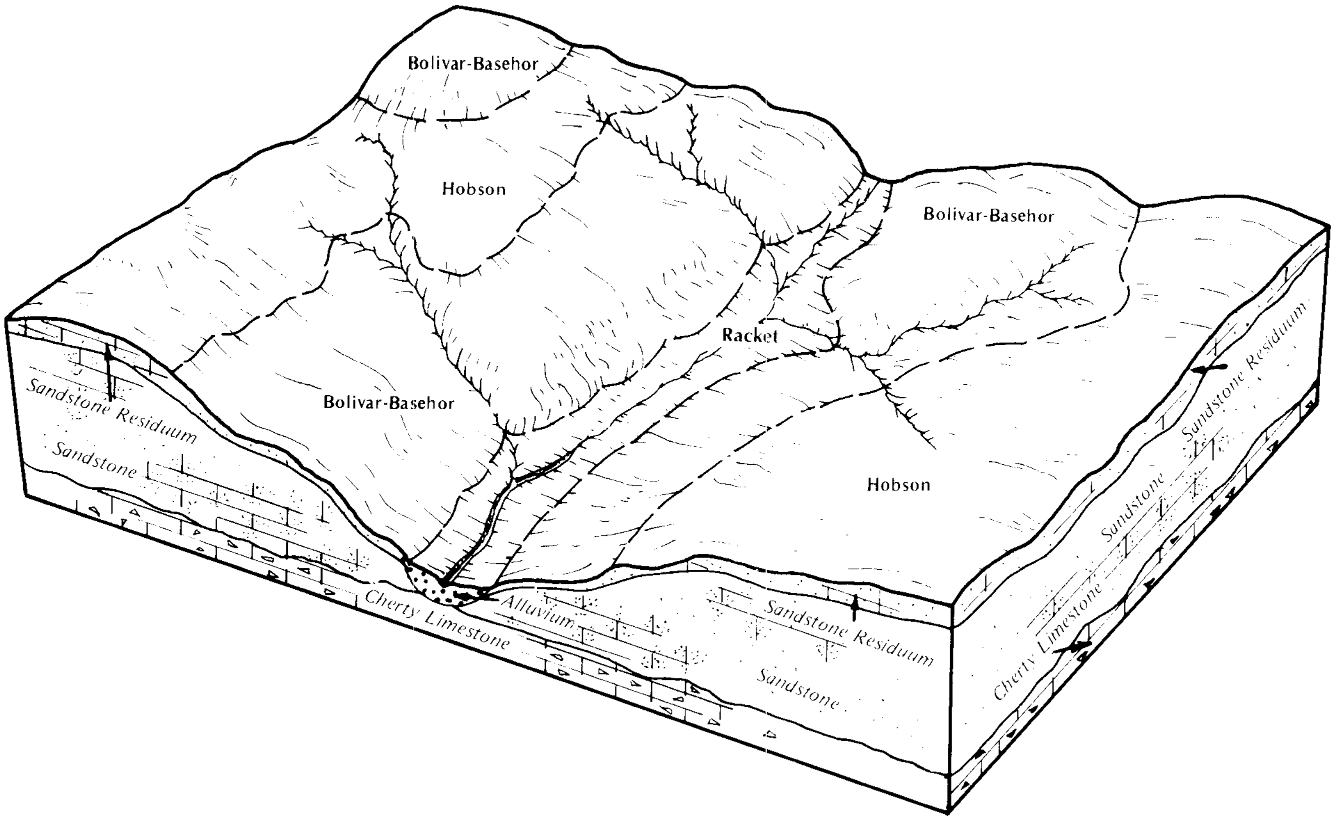

Figure 5.—Pattern of soils and parent material in the Hobson-Bolivar-Basehor association.

5. Racket-Claiborne-Nolin Association

Deep, very gently sloping to moderately sloping, well drained, silty soils; on flood plains and foot slopes

This association is on flood plains and foot slopes along the Niangua River and its tributaries. Slopes range from 1 to 9 percent.

This association makes up about 7 percent of the survey area. It is about 60 percent Racket soils, 22 percent Claiborne soils, 5 percent Nolin soils, and 13 percent soils of minor extent (fig. 6).

Racket soils generally are on flood plains along the larger streams. Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer and subsoil also are very dark grayish brown, friable silt loam. The subsurface layer is about 5 inches thick, and the subsoil is about 30 inches thick. The substratum to a depth of 60 inches or more is brown, friable loam.

Claiborne soils generally are on foot slopes above the flood plains. Typically, the surface layer is dark yellowish brown, friable silt loam about 6 inches thick. The upper part of the subsoil is yellowish red, friable silt loam. The lower part to a depth of 60 inches or more is red, firm silty clay loam.

Nolin soils generally are on flood plains along streams. Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsurface layer also is dark brown, friable silt loam. It is about 8 inches thick. The subsoil to a depth of 60 inches or more is brown, friable silt loam.

The soils of minor extent include Cedargap and Hartville soils. Cedargap soils are along the smaller drainageways. They have more chert fragments throughout than the major soils. Hartville soils are on high flood plains and are somewhat poorly drained.

The production of forage crops is the main enterprise in areas of this association. The association is suited to pasture and to trees. Plant competition and frequent flooding of brief duration are management concerns affecting both forage and timber production.

The Racket and Nolin soils are unsuited to building

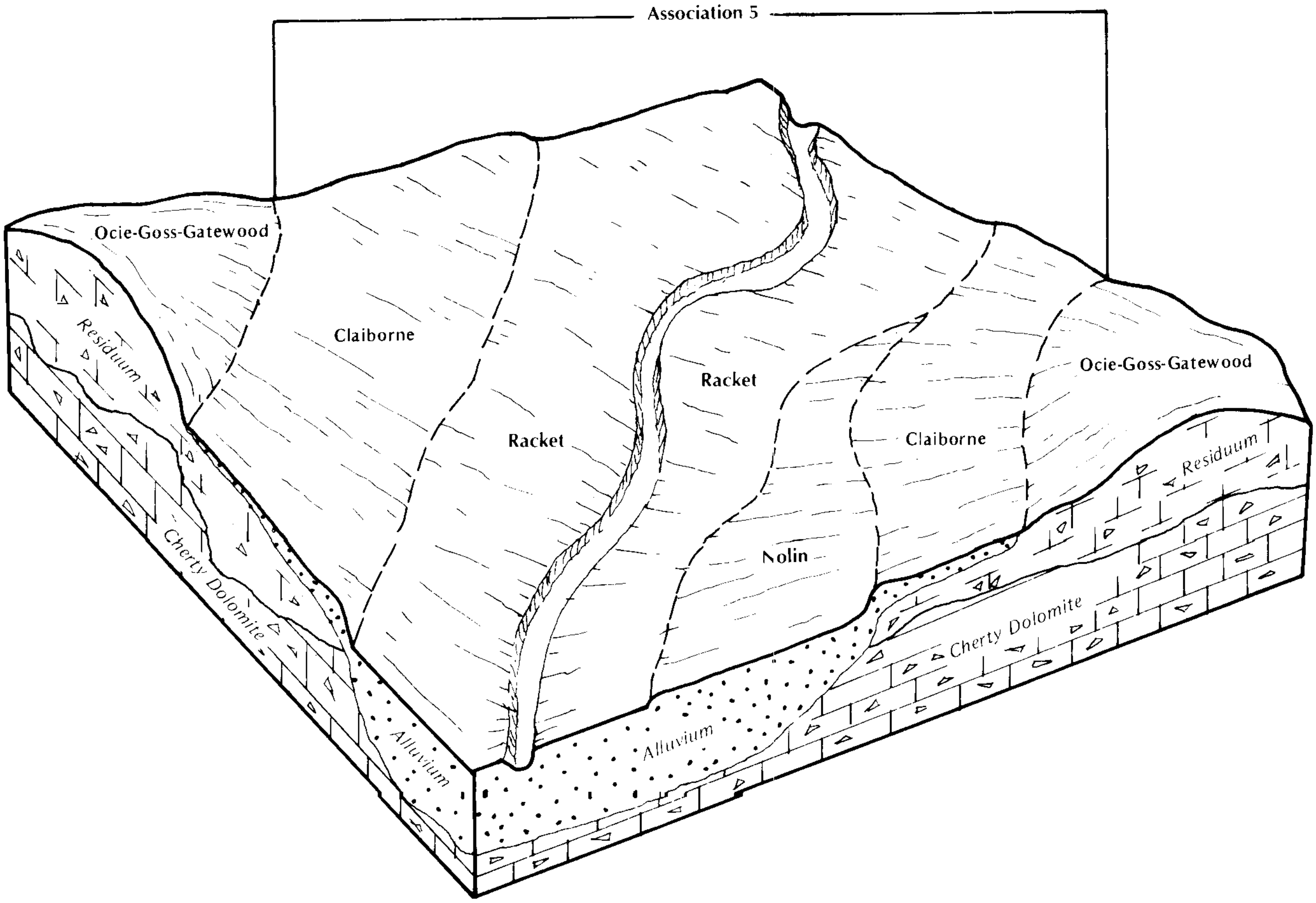

Figure 6.—Pattern of soils and parent material in the Racket-Claiborne-Nolin association.

site development and sanitary facilities because of the flooding. The Claiborne soils are suitable for these uses, but restricted permeability, seepage, and the shrink-swell potential are management concerns.

6. Viraton-Wilderness Association

Deep, gently sloping and moderately sloping, moderately well drained, silty and cherty soils; on uplands

This association is on ridgetops and short side slopes on high, broad divides between the major drainage systems. Slopes range from 2 to 9 percent.

This association makes up about 5 percent of the survey area. It is about 41 percent Viraton and similar soils, 30 percent Wilderness soils, and 29 percent soils of minor extent.

Viraton soils generally are on broad ridgetops and long, convex side slopes. Typically, the surface layer is dark brown, friable silt loam about 5 inches thick. The subsurface layer is dark yellowish brown, friable silt loam about 5 inches thick. The part of the subsoil above a fragipan is about 14 inches of brown, friable silt loam and strong brown, firm cherty silty clay loam. The fragipan is yellowish red, very firm extremely cherty silt loam about 18 inches thick. The part of the subsoil below the fragipan to a depth of about 60 inches is red, very firm silty clay.

Wilderness soils generally are on ridgetops and short, convex slopes. Typically, the surface layer is very dark grayish brown, very friable cherty silt loam about 3 inches thick. The subsurface layer is yellowish brown, very friable cherty silt loam about 5 inches thick. The part of the subsoil above a fragipan is brown and strong brown, friable and firm very cherty silty clay loam about 7 inches thick. The fragipan is brown, very firm extremely cherty silt loam about 18 inches thick. The part of the subsoil below the fragipan extends to a depth of 60 inches or more. It is strong brown and brown, very firm very cherty and extremely cherty clay and dark red, very firm clay.

The soils of minor extent include Gatewood, Goss, and Ocie soils. These soils are on the steeper side slopes. They do not have a fragipan.

The production of forage crops is the main enterprise in areas of this association. Seasonal wetness and susceptibility to drought and erosion are management concerns.

Areas that have not been cleared for pasture support timber species, such as oak and hickory. Timber production is hindered by the fragipan, which limits the rooting depth and causes a windthrow hazard. Seedling mortality also is a management concern.

This association is suited to building site development and sanitary facilities. Wetness and restricted permeability are the main management concerns.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Viraton silt loam, 2 to 5 percent slopes, is a phase of the Viraton series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Ocie-Goss-Gatewood complex, 9 to 25 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

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

The descriptions, names, and delineations of soils identified on the detailed soil maps of this county do not fully agree with those of the soils identified on the maps of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions. In some areas combining small acreages of similar soils that respond to use and management in much the same way is more practical than mapping these soils separately.

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

Soil Descriptions

02B—Celt silt loam, 2 to 5 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on ridgetops in the uplands. Individual areas are irregular in shape and range from about 20 to 150 acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 3 inches thick. The subsurface layer is yellowish brown, friable silt loam about 7 inches thick. The part of the subsoil above a fragipan is about 14 inches thick. It is brown, firm silty clay in the upper part and grayish brown, mottled, firm silty clay loam in the lower part. The fragipan is about 16 inches thick. It is mottled light brownish gray, brownish yellow, and strong brown, very firm very cherty silty clay loam in the upper part and mottled light brownish gray, brownish yellow, and red, very firm extremely cherty silt loam in the lower part. The part of the subsoil below the fragipan to a depth of 60 inches or more is red, firm very cherty and cherty clay.

Included with this soil in mapping are areas of Bado, Lebanon, and Wilderness soils. These soils make up about 20 percent of the unit. The poorly drained Bado soils are in the lower depressional areas. The moderately well drained Lebanon soils are on the higher ridges. The moderately well drained Wilderness soils are at the edges of the unit, in areas that drop off into steeper terrain.

Permeability is moderately slow above the fragipan in the Celt soil and very slow in the fragipan. Runoff is slow. A perched water table is at a depth of 1.5 to 2.5 feet during most winter and spring months. The available water capacity is low. Organic matter content is moderately low, and natural fertility is low. The shrink-swell potential is moderate. The root zone is limited by the fragipan at a depth of about 24 inches.

Most areas are used as pasture, hayland, or woodland. This soil is moderately well suited to legumes, such as birdsfoot trefoil; to cool-season grasses, such as reed canarygrass and tall fescue; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. The limited root zone, wetness in spring, and droughtiness in summer are the major management concerns. Overgrazing reduces forage yields and increases the extent of weeds. Grazing when the soil is wet causes surface compaction and poor tilth. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover.

A few areas support native hardwoods. This soil is suited to trees. Windthrow is a management concern. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suited to building site development and some kinds of onsite waste disposal. The wetness and the shrink-swell potential are limitations affecting the design of dwellings. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the foundations, footings, and basement walls helps to prevent the damage caused by excessive wetness. Landscaping can improve surface drainage. Measures that increase the depth of the soil material to the water table should be considered. The wetness is a limitation on sites for sewage lagoons. It can be overcome, however, by sealing the sides and bottom of the lagoons. This measure helps to prevent seepage and the contamination of ground water. The soil generally is unsuitable as a site for septic tank absorption fields because of the wetness and the very slow permeability.

Low strength, the wetness, and the potential for frost action limit the use of this soil as a site for local roads and streets. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Properly constructed roadside ditches remove excess water and minimize the damage caused by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3D.

03C—Wilderness cherty silt loam, 2 to 9 percent slopes. This deep, gently sloping and moderately sloping, moderately well drained soil is on ridgetops in the uplands. Chert is on the surface. Individual areas are irregular in shape and range from about 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, very friable cherty silt loam about 3 inches thick. The subsurface layer is yellowish brown, very friable cherty silt loam about 5 inches thick. The part of the subsoil above a fragipan is brown and strong brown, friable and firm very cherty silty clay loam about 7 inches thick. The fragipan is brown, very firm extremely cherty silt loam about 18 inches thick. The part of the subsoil below the fragipan to a depth of 60 inches or more is strong brown and brown, very firm very cherty and extremely cherty clay and dark red, very firm clay.

Included with this soil in mapping are small areas of Gepp, Goss, and Viraton soils; some areas where the fragipan is discontinuous; and some areas where stones are on the surface. Gepp and Goss soils do not have a fragipan. Viraton soils are not cherty in the upper part. All of the included soils are in positions on the landscape similar to those of the Wilderness soil. They make up about 5 to 15 percent of the unit.

Permeability is moderate above the fragipan in the Wilderness soil and slow in the fragipan. Runoff is medium. A perched water table is at a depth of 1 to 2 feet during most winter and spring months. The available water capacity is very low. Organic matter content and natural fertility are low. The shrink-swell potential is moderate below the fragipan. The root zone is limited by the fragipan at a depth of about 15 inches.

Most areas are used as pasture or woodland. This soil is moderately suited to the commonly grown legumes, such as birdsfoot trefoil, lespedeza, and alsike clover; to cool-season grasses, such as orchardgrass and tall fescue; and to warm-season grasses, such as big bluestem, indiangrass, and little bluestem. The limited root zone, droughtiness, and erosion are the major management concerns. Also, the content of chert can hinder tillage. Growing grasses and legumes for pasture and hay can help to control erosion. The soil should be tilled only when a stand is to be established, or when renovation or reseeding is needed. Seeding new stands early in the year ensures a good ground cover before the end of the growing season. Nurse crops of small grain provide cover in fall and winter before late-seeded grasses and legumes are established. Overgrazing reduces forage yields and increases the extent of weeds. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, and timely deferment of grazing.

A few areas support native hardwoods. This soil is suited to trees. Seedling mortality and the windthrow hazard are management concerns. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. The stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is slight. Fire prevention and controlled grazing are needed.

This soil is suited to building site development and onsite waste disposal. The wetness is a limitation if the soil is used as a site for dwellings. Installing tile drains around foundations, footings, and basement walls helps to prevent the damage caused by excessive wetness. The wetness and the slow permeability are limitations on sites for septic tank absorption fields. These fields can function adequately if a properly constructed mound of fill material increases the thickness of the soil over the fragipan. This mound allows for more surface exposure for evaporation and allows surface water to drain away from the lateral field. Seepage and slope are limitations on sites for sewage lagoons. If the site is leveled, properly constructed sewage lagoons can function adequately. Sealing the sides and bottom of the lagoons helps to prevent seepage and the contamination of ground water.

The wetness and the potential for frost action limit the use of this soil as a site for local roads and streets. Grading the roads so that they shed water and constructing adequate roadside ditches minimize the damage caused by wetness and frost action.

The land capability classification is IVs. The woodland ordination symbol is 3D.

04—Bado silt loam. This deep, nearly level, poorly drained soil is on flats and in slight depressions on the top of broad ridges in the uplands. Individual areas are somewhat oval and range from 5 to about 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is grayish brown, friable silt loam about 4 inches thick. The part of the subsoil above a fragipan is dark grayish brown, mottled, firm silty clay about 17 inches thick. The fragipan is brownish yellow, mottled, very firm silt loam about 23 inches thick. The part of the subsoil below the fragipan to a depth of 66 inches is mottled brownish yellow and red, firm very cherty silty clay loam and red, firm very cherty silty clay loam.

Included with this soil in mapping are small areas of Lebanon, Celt, and Viraton soils. These soils make up 5 to 10 percent of the unit. Lebanon and Viraton soils are moderately well drained, and Celt soils are somewhat poorly drained. All of the included soils are along the boundary of the unit, in the more convex areas.

Permeability is slow above the fragipan in the Bado soil and very slow in the fragipan. Runoff is very slow. The available water capacity is low. A perched water table is within a depth of 2 feet during most winter and spring months. Organic matter content and natural fertility are low. The shrink-swell potential in the part of the subsoil above the fragipan is high. The root zone is limited by the fragipan at a depth of about 26 inches.

Most areas are used as pasture or woodland. This soil is suited to grasses for hay and pasture. It is moderately well suited to legumes, such as birdsfoot trefoil and alsike clover; to cool-season grasses, such as reed canarygrass and tall fescue; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. The limited root zone, wetness in spring, and droughtiness in summer are the main management concerns. Overgrazing reduces forage yields and increases the extent of weeds. Grazing when the soil is wet causes surface compaction and poor tilth. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods.

Many areas support native hardwoods. This soil is suited to trees. The equipment limitation, the windthrow hazard, and seedling mortality are management concerns. Equipment should be used only during periods when the soil is dry or frozen. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Ridging the soil and then planting on the ridges increase the seedling survival rate. Reinforcement planting may be needed. Fire prevention and control of grazing are needed.

This soil is suited to building site development and some kinds of onsite sewage disposal. The wetness and the shrink-swell potential are limitations affecting the design of dwellings. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the foundations, footings, and basement walls helps to prevent the damage caused by excessive wetness. Properly constructed sewage lagoons function adequately on this soil, but septic tank absorption fields generally do not function properly because of the wetness and the very slow permeability. Community sewers should be used if they are available.

The wetness, the high shrink-swell potential, the potential for frost action, and low strength are limitations on sites for local roads and streets. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by wetness, shrinking and swelling, and frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

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

05—Gerald silt loam. This deep, nearly level, somewhat poorly drained soil is on broad ridgetops in the uplands. Individual areas are irregular in shape and range from about 10 to more than 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. The part of the subsoil above a fragipan is about 18 inches thick. The upper part is dark grayish brown and very dark grayish brown, mottled, friable silty clay loam. The lower part is dark grayish brown and grayish brown, mottled, firm and very firm silty clay. The fragipan is about 11 inches thick. It is multicolored, very firm silty clay loam. The part of the subsoil below the fragipan to a depth of 60 inches or more is mixed red and dark red, firm silty clay loam and firm, extremely cherty silty clay.

Included with this soil in mapping are areas of the moderately well drained Hoberg soils. These soils make up about 5 to 10 percent of the unit. They are lower on the ridgetops than the Gerald soil and are on side slopes.

Permeability is very slow in the fragipan of the Gerald soil and moderately slow below the fragipan. Runoff is slow. A perched water table is at a depth of 1 to 2 feet during most winter and spring months. The available water capacity is low. Organic matter content is moderately low, and natural fertility is low. The shrink-swell potential is high in the part of the subsoil above the fragipan. The root zone is limited by the fragipan at a depth of about 27 inches.

Most areas are used as pasture or hayland. This soil is moderately well suited to legumes, such as birdsfoot trefoil and alsike clover; to cool-season grasses, such as reed canarygrass and tall fescue; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. The limited root zone, wetness in spring, and droughtiness in summer are the main management concerns. Overgrazing reduces forage yields and increases the extent of weeds. Grazing when the soil is wet causes surface compaction and poor tilth. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods.

This soil is suited to building site development and some kinds of onsite waste disposal. The wetness and the shrink-swell potential are limitations affecting the design of dwellings. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the foundations, footings, and basement walls helps to prevent the damage caused by excessive wetness. Properly constructed sewage lagoons function adequately on this soil, but septic tank absorption fields generally do not function properly because of the wetness and the very slow permeability. Community sewers should be used if they are available.

Low strength, the shrink-swell potential, and frost action limit the use of this soil as a site for local roads and streets. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low

Figure 7.—An area of Hoberg silt loam, 2 to 5 percent slopes, used for hay.

strength. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action.

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

06B—Hoberg silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on the tops and sides of ridges in the uplands. Individual areas are irregular in shape and range from about 20 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is very dark grayish brown and dark brown, friable silt loam about 13 inches thick. The part of the subsoil above a fragipan is dark yellowish brown, firm silty clay loam about 8 inches thick. The fragipan is red, very firm extremely cherty silty clay loam about 24 inches thick. The part of the subsoil below the fragipan to a depth of about 60 inches is red, firm very cherty clay.

Included with this soil in mapping are areas of Eldon, Gerald, Keeno, and Lebanon soils. These soils make up about 15 percent of the unit. Eldon and Keeno soils are on long side slopes. They have more chert in the upper part than the Hoberg soil. Gerald soils are on broad ridgetops. They have more clay above the fragipan than the Hoberg soil. Lebanon soils are in positions on the landscape similar to those of the Hoberg soil. They have more clay than the Hoberg soil and do not have a dark surface layer.

Permeability is moderate above the fragipan in the Hoberg soil and slow in the fragipan. Runoff is medium. A perched water table is at a depth of 1 to 3 feet during most winter and spring months. The available water capacity is low. Organic matter content is moderately low, and natural fertility is medium. The shrink-swell potential is moderate below the fragipan. The root zone is limited by the fragipan at a depth of about 24 inches.

Most areas are used as pasture or hayland (fig. 7). A few areas are used as woodland. This soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue, reed canarygrass, and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, Caucasian bluestem, and indiangrass. The limited root zone, wetness in spring, and droughtiness in summer are the main management concerns. Timely tillage and a quickly established ground cover help to prevent excessive erosion. Overgrazing reduces forage yields and increases the extent of weeds. Grazing when the soil is wet causes surface compaction and poor tilth. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods.

This soil is suited to trees. Windthrow is a management concern. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

This soil is suited to building site development and onsite waste disposal. The wetness is a limitation if the soil is used as a site for dwellings. Installing tile drains around foundations, footings, and basement walls helps to prevent the damage caused by excessive wetness. The wetness and the slow permeability are limitations on sites for septic tank absorption fields. These fields can function adequately if a properly constructed mound of fill material increases the thickness of the soil over the fragipan. This mound allows for more surface exposure for evaporation and allows surface water to drain away from the lateral field. Seepage and slope are limitations on sites for sewage lagoons. If the site is leveled, properly constructed sewage lagoons can function adequately. Sealing the sides and bottom of the lagoons helps to prevent seepage and the contamination of ground water.

The wetness and the potential for frost action limit the use of this soil as a site for local roads and streets. Grading the roads so that they shed water and constructing adequate roadside ditches minimize the damage caused by wetness and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3D.

07B—Lebanon silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on ridgetops in the uplands. Individual areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 5 inches thick. The part of the subsoil above a fragipan is silty clay loam about 16 inches thick. It is strong brown, mottled, and friable in the upper part and mixed brown and reddish brown, mottled, and firm in the lower part. The fragipan is about 18 inches thick. It is mottled light brownish gray, dark grayish brown, and pale brown, very firm extremely cherty silty clay loam. The part of the subsoil below the fragipan to a depth of about 60 inches or more is reddish brown, mottled, firm very cherty silty clay and dark red and red, firm very cherty clay. In places the part of the subsoil above the fragipan has less clay and more chert.

Included with this soil in mapping are areas of Bado and Celt soils. These soils make up about 5 to 10 percent of the unit. The poorly drained Bado soils are in depressions on broad ridgetops. The somewhat poorly drained Celt soils are in positions on the landscape similar to those of the Lebanon soil.

Permeability is moderately slow above the fragipan in the Lebanon soil and very slow in the fragipan. Runoff is medium. A perched water table is at a depth of 1 to 2 feet during most winter and spring months. The available water capacity is low. Organic matter content is moderately low, and natural fertility is low. The shrink-swell potential is moderate. The root zone is limited by the fragipan at a depth of about 21 inches.

Most areas are used as pasture or hayland. This soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue, reed canarygrass, and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, Caucasian bluestem, and indiangrass. The limited root zone, wetness in spring, and droughtiness in summer are the main management concerns. Timely tillage and a quickly established ground cover help to prevent excessive erosion. Overgrazing reduces forage yields and increases the extent of weeds. Grazing when the soil is wet causes surface compaction and poor tilth. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods.

Many areas support native hardwoods. This soil is suited to trees. Windthrow is a management concern. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Fire prevention and control of grazing are needed.

This soil is suited to building site development and onsite waste disposal. The wetness is a limitation if the soil is used as a site for dwellings. Installing tile drains around the foundations, footings, and basement walls helps to prevent the damage caused by excessive wetness. The wetness and the slow permeability are limitations on sites for septic tank absorption fields. These fields can function adequately if a properly constructed mound of fill material increases the thickness of the soil over the fragipan. This mound allows for more surface exposure for evaporation and allows surface water to drain away from the lateral field. The slope is a limitation on sites for sewage lagoons. If the site is leveled, properly constructed sewage lagoons can function adequately. Community sewers should be used if they are available.

The wetness, the shrink-swell potential, the potential for frost action, and low strength are limitations on sites for local roads and streets. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by wetness, shrinking and swelling, and frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is IIe. The woodland ordination symbol is 3D.

08B—Viraton silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on ridgetops in the uplands. Individual areas are irregular in shape and range from about 40 to 300 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 5 inches thick. The subsurface layer is dark yellowish brown, friable silt loam about 5 inches thick. The part of the subsoil above a fragipan is about 14 inches of brown, friable silt loam and strong brown, firm cherty silty clay loam. The fragipan is yellowish red, very firm extremely cherty silt loam about 18 inches thick. The part of the subsoil below the fragipan to a depth of about 60 inches is red, very firm silty clay. In places the part of the subsoil above the fragipan has more clay and less chert.

Included with this soil in mapping are areas of Bado, Celt, and Wilderness soils. These soils make up about 15 percent of the unit. The poorly drained Bado and somewhat poorly drained Celt soils are in depressions. Wilderness soils are cherty in the upper part. They are at the lower edges of the mapped areas.

Permeability is moderate above the fragipan in the Viraton soil and very slow in the fragipan. Runoff is medium. A perched water table is at a depth of 1.5 to 2.5 feet during most winter and spring months. The available water capacity is low. Organic matter content and natural fertility also are low. The shrink-swell potential is moderate. The root zone is limited by the fragipan at a depth of about 24 inches.

Most areas are used as pasture or hayland. This soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue, reed canarygrass, and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, Caucasian bluestem, and indiangrass. The limited root zone, wetness in spring, and droughtiness in summer are the major management concerns. Timely tillage and a quickly established ground cover help to prevent excessive erosion. Overgrazing reduces forage yields and increases the extent of weeds. Grazing when the soil is wet causes surface compaction and poor tilth. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods.

Some areas support native hardwoods. This soil is suited to trees. Seedling mortality and the windthrow hazard are management concerns. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Fire prevention and control of grazing are needed.

This soil is suited to building site development and some kinds of onsite waste disposal. The wetness and the shrink-swell potential are limitations affecting the design of dwellings. Properly designing footings and foundations and constructing them with adequately reinforced concrete help to prevent the structural damage to dwellings with basements caused by shrinking and swelling. Installing tile drains around the foundations, footings, and basement walls helps to prevent the damage caused by excessive wetness. Landscaping can improve surface drainage. Measures that increase the depth of the soil material to the water table should be considered. The slope and the wetness are limitations on sites for sewage lagoons. If the site is leveled, properly constructed sewage lagoons can function adequately. Wetness can be overcome by sealing the berms and bottom of the lagoons. This measure helps to prevent seepage and the contamination of ground water. The soil generally is unsuitable as a site for septic tank absorption fields because of the wetness and the very slow permeability.

The wetness and the potential for frost action limit the use of this soil as a site for local roads and streets. Grading the roads so that they shed water and constructing adequate roadside ditches minimize the damage caused by wetness and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3D.

08C—Viraton silt loam, 5 to 9 percent slopes. This deep, moderately sloping, moderately well drained soil is on ridgetops in the uplands. Individual areas are irregular in shape and range from about 60 to 400 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is yellowish brown, mottled, very friable silt loam about 4 inches thick. The part of the subsoil above a fragipan is about 17 inches thick. It is strong brown. The upper part is friable silt loam, and the lower part is firm silty clay loam. The fragipan extends to a depth of about 54 inches. The upper part is mottled light brownish gray, strong brown, and yellowish brown, very firm cherty silt loam, and the lower part is mottled reddish brown, light brownish gray, and strong brown, very firm very cherty silty clay loam. The part of the subsoil below the fragipan to a depth of 60 inches or more is dark red, firm very cherty clay. In places the part of the subsoil above the fragipan has more clay and less chert.

Included with this soil in mapping are areas of Bado, Celt, and Wilderness soils. These soils make up about 15 percent of the unit. The poorly drained Bado and somewhat poorly drained Celt soils are in depressions. Wilderness soils are cherty in the upper part. They are at the lower edges of the mapped areas.

Permeability is moderate above the fragipan in the Viraton soil and very slow in the fragipan. Runoff is medium. A perched water table is at a depth of 1.5 to 2.5 feet during most winter and spring months. The available water capacity is low. Organic matter content and natural fertility also are low. The shrink-swell potential is moderate. The root zone is limited by the fragipan at a depth of about 26 inches.

Most areas are used as pasture or hayland. This soil is well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue, reed canarygrass, and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, Caucasian bluestem, and indiangrass. The limited root zone, wetness in spring, and droughtiness in summer are the major management concerns. Timely tillage and a quickly established ground cover help to prevent excessive erosion. Overgrazing reduces forage yields and increases the extent of weeds. Grazing when the soil is wet causes surface compaction and poor tilth. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods.

Some areas support native hardwoods. This soil is suited to trees. Seedling mortality and the windthrow hazard are management concerns. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Fire prevention and controlled grazing are needed.

This soil is suited to building site development and some kinds of onsite waste disposal. The wetness and the shrink-swell potential are limitations affecting the design of dwellings. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage to dwellings with basements caused by shrinking and swelling. Installing tile drains around the foundations, footings, and basement walls helps to prevent the damage caused by excessive wetness. Landscaping can improve surface drainage. Measures that increase the depth of the soil material to the water table should be considered. The slope and the wetness are limitations on sites for sewage lagoons. If the site is leveled, properly constructed sewage lagoons can function adequately. The wetness can be overcome by sealing the berms and bottom of the lagoons. This measure helps to prevent seepage and the contamination of ground water. The soil generally is unsuitable as a site for septic tank absorption fields because of the wetness and the very slow permeability.

The wetness and the potential for frost action limit the use of this soil as a site for local roads and streets. Grading the roads so that they shed water and constructing adequate roadside ditches minimize the damage caused by wetness and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3D.

09B—Hobson silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on ridgetops in the uplands. Individual areas are irregular in shape and range from about 80 to 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 4 inches thick. The subsurface layer is brown, very friable silt loam about 3 inches thick. The part of the subsoil above a fragipan is about 19 inches of light yellowish brown, very friable loam and brown and reddish brown, firm clay loam. The fragipan is about 16 inches thick. It is mottled strong brown, light gray, and reddish yellow, very firm fine sandy loam in the upper part and strong brown, mottled, very firm sandy clay loam in the lower part. The part of the subsoil below the fragipan to a depth of 60 inches is red, mottled, firm clay loam.

Included with this soil in mapping are areas of Basehor and Bolivar soils. These soils make up about 15 percent of the unit. They do not have a fragipan. They are at the lower edges of the mapped areas.

Permeability is moderate above the fragipan in the Hobson soil and slow in the fragipan. Runoff is medium.

A perched water table is at a depth of 1.5 to 3.0 feet during most winter and spring months. The available water capacity, organic matter content, and natural fertility are low. The shrink-swell potential also is low. The root zone is limited by the fragipan at a depth of about 26 inches.

Most areas are used as pasture or hayland. This soil is moderately well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, Caucasian bluestem, and indiangrass. The limited root zone, wetness in spring, and droughtiness in summer are the major management concerns. Erosion is a hazard if the soil is tilled during seedbed preparation. Timely tillage and a quickly established ground cover help to prevent excessive erosion. Overgrazing reduces forage yields and increases the extent of weeds. Grazing when the soil is wet causes surface compaction and poor tilth. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods.

Some areas support native hardwoods. This soil is suited to trees. Seedling mortality and the windthrow hazard are management concerns. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Fire prevention and controlled grazing are needed.

This soil is suited to building site development and some kinds of onsite waste disposal. The wetness is a limitation affecting the design of dwellings. Installing tile drains around the foundations, footings, and basement walls helps to prevent the damage caused by excessive wetness. Landscaping can improve surface drainage. Measures that increase the depth of the soil material to the water table should be considered. The slope and the wetness are limitations on sites for sewage lagoons. If the site is leveled, properly constructed sewage lagoons can function adequately. The wetness can be overcome by sealing the berms and bottom of the lagoons. This measure helps to prevent seepage and the contamination of ground water. The soil generally is unsuitable as a site for septic tank absorption fields because of the wetness and the slow permeability.

The wetness and the potential for frost action limit the use of this soil as a site for local roads and streets. Grading the roads so that they shed water and constructing adequate roadside ditches minimize the damage caused by wetness and frost action.

The land capability classification is IIe. The woodland ordination symbol is 3D.

09C—Hobson loam, 5 to 9 percent slopes. This deep, moderately sloping, moderately well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from about 20 to 120 acres in size.

Typically, the surface layer is dark grayish brown, very friable loam about 3 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The part of the subsoil above a fragipan is light yellowish brown and brown, firm loam and clay loam about 20 inches thick. The fragipan extends to a depth of about 49 inches. It is mottled strong brown, gray, and reddish yellow, firm fine sandy loam and sandy clay loam. The part of the subsoil below the fragipan to a depth of 60 inches is red, firm clay loam.

Included with this soil in mapping are areas of Basehor and Bolivar soils. These soils make up about 10 percent of the unit. They do not have a fragipan. They are at the lower edges of the mapped areas.

Permeability is moderate above the fragipan in the Hobson soil and slow in the fragipan. Runoff is medium. A perched water table is at a depth of 1.5 to 3.0 feet during most winter and spring months. The available water capacity, organic matter content, and natural fertility are low. The shrink-swell potential also is low. The root zone is limited by the fragipan at a depth of about 27 inches.

Most areas are used as pasture or hayland. This soil is moderately well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, Caucasian bluestem, and indiangrass. The limited root zone, wetness in spring, and droughtiness in summer are the major management concerns. Erosion is a hazard if the soil is tilled during seedbed preparation. Timely tillage and a quickly established ground cover help to prevent excessive erosion. Overgrazing reduces forage yields and increases the extent of weeds. Grazing when the soil is wet causes surface compaction and poor tilth. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods.

Some areas support native hardwoods. This soil is suited to trees. Seedling mortality and the windthrow hazard are management concerns. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Fire prevention and controlled grazing are needed.

This soil is suited to building site development and some kinds of onsite waste disposal. The wetness is a limitation affecting the design of dwellings. Installing tile drains around the foundations, footings, and basement walls helps to prevent the damage caused by excessive wetness. Landscaping can improve surface drainage. Measures that increase the depth of the soil material to the water table should be considered. The slope and the wetness are limitations on sites for sewage lagoons. If the site is leveled, properly constructed sewage lagoons can function adequately. The wetness can be overcome by sealing the berms and bottom of the lagoons. This measure helps to prevent seepage and the contamination of ground water. The soil generally is unsuitable as a site for septic tank absorption fields because of the wetness and the slow permeability.

The wetness and the potential for frost action limit the use of this soil as a site for local roads and streets. Grading the roads so that they shed water and constructing adequate roadside ditches minimize the damage caused by wetness and frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3D.

14G—Gepp-Goss-Bardley complex, 5 to 50 percent slopes. These moderately sloping to steep, well drained soils are on side slopes in the uplands. The Gepp and Goss soils are deep. The Bardley soil is moderately deep. Individual areas are irregular in shape and range from about 100 to 500 acres in size. The extent of each soil varies from area to area, but the average generally is about 35 percent Gepp soil, 30 percent Goss soil, and 25 percent Bardley soil.

Typically, the Gepp soil has a surface layer of brown, friable very cherty silt loam about 2 inches thick. The subsurface layer is pale brown, friable very cherty silt loam about 5 inches thick. The upper part of the subsoil is red, firm silty clay loam. The lower part to a depth of 65 inches or more is red and strong brown, firm cherty clay and clay. In places the depth to bedrock is less than 60 inches.

Typically, the Goss soil has a surface layer of brown, friable cherty silt loam about 8 inches thick. The upper part of the subsoil is brown and reddish brown, firm very cherty silty clay loam. The lower part to a depth of 64 inches is red, dark red, and yellowish red, firm very cherty and extremely cherty clay.

Typically, the Bardley soil has a surface layer of dark grayish brown, friable very cherty loam about 2 inches thick. The subsoil extends to a depth of about 24 inches. The upper part is yellowish red, firm cherty silty clay loam. The lower part is red, firm clay. Hard dolomite bedrock is at a depth of about 24 inches. In places the subsoil is yellowish brown.

Included with these soils in mapping are areas of Gasconade and Wilderness soils and some areas where stones are on the surface. The shallow, somewhat excessively drained Gasconade soils are on the lower side slopes along stream channels. The moderately well drained Wilderness soils are on the higher side slopes. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Gepp, Goss, and Bardley soils. Runoff is rapid. The available water capacity is moderate in the Gepp soil, low in the Goss soil, and very low in the Bardley soil. Organic matter content and natural fertility are low in all three soils. The shrink-swell potential is moderate in the subsoil.

Most areas are used as pasture or woodland. These soils are moderately well suited to legumes, such as crownvetch, lespedeza, and birdsfoot trefoil; to cool-season grasses, such as tall fescue; and to warm-season grasses, such as Caucasian bluestem, switchgrass, and indiangrass. Droughtiness, erosion, and chert fragments in the surface layer are the main management concerns. These soils should not be tilled. They generally are unsuited to hay because of the slope.

Many areas support native hardwoods. These soils are suited to trees (fig. 8). The hazard of erosion and the equipment limitation are the main management concerns. In many places seedlings cannot be planted by machine because of the slope. Logging roads and skid trails should be built on the contour. In the steepest areas, the logs should be yarded uphill to logging roads and skid trails. Erosion is a major hazard. Properly designing the roads and skid trails can minimize the steepness and length of the slopes and the concentration of water. Replanting harvested areas as soon as possible minimizes the length of time that the surface remains unprotected. Seeding of disturbed areas may be necessary after harvesting is completed. Seedling mortality is a management concern on the Bardley and Goss soils. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. Windthrow is a hazard on the Bardley soil. The stands on this soil

Figure 8.—A timbered area of Gepp-Goss-Bardley complex, 5 to 50 percent slopes.

should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is slight. Fire prevention and controlled grazing are needed.

These soils generally are not suited to building site development or onsite waste disposal because of the slope.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Gepp and Goss soils is 3R, and that assigned to the Bardley soil is 2R.

17D—Gepp-Goss very cherty silt loams, 5 to 14 percent slopes. These deep, gently sloping to strongly sloping, well drained soils are on narrow ridgetops and side slopes in the uplands. The Gepp soil is at the slightly higher elevations. It is the dominant soil on the narrow crown of the ridges. The Goss soil is at the slightly lower elevations. It is the dominant soil on shoulder slopes and in saddles. Individual areas are long and narrow or are irregular in shape. They range from about 15 to 100 acres in size. The extent of each soil varies from area to area, but the average generally is about 50 percent Gepp soil and 40 percent Goss soil.

Typically, the Gepp soil has a surface layer of very dark grayish brown, friable very cherty silt loam about 1 inch thick. The subsurface layer is brown, friable very cherty silt loam about 8 inches thick. The subsoil extends to a depth of about 63 inches. It is red, firm cherty silty clay loam and clay in the upper part; red and dark red, mottled, firm clay in the next part; and mottled dark red, yellowish brown, and light gray, firm clay in the lower part.

Typically, the Goss soil has a surface layer of very dark grayish brown, friable very cherty silt loam about 3 inches thick. The subsurface layer is brown and yellowish brown, firm very cherty silt loam about 14 inches thick. The subsoil extends to a depth of about 65 inches. It is yellowish red, firm cherty silty clay in the upper part and red and dark red, firm very cherty and cherty clay in the lower part.

Included with these soils in mapping are areas of Celt, Viraton, and Wilderness soils and some areas where stones are on the surface. Included soils make up about 10 percent of the unit. Celt and Viraton soils have less chert in the surface layer than the Gepp and Goss soils and have a fragipan. They are on the broader ridges. Wilderness soils have a fragipan. They are on the higher mounds along the ridgetops.

Permeability is moderate in the Gepp and Goss soils. Runoff is medium or rapid. The available water capacity is low in the Goss soil and moderate in the Gepp soil. Organic matter content is moderately low in both soils, and natural fertility is low. The shrink-swell potential is moderate in the subsoil.

Most areas are used as woodland. A few areas are used as pasture or hayland. These soils are moderately well suited to the commonly grown legumes, such as crownvetch and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. The pasture should be tilled only when a stand is to be established or when renovation or reseeding is needed. New stands should be seeded early enough to ensure a good ground cover. Overgrazing reduces forage yields and increases the extent of weeds and woody invaders. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, and timely deferment of grazing. Clipping the pasture and applying chemical sprays help to control weeds and brush.

Most areas support native hardwoods. These soils are suited to trees. Chert hinders the use of planting equipment on the Goss soil. Reinforcement planting may be necessary because of seedling mortality on this soil. Fire prevention and controlled grazing are needed.

These soils are suited to building site development and onsite waste disposal. The moderate permeability, the shrink-swell potential, and the slope are limitations. Also, large stones limit urban development on the Goss soil. They should be removed from the building site. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. The dwellings can be designed so that they conform to the natural slope of the land. Some land shaping generally is necessary. Enlarging septic tank absorption fields helps to overcome the moderate permeability. Backfilling with material that is free of stones helps to compensate for the reduced absorption capacity caused by the content of chert. Land shaping and installing the distribution lines on the contour help to prevent downhill seepage and improve the efficiency of the absorption system. If the site is leveled, properly constructed sewage lagoons can function adequately. Sealing the sides and bottom of the lagoons helps to prevent seepage. Community sewers should be used if they are available.

The slope, the shrink-swell potential, the potential for frost action, and low strength are limitations on sites for local roads and streets. The roads should be designed so that they conform to the natural slope of the land. Some cutting and filling may be necessary. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is VIe. The woodland ordination symbol assigned to the Gepp soil is 3A, and that assigned to the Goss soil is 3F.

18D—Gasconade-Rock outcrop complex, 2 to 14 percent slopes. This map unit consists of a shallow, gently sloping to strongly sloping, somewhat excessively drained Gasconade soil between ledges of Rock outcrop. The unit is on rough, broken side slopes adjacent to streams. Individual areas are irregular in shape and range from about 5 to 150 acres in size. The extent of the Gasconade soil and the Rock outcrop varies from area to area, but the average generally is about 60 percent Gasconade soil and 20 percent Rock outcrop.

Typically, the surface layer of the Gasconade soil is very dark gray, friable flaggy silty clay loam about 4 inches thick. The subsoil is very dark grayish brown, firm very flaggy silty clay about 8 inches thick. Hard dolomite bedrock is at a depth of about 12 inches.

The Rock outcrop is exposed dolomite bedrock. As much as 2 inches of soil material and chert fragments covers the bedrock in places.

Included in this unit in mapping are areas of the moderately deep, well drained Bardley and deep, well drained Eldon and Goss soils. These soils are on side slopes above the Gasconade soil. Also included are some areas where the soil is more than 20 inches deep over bedrock, a few areas where the soil is underlain by sandstone, and areas where some stones and smaller coarse fragments of dolomite and chert are on the surface. Included soils make up as much as 20 percent of the unit.

Permeability is moderately slow in the Gasconade soil. Runoff is rapid. The available water capacity is very low. Organic matter content is moderate, and natural fertility is low. The shrink-swell potential is moderate. The root zone is limited by the hard bedrock at a depth of about 12 inches.

Most areas are used as pasture or support native grasses, eastern redcedar, or low-quality hardwoods. Tall fescue, alsike clover, big bluestem, little bluestem, and indiangrass are the best suited forage species on the shallow, droughty Gasconade soil. The high content of coarse fragments in the surface layer, surface stones, and the Rock outcrop limit the use of equipment.

The Gasconade soil is poorly suited to hardwoods because of the shallowness to bedrock. Eastern redcedar grows best. Because of low production, timber management generally is not feasible. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Overcoming these hazards or limitations is difficult.

The Gasconade soil has poor potential for the development of habitat for most types of upland game, but it provides an edge type of habitat for wildlife. Native grasses and eastern redcedar provide most of the food and cover.

The Gasconade soil generally is not suited to building site development or onsite waste disposal because of the shallowness to bedrock. Building site development is impractical because of the cost of excavating the bedrock.

The land capability classification is VIs. The woodland ordination symbol assigned to the Gasconade soil is 2D. The Rock outcrop is not assigned a woodland ordination symbol.

18G—Gasconade-Rock outcrop complex, 14 to 60 percent slopes. This map unit consists of a shallow, moderately steep and steep, somewhat excessively drained Gasconade soil between ledges of Rock outcrop. The unit is on rough, broken side slopes adjacent to streams. Individual areas are irregular in shape and range from about 5 to 300 acres in size. The extent of the Gasconade soil and the Rock outcrop varies from area to area, but the average generally is about 60 percent Gasconade soil and 20 percent Rock outcrop.

Typically, the surface layer of the Gasconade soil is very dark gray, friable very flaggy silty clay loam about 6 inches thick. The subsoil is dark yellowish brown, firm very flaggy silty clay loam about 3 inches thick. Hard dolomite bedrock is at a depth of about 9 inches.

The Rock outcrop is exposed dolomite bedrock. As much as 2 inches of soil material and chert fragments covers the bedrock in places.

Included in this unit in mapping are areas of Bardley and Goss soils, a few small areas where the soil is underlain by sandstone bedrock, and areas where some stones and smaller coarse fragments of dolomite and chert are on the surface. Included soils make up as much as 20 percent of the unit. The well drained Goss and Bardley soils are on side slopes above the Gasconade soil.

Permeability is moderately slow in the Gasconade soil. Runoff is rapid. The available water capacity is very low. Organic matter content is moderate, and natural fertility is low. The shrink-swell potential is moderate. The root zone is limited by the hard bedrock within a depth of 20 inches.

Most areas support native grasses, eastern redcedar, or low-quality hardwoods. Alsike clover, big bluestem, little bluestem, and indiangrass are the best suited forage species on the shallow, droughty Gasconade soil. The high content of coarse fragments in the surface layer, surface stones, and the Rock outcrop limit the use of equipment.

The Gasconade soil is poorly suited to hardwoods because of the shallowness to bedrock. Eastern redcedar grows best. Because of low production, timber management generally is not feasible. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Overcoming these hazards or limitations is difficult.

The Gasconade soil has poor potential for the development of habitat for most types of upland game, but it provides an edge type of habitat for wildlife. Native grasses and eastern redcedar provide most of the food and cover.

The Gasconade soil generally is not suited to building site development or onsite waste disposal because of the shallowness to bedrock. Building site development is impractical because of the cost of excavating the bedrock.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Gasconade soil is 2R. The Rock outcrop is not assigned a woodland ordination symbol.

20C—Ocie-Goss-Gatewood complex, 5 to 9 percent slopes. These moderately sloping soils are on side slopes and ridgetops in the uplands. The Ocie soil is deep and moderately well drained, the Goss soil is deep and well drained, and the Gatewood soil is moderately deep and moderately well drained. Individual areas are irregular in shape and range from about 20 to 200 acres in size. The extent of each soil varies from area to area, but the average generally is about 30 percent Ocie soil, 25 percent Goss soil, and 20 percent Gatewood soil.

Typically, the Ocie soil has a surface layer of dark grayish brown, friable cherty silt loam about 3 inches thick. The subsurface layer is brown and yellowish brown, friable very cherty silt loam about 22 inches thick. The subsoil extends to a depth of about 44 inches. The upper part is strong brown, firm very cherty silty clay loam, and the lower part is yellowish brown, light brownish gray, and red, firm clay. The substratum extends to a depth of about 53 inches. It is mixed olive gray, light greenish gray, and yellowish red, firm clay. Dolomite bedrock is at a depth of about 53 inches. In places the upper part of the subsoil has fewer chert fragments.

Typically, the Goss soil has a surface layer of brown, friable very cherty silt loam about 9 inches thick. The subsoil extends to a depth of about 66 inches. It is strong brown, firm cherty silty clay loam in the upper part; yellowish red, firm very cherty silty clay loam and extremely cherty silty clay in the next part; and multicolored, firm very cherty clay in the lower part.

Typically, the Gatewood soil has a surface layer of dark grayish brown, friable very cherty silt loam about 4 inches thick. The subsurface layer is brown, friable very cherty silt loam about 3 inches thick. The subsoil extends to a depth of about 25 inches. It is dark yellowish brown. The upper part is friable cherty silty clay, and the lower part is firm clay. Hard dolomite bedrock is at a depth of about 25 inches.

Included with these soils in mapping are areas of Gasconade and Viraton soils, dolomite rock outcrops, and some areas where stones are on the surface. Included areas make up about 25 percent of the unit. The shallow Gasconade soils and the rock outcrops generally are on low foot slopes and on side slopes. Viraton soils have a fragipan. They are at the upper edges of the mapped areas.

Permeability is moderate in the Goss soil and slow in the Ocie and Gatewood soils. Runoff is medium. The available water capacity is low in the Ocie and Goss soils and very low in the Gatewood soil. Organic matter content and natural fertility are low in all three soils. The shrink-swell potential is moderate in the Goss soil and high in the Ocie and Gatewood soils.

Most areas are used as pasture, hayland, or woodland. These soils are moderately well suited to legumes, such as lespedeza, birdsfoot trefoil, and crownvetch; to cool-season grasses, such as tall fescue, reed canarygrass, and bluegrass; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. Erosion during seedbed preparation is a management concern. Timely tillage and a quickly established ground cover help to prevent excessive erosion. Overgrazing reduces forage yields and increases the extent of weeds and woody invaders. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, and timely deferment of grazing.

Many areas support native hardwoods. These soils are suited to trees. No major hazards or limitations affect planting or harvesting on the Ocie and Gatewood soils. Because of the chert fragments, the equipment limitation and seedling mortality are management concerns on the Goss soil. Hand planting and reinforcement planting may be needed. Planting container-grown nursery stock increases the seedling survival rate. Fire prevention and controlled grazing are needed.

These soils are suited to building site development and some kinds of onsite waste disposal. Restricted permeability, slope, depth to bedrock, large stones, seepage, and the shrink-swell potential are limitations. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. Fill material or blasting may be necessary to provide adequate depth for basements in areas of the Gatewood soil. Large stones should be removed from building sites in areas of the Goss soil.

Because of the depth to bedrock and the slow permeability, the Ocie and Gatewood soils are unsuitable as sites for septic tank absorption fields. Enlarging the absorption fields helps to overcome the moderate permeability in the Goss soil. This soil has large stones, which can increase the cost of laying out the absorption field. Properly constructed sewage lagoons can function adequately if the site is leveled. Sealing the berms and bottom of the lagoons helps to prevent seepage and the contamination of ground water. Because of the depth to bedrock, the berms of the lagoons in areas of the Ocie and Gatewood soils should be built up with additional material.

The high shrink-swell potential, the potential for frost action, and low strength are limitations on sites for local roads and streets. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is IVe. The woodland ordination symbol assigned to the Ocie soil is 3A, that assigned to the Goss soil is 3F, and that assigned to the Gatewood soil is 2A.

20E—Ocie-Goss-Gatewood complex, 9 to 25 percent slopes. These strongly sloping and moderately steep soils are on side slopes in the uplands. The Ocie soil is deep and moderately well drained, the Goss soil is deep and well drained, and the Gatewood soil is moderately deep and moderately well drained. Individual areas are irregular in shape and range from about 40 to 300 acres in size. The extent of each soil varies from area to area, but the average generally is about 30 percent Ocie soil, 25 percent Goss soil, and 20 percent Gatewood soil.

Typically, the Ocie soil has a surface layer of dark brown, very friable cherty silt loam about 1 inch thick. The subsurface layer is light yellowish brown and yellowish brown, very friable cherty silt loam about 10 inches thick. The subsoil extends to a depth of about 54 inches. The upper part is yellowish brown, firm very cherty silty clay loam; the next part is strong brown, mottled, firm clay; and the lower part is yellowish brown, mottled, firm clay. The substratum also is yellowish brown, mottled, firm clay. It is about 5 inches thick. Hard dolomite bedrock is at a depth of about 59 inches. In places the upper part of the subsoil has fewer chert fragments.

Typically, the Goss soil has a surface layer of dark brown, friable very cherty silt loam about 2 inches thick. The subsurface layer is pale brown and light yellowish brown, friable extremely cherty silt loam about 10 inches thick. The subsoil to a depth of 60 inches is dark red, firm extremely cherty silty clay loam, extremely cherty clay, very cherty clay, and clay.

Typically, the Gatewood soil has a surface layer of dark brown, friable very cherty silt loam about 2 inches thick. The subsurface layer is dark grayish brown, friable very cherty silt loam about 6 inches thick. The subsoil extends to a depth of about 30 inches. The upper part is light yellowish brown, firm cherty silty clay, and the lower part is yellowish brown, very firm clay. Hard dolomite bedrock is at a depth of about 30 inches.

Included with these soils in mapping are areas of Gasconade soils, outcrops of hard dolomite bedrock, and some areas where stones are on the surface. Included areas make up about 25 percent of the unit. The shallow Gasconade soils and the outcrops of bedrock are on low foot slopes or on the side slopes.

Permeability is moderate in the Goss soil and slow in the Ocie and Gatewood soils. Runoff is medium on all three soils. The available water capacity is low in the Ocie and Goss soils and very low in the Gatewood soil. Organic matter content and natural fertility are low in all three soils. The shrink-swell potential is moderate in the Goss soil and high in the Ocie and Gatewood soils.

Most areas are used as pasture, hayland, or woodland. These soils are moderately well suited to legumes, such as lespedeza, birdsfoot trefoil, and crownvetch; to cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. Erosion and the chert fragments in the surface layer are management concerns. Tilling and haying may be difficult because of the slope. The soil should be tilled only when a stand is to be established or when reseeding is needed to reduce the hazard of erosion. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, and timely deferment of grazing.

Many areas support native hardwoods. These soils are well suited to trees. The hazard of erosion and the equipment limitation are management concerns. Reseeding harvested areas as soon as possible minimizes the length of time that the surface remains unprotected. Safety precautions are needed when equipment is operated on these slopes. Seedling mortality is a management concern on the Goss soil. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. Fire prevention and controlled grazing are needed.

These soils are suited to building site development and some kinds of onsite waste disposal. Restricted permeability, slope, depth to bedrock, large stones, seepage, and the shrink-swell potential are limitations. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. The dwellings can be designed so that they conform to the natural slope of the land. Some land shaping generally is necessary. Fill material or blasting may be necessary to provide adequate depth for basements in areas of the Gatewood soil. Large stones should be removed from building sites in areas of the Goss soil.

Because of depth to bedrock and the slow permeability, the Ocie and Gatewood soils are unsuitable as sites for septic tank absorption fields. Enlarging the absorption fields helps to overcome the moderate permeability in the Goss soil. This soil has large stones, which can increase the cost of laying out the absorption field. Land shaping can modify the slope. Also, the laterals can be installed across the slope. Properly constructed sewage lagoons can function adequately if the site is leveled. Sealing the berms and bottom of the lagoons helps to prevent seepage and the contamination of ground water. Because of the depth to bedrock, the berms of the lagoons in areas of the Ocie and Gatewood soils should be built up with additional material.

The slope, the shrink-swell potential, the potential for frost action, and low strength are limitations on sites for local roads and streets. The roads should be designed so that they conform to the natural slope of the land. Some cutting and filling may be necessary. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Ocie and Goss soils is 3R, and that assigned to the Gatewood soil is 2R.

24E—Goss very cherty silt loam, 5 to 20 percent slopes, very stony. This deep, gently sloping to moderately steep, well drained soil is on convex side slopes and ridgetops in the uplands. Stones commonly cover 0.1 to 2.0 percent of the surface. Individual areas are irregular in shape and range from about 10 to more than 80 acres in size.

Typically, the surface layer is very dark grayish brown, friable very cherty silt loam about 3 inches thick. The subsurface layer is pale brown, friable very cherty silt loam about 15 inches thick. The upper part of the subsoil is yellowish red, firm very cherty silty clay loam. The lower part to a depth of about 60 inches is dark red, firm extremely cherty clay.

Included with this soil in mapping are areas of Bardley, Gepp, and Wilderness soils; areas where limestone bedrock is at a depth of 40 to 60 inches; and some areas where dolomite bedrock crops out. Included areas make up about 10 percent of the unit. Bardley soils are on side slopes. They are moderately deep over bedrock. Gepp and Wilderness soils are on ridgetops and the upper side slopes. Gepp soils do not have chert in the lower part of the subsoil. Wilderness soils have a fragipan.

Permeability is moderate in the Goss soil. Runoff is rapid. The available water capacity is low. Organic matter content and natural fertility also are low. The shrink-swell potential is moderate.

Most areas are used as pasture or woodland. This soil is moderately suited to legumes, such as crownvetch and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. Erosion and surface stones are management concerns. Broadcast seeding may be needed. Overgrazing reduces the yield of grasses and legumes and increases the extent of weeds and woody invaders. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, and timely deferment of grazing.

Many areas support native hardwoods. This soil is suited to trees. Stones and chert fragments limit the use of planting and harvesting equipment. Seedling mortality also is a management concern. Hand planting is necessary in many places. Reinforcement planting may be needed. Fire prevention and controlled grazing are needed.

This soil is suited to building site development and to some kinds of onsite waste disposal. The slope, the shrink-swell potential, the moderate permeability, and surface stones are limitations. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. The dwellings can be designed so that they conform to the natural slope of the land. Some land shaping generally is necessary. Enlarging septic tank absorption fields helps to overcome the moderate permeability. Backfilling with material that is free of stones helps to compensate for the reduced absorption capacity caused by the content of chert. Land shaping can modify the slope. Also, the laterals can be installed across the slope. Properly constructed sewage lagoons can function adequately if the site is leveled. Sealing the berms and bottom of the lagoons helps to prevent seepage and the contamination of ground water. Community sewers should be used if they are available.

The slope, the shrink-swell potential, the potential for frost action, and low strength are limitations on sites for local roads and streets. The roads should be designed so that they conform to the natural slope of the land. Some cutting and filling may be necessary. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is VIs. The woodland ordination symbol is 3X.

25C—Goss-Wilderness cherty silt loams, 3 to 9 percent slopes. These deep, gently sloping and moderately sloping soils are on the convex tops and sides of ridges in the uplands. The well drained Goss soil is in the more sloping areas. The moderately well drained Wilderness soil is at the higher elevations. Individual areas are irregular in shape and range from about 10 to more than 100 acres in size. The extent of each soil varies from area to area, but the average generally is about 50 percent Goss soil and 35 percent Wilderness soil.

Typically, the Goss soil has a surface layer of brown, very friable cherty silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. It is brown and reddish brown, friable very cherty silty clay loam in the upper part and red and dark red, firm extremely cherty clay and dark red and yellowish red, firm very cherty clay in the lower part.

Typically, the Wilderness soil has a surface layer of dark brown, friable cherty silt loam about 3 inches thick. The subsurface layer is brown, friable cherty silt loam about 5 inches thick. The part of the subsoil above a fragipan is mixed yellowish brown and brown, very firm very cherty silty clay loam about 10 inches thick. The fragipan is about 22 inches thick. It is mottled pale brown and light brownish gray, very firm extremely cherty silty clay loam in the upper part and mottled yellowish red, red, pale brown, and light brownish gray, very firm extremely cherty silty clay loam in the lower part. The part of the subsoil below the fragipan to a depth of 60 inches is mixed red, yellowish red, and pale brown, firm very cherty clay and very cherty silty clay.

Included with these soils in mapping are areas of Ocie and Viraton soils and a few intermingled stony areas. Ocie soils have less chert in the lower part of the subsoil than the Goss soil and do not have a fragipan. They are on the lower side slopes. Viraton soils have a fragipan and a surface layer of silt loam. They are on the tops of broad ridges. Included soils make up about 15 percent of the unit.

Permeability is moderate in the Goss soil. It is moderate above the fragipan in the Wilderness soil and slow in the fragipan. Runoff is medium on both soils. The available water capacity is low in the Goss soil and very low in the Wilderness soil. A perched water table is at a depth of 1 to 2 feet in the Wilderness soil during most winter and spring months. Organic matter content and natural fertility are low in both soils. The shrink-swell potential is moderate.

Most areas are used as pasture or hayland. Some areas are used as woodland. These soils are well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue, reed canarygrass, and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, Caucasian bluestem, and indiangrass. Erosion during seedbed preparation is a management concern. Timely tillage and a quickly established ground cover help to prevent excessive erosion. The soil should be tilled only when a stand is to be established or when renovation or reseeding is needed. New stands should be seeded early enough to ensure a good ground cover. Overgrazing reduces forage yields and increases the extent of weeds. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, and timely deferment of grazing. Clipping the pasture and applying chemical sprays help to control weeds and brush.

Some areas support native hardwoods. These soils are suited to trees. Seedling mortality is a management concern on both soils, and the windthrow hazard is a concern on the Wilderness soil. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. The stands on the Wilderness soil should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Fire prevention and controlled grazing are needed.

These soils are suited to building site development and some kinds of onsite waste disposal. The wetness and restricted permeability in the Wilderness soil and the shrink-swell potential and large stones in the Goss soil are limitations. The large stones should be removed from the building sites. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the foundations, footings, and basement walls helps to prevent the damage caused by excessive wetness. Properly constructed sewage lagoons can function adequately on the Goss and Wilderness soils if the site is leveled. Sealing the berms and bottom of the lagoons helps to prevent seepage and the contamination of ground water. Septic tank absorption fields can function adequately in the Goss soil if a properly constructed mound of fill material increases the thickness of the soil over the fragipan. This soil has large stones, which can increase the cost of laying out the absorption field. Community sewers should be used if they are available.

The wetness, the high shrink-swell potential, the potential for frost action, and low strength are limitations on sites for local roads and streets. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action in the Goss and Wilderness soils and by wetness in the Wilderness soil. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

The land capability classification is IVe. The woodland ordination symbol assigned to the Goss soil is 3F, and that assigned to the Wilderness soil is 3D.

33C—Eldon-Keeno cherty silt loams, 3 to 14 percent slopes. These deep, gently sloping to strongly sloping soils are on the convex tops and sides of ridges in the uplands. The well drained Eldon soil is at the lower elevations and generally has a slope of 5 percent or more. The moderately well drained Keeno soil is at the higher elevations and generally has a slope of 5 percent or less. Individual areas are irregular in shape and range from about 10 to more than 100 acres in size. The extent of each soil varies from area to area, but the average generally is about 50 percent Eldon soil and 40 percent Keeno soil.

Typically, the surface layer of the Eldon soil is very dark brown, very friable cherty silt loam about 4 inches thick. The subsurface layer also is very dark brown, very friable cherty silt loam. It is about 5 inches thick. The subsoil extends to a depth of about 60 inches. It is dark yellowish brown and brown, friable very cherty silty clay loam in the upper part; red and dark red, firm very cherty silty clay in the next part; and red and brownish yellow, firm clay in the lower part.

Typically, the surface layer of the Keeno soil is very dark brown, very friable cherty silt loam about 10 inches thick. The part of the subsoil above a fragipan is dark brown, friable very cherty silty clay loam about 18 inches thick. The fragipan is very firm, extremely cherty silty clay loam about 16 inches thick. It is mottled brown and light yellowish brown in the upper part and mottled yellowish red, reddish brown, and pale brown in the lower part. The part of the subsoil below the fragipan to a depth of 60 inches or more is red, firm clay.

Included with these soils in mapping are areas of Hoberg and Peridge soils and some areas where stones are on the surface. Included soils make up about 10 percent of the unit. Hoberg and Peridge soils are in landscape positions similar to those of the Eldon and Keeno soils. Hoberg soils have less chert in the upper part than the Eldon and Keeno soils. Peridge soils do not have a fragipan.

Permeability is moderate in the Eldon soil. It is moderate above and below the fragipan in the Keeno soil and slow in the fragipan. Runoff is medium on both soils. The available water capacity is low in the Keeno soil and moderate in the Eldon soil. Organic matter content is low in the Eldon soil and moderately low in the Keeno soil. Natural fertility is low in both soils. A perched water table is at a depth of 1.5 to 2.5 feet in the Keeno soil during most winter and spring months. The shrink-swell potential is moderate in both soils.

Most areas are used as pasture or hayland. These soils are well suited to legumes, such as lespedeza and birdsfoot trefoil; to cool-season grasses, such as tall fescue, reed canarygrass, and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, Caucasian bluestem, and indiangrass. Overgrazing reduces forage yields and increases the extent of weeds. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, and timely deferment of grazing.

These soils are suited to building site development and to some kinds of onsite waste disposal. The main limitations are the wetness and restricted permeability in the Keeno soil; the shrink-swell potential in the Eldon soil; and the slope, content of chert, and surface stones in areas of both soils. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. The dwellings can be designed so that they conform to the natural slope of the land. Some land shaping generally is necessary. Septic tank absorption fields can function adequately in the Keeno soil if a properly constructed mound of fill material increases the thickness of the soil over the fragipan. Enlarging septic tank absorption fields helps to overcome the restricted permeability. Backfilling with material that is free of stones helps to compensate for the reduced absorption capacity caused by the content of chert. Community sewers should be used if they are available.

The slope, the wetness, the shrink-swell potential, the potential for frost action, and low strength are limitations on sites for local roads and streets. The roads should be designed so that they conform to the natural slope of the land. Some cutting and filling may be necessary. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by frost action and shrinking and swelling in the Eldon and Keeno soils and by wetness in the Keeno soil. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

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

42B—Peridge silt loam, 1 to 5 percent slopes. This deep, very gently sloping and gently sloping, well drained soil is on the tops and sides of ridges in the uplands and high terraces. Individual areas are irregular in shape and range from about 20 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 6 inches thick. The subsoil to a depth of about 60 inches or more is silty clay loam. The upper part is brown and friable and yellowish red and firm, and the lower part is yellowish red, mottled, and firm.

Included with this soil in mapping are areas of Goss and Viraton soils. Goss soils have more clay and chert than the Peridge soil. They are on the lower side slopes and ridges at lower levels. Viraton soils have a fragipan. They are in landscape positions similar to those of the Peridge soil. Also included are some areas where the soil has more chert below a depth of 40 inches than the Peridge soil and some areas where the surface layer is darker. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Peridge soil. Runoff is medium. The available water capacity is high. Organic matter content is moderately low, and natural fertility is medium. The shrink-swell potential is moderate in the lower part of the subsoil.

Most areas are used as pasture or hayland. A few areas are used as woodland. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. No serious hazards or limitations affect pasture or hayland. Erosion is a management concern in newly seeded areas. Timely seedbed preparation and seeding can help to ensure that a good ground cover is established as soon as possible. Nurse crops can provide cover in fall and winter on late-seeded pastures.

A few areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting. Timber production and the quality of the stand can be improved by the removal of undesirable trees, selective cutting, fire prevention, and controlled grazing.

This soil is suited to building site development and to most kinds of onsite waste disposal. There are no major hazards or limitations on sites for dwellings if the sites are graded for good surface drainage. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. The moderate permeability, the slope, and seepage are limitations on sites for septic tank absorption fields and sewage lagoons. Enlarging the absorption fields helps to overcome the moderate permeability. Sewage lagoons can function adequately if the site is leveled. Sealing the berms and bottom of the lagoons helps to prevent seepage and the contamination of ground water. Community sewers should be used if they are available.

Low strength and the potential for frost action are limitations on sites for local roads and streets. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water and constructing adequate roadside ditches minimize the damage caused by frost action.

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

42C—Peridge silt loam, 5 to 9 percent slopes. This deep, moderately sloping, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from about 40 to 200 acres in size.

Typically, the surface layer is brown, very friable silt loam about 6 inches thick. The upper part of the subsoil is strong brown and yellowish red, firm silty clay loam. The lower part to a depth of about 60 inches is mixed strong brown, light yellowish brown, dark red, and yellowish red, firm silty clay loam and cherty clay.

Included with this soil in mapping are areas of Goss and Viraton soils. Goss soils have more clay and chert than the Peridge soil. Also, they are lower on the side slopes. Viraton soils have a fragipan. They are in positions on the landscape similar to those of the Peridge soil. Also included are some areas where the soil has more chert below a depth of 40 inches than the Peridge soil, and some areas where the surface layer is darker. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Peridge soil. Runoff is medium. The available water capacity is high. Organic matter content is moderately low, and natural fertility is medium. The shrink-swell potential is moderate in the lower part of the subsoil.

Most areas are used as pasture or hayland. A few areas are used as woodland. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. No serious hazards or limitations affect pasture or hayland. Erosion is a management concern in newly seeded areas. Timely seedbed preparation and seeding can help to ensure that a good ground cover is established as soon as possible. Nurse crops can provide cover in fall and winter on late-seeded pastures.

A few small areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting. Timber production and the quality of the stand can be improved by the removal of undesirable trees, selective cutting, fire prevention, and controlled grazing.

This soil is suited to building site development and to most kinds of onsite waste disposal. There are no major hazards or limitations on sites for dwellings if the sites are graded for good surface drainage. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. The moderate permeability, the slope, and seepage are limitations on sites for septic tank absorption fields and sewage lagoons. Enlarging the absorption fields helps to overcome the moderate permeability. Sewage lagoons can function adequately if the site is leveled. Sealing the berms and bottom of the lagoons helps to prevent seepage and the contamination of ground water. Community sewers should be used if they are available.

Low strength and the potential for frost action are limitations on sites for local roads and streets. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water and constructing adequate roadside ditches minimize the damage caused by frost action.

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

51B—Claiborne silt loam, 2 to 5 percent slopes. This deep, gently sloping, well drained soil is on foot slopes along the major flood plains. Individual areas are irregular in shape and range from about 5 to more than 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 4 inches thick. The subsurface layer also is brown, friable silt loam about 4 inches thick. The upper part of the subsoil is strong brown and yellowish red, firm silt loam and silty clay loam. The lower part to a depth of about 60 inches or more is red, firm silty clay loam.

Included with this soil in mapping are areas of Lebanon and Viraton soils. These soils make up about 10 percent of the unit. They have a fragipan. They are in areas upslope from the Claiborne soil.

Permeability is moderate in the Claiborne soil. Runoff is medium. The available water capacity is high. Organic matter content is low, and natural fertility is medium. The shrink-swell potential is moderate.

Most areas are used as pasture or hayland (fig. 9). A few areas are used as woodland. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. No serious hazards or limitations affect pasture or hayland. Erosion is a management concern in newly seeded areas. Timely seedbed preparation and seeding can help to ensure that a good ground cover is established as soon as possible. Nurse crops provide cover in fall and winter on late-seeded pastures. Overgrazing reduces yields of grasses and legumes and increases the runoff rate and the extent of weeds. The quality of the pasture and forage production can be improved by controlled stocking rates, pasture rotation, timely deferment of grazing, and applications of fertilizer.

A few small areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting. Timber production and the quality of the stand can be improved by the removal of undesirable trees, selective cutting, fire prevention, and controlled grazing.

This soil is suited to building site development and to most kinds of onsite waste disposal. The shrink-swell potential, the moderate permeability, the slope, and seepage are limitations. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. Enlarging septic tank

Figure 9.—Dairy cattle grazing winter hay in an area of Claiborne silt loam, 2 to 5 percent slopes.

absorption fields helps to overcome the restricted permeability. Sewage lagoons can function adequately if the site is leveled. Sealing the berms and bottom of the lagoons helps to prevent seepage and the contamination of ground water. Community sewers should be used if they are available.

Low strength and the potential for frost action are limitations on sites for local roads and streets. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water and constructing adequate roadside ditches minimize the damage caused by frost action.

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

51C2—Claiborne silt loam, 5 to 9 percent slopes, eroded. This deep, moderately sloping, well drained soil is on foot slopes along the major flood plains. Individual areas are irregular in shape and range from about 5 to more than 40 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 6 inches thick. The upper part of the subsoil is yellowish red, friable silt loam. The lower part to a depth of about 60 inches is red, firm silty clay loam.

Included with this soil in mapping are areas of Nolin and Viraton soils. These soils make up about 10 percent of the unit. Nolin soils have less clay than the Claiborne soil. They are on the flood plains along the major streams. Viraton soils have a fragipan. They are in areas upslope from the Claiborne soil.

Permeability is moderate in the Claiborne soil. Runoff is medium. The available water capacity is high. Organic matter content is moderately low, and natural fertility is medium. The shrink-swell potential is moderate.

Most areas are used as pasture or hayland. A few areas are used as woodland. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as smooth bromegrass and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. Erosion is the management concern. Growing grasses and legumes for pasture and hay is effective in controlling erosion. Timely seedbed preparation and seeding can help to ensure that a good ground cover is established as soon as possible. Nurse crops can provide cover in fall and winter on late-seeded pastures. Overgrazing reduces yields of grasses and legumes and increases the runoff rate and the extent of weeds. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, and timely deferment of grazing.

A few small areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting. Timber production and the quality of the stand can be improved by the removal of undesirable trees, selective cutting, fire prevention, and controlled grazing.

This soil is suited to building site development and to most kinds of onsite waste disposal. The shrink-swell potential, the moderate permeability, the slope, and seepage are limitations. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling. Enlarging septic tank absorption fields helps to overcome the moderate permeability. Sewage lagoons can function adequately if the site is leveled. Sealing the berms and bottom of the lagoons helps to prevent seepage and the contamination of ground water. Community sewers should be used if they are available.

Low strength and the potential for frost action are limitations on sites for local roads and streets. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Grading the roads so that they shed water and constructing adequate roadside ditches minimize the damage caused by frost action.

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

52B—Hartville silt loam, 1 to 4 percent slopes. This deep, nearly level and very gently sloping, somewhat poorly drained soil is on high flood plains. It is occasionally flooded. Individual areas are irregular in shape and range from about 10 to 50 acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 5 inches thick. The subsurface layer is about 9 inches thick. It is friable. It is dark brown, mottled silt loam in the upper part and brown, mottled silty clay loam in the lower part. The subsoil to a depth of 60 inches or more is mottled and firm. It is dark grayish brown silty clay loam in the upper part and yellowish brown silty clay in the lower part.

Included with this soil in mapping are areas of poorly drained soils. These soils make up about 5 percent of the unit. They generally are in the lower areas adjoining the flood plains.

Permeability is slow in the Hartville soil. Runoff is medium. The available water capacity is moderate. A perched water table is at a depth of 1.5 to 3.0 feet during most winter and spring months. Organic matter content is moderately low, and natural fertility is medium. The shrink-swell potential is high.

Most areas are used as pasture, hayland, or woodland. This soil is moderately well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as big bluestem, little bluestem, indiangrass, and switchgrass. The species that are tolerant of wetness grow best. Erosion is a management concern in newly seeded areas. Timely seedbed preparation and seeding can help to ensure that a good ground cover is established as soon as possible.

Some areas support native hardwoods. This soil is suited to trees. Seedling mortality and the windthrow hazard are management concerns. Reinforcement planting may be necessary. The stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is slight. Fire prevention and controlled grazing are needed.

This soil generally is unsuitable for building site development and onsite waste disposal because of the occasional flooding.

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

55A—Nolin silt loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on flood plains. It is frequently flooded. Individual areas are irregular in shape and range from about 5 to more than 80 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsurface layer also is dark brown, friable silt loam. It is about 8 inches thick. The subsoil to a depth of about 60 inches or more is brown, friable silt loam.

Included with this soil in mapping are areas of Cedargap and Racket soils and areas where the soil has a gravelly or sandy substratum. Included soils make up about 10 percent of the unit. Cedargap soils have more chert than the Nolin soil. They are on flood plains along the smaller streams. Racket soils have more sand and fine gravel than the Nolin soil. They are in the lower positions on the flood plains.

Permeability is moderate in the Nolin soil. Runoff is medium. The available water capacity is high. A seasonal high water table is at a depth of about 3 to 6 feet during most winter and spring months. Organic matter content is high, and natural fertility is medium.

Most areas are used as pasture or hayland. A few areas are used as woodland. This soil is well suited to most of the commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Frequent flooding during the spring and early summer is the main management concern. It should be considered when a grazing system is designed.

A few small areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting. The use of equipment is limited, however, by the frequent flooding. Harvesting activities may be delayed during and immediately after periods of flooding. Timber production and the quality of the stand can be improved by the removal of undesirable trees, selective cutting, fire prevention, and controlled grazing.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding.

The land capability classification is IIw. The woodland ordination symbol is 8W.

59A—Racket silt loam, loamy substratum, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on the flood plains along large streams. It is frequently flooded. Individual areas are dissected by stream channels. They are long and narrow and range from about 40 to several hundred acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer also is very dark grayish brown, friable silt loam. It is about 5 inches thick. The subsoil is very dark grayish brown, friable loam about 30 inches thick. The substratum to a depth of 60 inches or more is brown, friable loam.

Included with this soil in mapping are Cedargap and Nolin soils. Cedargap soils contain more chert than the Racket soil. They are on flood plains along small streams. Nolin soils contain less sand than the Racket soil. Also, they are on higher flood plains. Also included are soils that are grayer in the subsoil than the Racket soil. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Racket soil. Runoff is slow. The available water capacity is moderate. A seasonal high water table is at a depth of about 3.5 to 6.0 feet during most winter and spring months. Organic matter content is moderate, and natural fertility is high.

Most areas are used as pasture or hayland. A few areas are used as woodland. This soil is well suited to red clover; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Frequent flooding during the spring and early summer is the main management concern. It should be considered when a grazing system is designed.

A few small areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting. Planting can improve black walnut stands. Timber production and the quality of the stand can be improved by the removal of undesirable trees, selective cutting, fire prevention, and controlled grazing.

This soil generally is unsuitable for building site development and onsite waste disposal because of the frequent flooding.

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

62B—Sampsel silt loam, 2 to 5 percent slopes. This deep, gently sloping, poorly drained soil is on foot slopes and side slopes and in upland drainageways. Individual areas commonly are dissected by small, intermittent streams. They are irregular in shape and range from about 7 to 40 acres in size.

Typically, the surface layer is black, friable silt loam about 6 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 6 inches thick. The subsoil extends to a depth of about 70 inches or more. It is very dark gray, firm silty clay loam in the upper part; dark gray, mottled, very firm silty clay in the next part; and mottled grayish brown and dark yellowish brown, very firm silty clay loam in the lower part.

Included with this soil in mapping are areas of the well drained Peridge soils. These soils make up about 10 percent of the unit. They are on side slopes above the Sampsel soil.

Permeability is slow in the Sampsel soil. Runoff is medium. The available water capacity is moderate. A perched water table is within a depth of 1.5 feet during most winter and spring months. Organic matter content is moderate, and natural fertility is medium. The shrink-swell potential is high.

Most areas are used as pasture or hayland. This soil is moderately well suited to most of the commonly grown legumes, such as ladino clover and lespedeza; to cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. The species that can tolerate wetness grow best. Overgrazing reduces the yield of grasses and legumes and increases the extent of weeds. Grazing when the soil is wet causes surface compaction and poor tilth. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, and timely deferment of grazing.

This soil is not well suited to building site development or onsite waste disposal. The high shrink-swell potential, seepage, wetness, the slow permeability, and the slope are limitations. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand and gravel help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the footings, foundations, and basement walls helps to prevent the damage caused by excessive wetness. Runoff from the adjacent slopes can be controlled by diversion terraces. Sewage lagoons can function adequately if the site is leveled. Sealing the berms and bottom of the lagoons helps to prevent seepage and the contamination of ground water. Septic tank absorption fields generally do not function properly because of the wetness and the slow permeability. Community sewers should be used if they are available.

The wetness, the high shrink-swell potential, the potential for frost action, and low strength are limitations on sites for local roads and streets. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by wetness, shrinking and swelling, and frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength.

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

64A—Cedargap cherty silt loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, somewhat excessively drained soil is on the flood plains along small streams. It is frequently flooded. Individual areas are dissected by stream channels. They are long and narrow and range from about 10 to more than 100 acres in size.

Typically, the surface layer is very dark brown, friable cherty silt loam about 9 inches thick. The subsurface layer is very dark grayish brown, firm very cherty silty clay loam about 15 inches thick. The substratum to a depth of 60 inches is dark brown, firm extremely cherty clay loam.

Included with this soil in mapping are areas of Nolin soils and some intermingled areas of Cedargap silt loam. Nolin soils contain less chert than the Cedargap soil. Also, they are on higher flood plains. Included soils make up about 15 percent of the unit.

Permeability is moderate in the Cedargap soil. Runoff is slow. The available water capacity is moderate. Organic matter content is moderately low, and natural fertility is medium.

Most areas are used as pasture or hayland (fig. 10). A few areas are used as woodland. This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as Caucasian bluestem and switchgrass. Droughtiness and flooding are the main management concerns. They should be considered when a grazing system is designed. Overgrazing reduces forage yields and increases the extent of weeds and brush. The quality of the pasture and forage production can be improved by applications of fertilizer, controlled stocking rates, pasture rotation, and timely deferment of grazing. Streambank management and a good ground cover can reduce the hazard of scouring and other flood damage.

A few small areas support native hardwoods. This soil is suited to trees. Planting can improve black walnut stands. Seedling mortality is a management concern. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. Fire prevention and controlled grazing are needed.

This soil generally is unsuitable for building site development and onsite waste disposal because of the frequent flooding.

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

65—Cedargap silt loam. This deep, nearly level, well drained soil is on the flood plains along small streams. It is frequently flooded. Individual areas are dissected by stream channels. They are long and narrow and range from about 10 to more than 100 acres in size.

Typically, the surface layer is very dark brown, friable silt loam about 7 inches thick. The upper part of the subsurface layer is very dark gray, friable cherty silt loam. The lower part to a depth of about 29 inches is black, very friable cherty loam. The substratum to a depth of 60 inches is dark brown and brown, firm extremely cherty clay loam.

Included with this soil in mapping are areas of Nolin and Racket soils and some intermingled areas of Cedargap cherty silt loam. Nolin and Racket soils

Figure 10.—Beef cattle grazing on a tall fescue-ladino clover pasture in an area of Cedargap cherty silt loam, 0 to 3 percent slopes. Many creeks in areas of this soil have springs that furnish a year-round water supply for livestock.

contain less chert in the lower part than the Cedargap soil. They are on the flood plains along the larger streams. Included soils make up about 15 percent of the unit.

Permeability is moderate in the Cedargap soil. Runoff is slow. The available water capacity is moderate. Organic matter content is moderately low, and natural fertility is medium.

Most areas are used as pasture or hayland. A few areas are used as woodland. This soil is well suited to most of the commonly grown legumes, such as ladino clover and red clover; to cool-season grasses, such as tall fescue and reed canarygrass; and to warm-season grasses, such as Caucasian bluestem and switchgrass. Droughtiness and flooding are the main management concerns. Overgrazing reduces yields of grasses and legumes and increases the extent of weeds. The quality of the pasture and forage production can be improved by applications of fertilizer, pasture rotation, controlled stocking rates, and timely deferment of grazing. Streambank management and a good ground cover can reduce the hazard of scouring and other flood damage.

A few small areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting. Planting can improve black walnut stands. Timber production and the quality of the stand can be improved by the removal of undesirable trees, selective cutting, fire prevention, and controlled grazing.

This soil generally is unsuitable for building site development and onsite waste disposal because of the frequent flooding.

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

69—Dunning silty clay loam. This deep, nearly level, very poorly drained soil is on flood plains along intermediate and small streams. It is frequently flooded. Individual areas are irregular in shape and range from about 20 to 100 acres in size.

Typically, the surface layer is black, firm silty clay loam about 4 inches thick. The subsurface layer also is black, firm silty clay loam. It is about 19 inches thick. The subsoil extends to a depth of about 46 inches. It is very dark gray, firm silty clay loam and silty clay in the upper part and very dark gray, firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is dark gray, very firm silty clay.

Included with this soil in mapping are areas of the gently sloping Sampsel soils. These soils make up about 10 percent of the unit. They are on foot slopes and at the head of drainageways above the Dunning soil.

Permeability is slow in the Dunning soil. Runoff also is slow. The available water capacity is high. An apparent water table is within a depth of 0.5 foot in most winter and spring months. Organic matter content is moderate, and natural fertility is medium. The shrink-swell potential is moderate.

Most areas are used as pasture, hayland, or woodland. This soil is moderately suited to legumes that can tolerate wetness and are shallow rooted, such as ladino clover and alsike clover, and to cool-season grasses, such as reed canarygrass. It is poorly suited to warm-season grasses and to hay. The wetness and the flooding are the main management concerns. They should be considered when a grazing system is designed. Maintaining stands of desirable species is difficult in the depressional areas. Land smoothing, surface ditches, and subsurface tile improve drainage.

Some areas support native hardwoods. This soil is suited to water-tolerant trees. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Equipment should be used only during periods when the soil is dry or frozen. Ridging the soil and then planting container-grown nursery stock on the ridges increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Timber production and the quality of the stand can be improved by the removal of undesirable trees, selective cutting, fire prevention, and controlled grazing.

This soil is unsuited to building site development and onsite waste disposal because of the flooding and the high water table.

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

72D—Bolivar-Basehor loams, 3 to 14 percent slopes. These gently sloping to strongly sloping, well drained soils are on side slopes in the uplands. The Bolivar soil is moderately deep, and the Basehor soil is shallow. Individual areas are irregular in shape and range from about 20 to 120 acres in size. The extent of each soil varies from area to area, but the average generally is about 50 percent Bolivar soil and 40 percent Basehor soil.

Typically, the Bolivar soil has a surface layer of dark grayish brown, very friable loam about 4 inches thick. The subsurface layer is yellowish brown, very friable loam about 10 inches thick. The subsoil is strong brown, friable clay loam about 8 inches thick. Hard sandstone bedrock is at a depth of about 22 inches.

Typically, the Basehor soil has a surface layer of dark brown, friable loam about 8 inches thick. The subsoil is strong brown, friable loam about 7 inches thick. Hard sandstone bedrock is at a depth of about 15 inches.

Included with these soils in mapping are areas of Rock outcrop, areas where stones are on the surface, and areas of the moderately well drained Hobson soils. Included areas make up about 10 percent of the unit. The Rock outcrop may be in any position on the landscape. The areas where stones are on the surface are on some of the steeper parts of the landcape. Hobson soils are on the upper side slopes, near the ridgetops in the uplands. These soils have a fragipan.

Permeability is moderate in the Bolivar soil and moderately rapid in the Basehor soil. Runoff is medium on both soils. The available water capacity is low in the Bolivar soil and very low in the Basehor soil. Organic matter content and natural fertility are low in both soils. The shrink-swell potential is moderate in the Bolivar soil.

Most areas are used as pasture or hayland. A few areas are used as woodland. These soils are suited to legumes, such as lespedeza and alsike clover; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem, little bluestem, and indiangrass. The rooting depth is shallow or moderately deep, and droughtiness is a management concern during much of the year. The limited depth to bedrock can hinder tillage. A quickly established ground cover is necessary to prevent excessive erosion.

Some areas support native hardwoods and eastern redcedar. The Bolivar soil is suited to trees. Production on the Basehor soil, however, generally does not warrant commercial timber management. The windthrow hazard is a management concern on both soils. Seedling mortality is a concern on the Basehor soil. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. Planting container-grown nursery stock increases the seedling survival rate. Reinforcement planting may be needed. Fire prevention and controlled grazing are needed.

These soils are not well suited to building site development and onsite waste disposal. Detailed onsite investigation is needed before a site is selected. The depth to bedrock, the slope, seepage, and the shrink-swell potential are limitations. Properly designing footings, foundations, and basement walls, constructing them with adequately reinforced concrete, and backfilling with sand or gravel help to prevent the structural damage caused by shrinking and swelling in the Bolivar soil. Blasting and modification of the slope may be necessary to provide adequate depth for basements in areas of both soils. The depth to bedrock and the slope are severe limitations affecting some kinds of onsite waste disposal. Mounding can increase depth to bedrock on sites for septic tank absorption fields. Properly constructed sewage lagoons can function adequately if the site is leveled. Borrow material from other areas is needed for the berms. Sealing the bottom of the lagoon helps to prevent seepage and the contamination of ground water. In places the adjacent soils are better suited to onsite waste disposal.

The slope, the shrink-swell potential, the potential for frost action, and low strength are limitations on sites for local roads and streets in areas of the Bolivar soil. The depth to bedrock is a limitation in areas of the Basehor soil. The roads should be designed so that they conform to the natural slope of the land. Some cutting and filling may be necessary. Grading the roads so that they shed water, constructing adequate roadside ditches, and installing culverts minimize the damage caused by shrinking and swelling and by frost action. Crushed rock, gravel, or other suitable base material minimizes the damage caused by low strength. Detailed onsite investigation is needed before a site is selected.

The land capability classification is VIe. The woodland ordination symbol assigned to the Bolivar soil is 3D, and that assigned to the Basehor soil is 2D.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 66,940 acres in the survey area, or 19 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county. Most of this acreage is used for forage crops or for hay or pasture.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify for prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Paul D. Frey, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 197,000 acres in Dallas County, or nearly 57 percent of the total acreage, was used for crops and pasture in 1982 *(10)*. Of this total, about 163,600 acres was used as permanent pasture; 2,200 acres for cultivated crops, mainly corn, soybeans, sorghum, and wheat; and 33,400 acres for rotation hay and pasture *(9)*. The rest was used mainly as urban land or wildlife habitat or for other miscellaneous purposes. The loss of cropland to highway construction and urban development has been slight.

The potential of the soils in Dallas County for sustained production of food is good. About 28,700 acres, or 8 percent of the total acreage, is prime farmland. Another 38,240 acres, or 11 percent, is potential prime farmland, depending on the frequency of flooding or the installation of drainage measures. About 75 percent of the potential cropland or pasture can be highly erosive. Most of the inadequately treated land used for cultivated crops is in upland areas. It is being farmed in a manner that causes erosion in excess of what is considered tolerable if production is to be sustained for a long period. Most of the marginal cropland used for cultivated crops should be converted to pasture or hayland. Erosion on most of the cropland can be held within tolerable limits by a system of conservation practices designed for specific sites.

Water erosion is a major problem on nearly all of the sloping cropland and overgrazed pasture in Dallas County. Loss of the surface layer through erosion reduces productivity. It is especially damaging on Hoberg, Lebanon, Viraton, Wilderness, and other soils that have a fragipan, which restricts the rooting depth. In many areas seedbed preparation and tillage are difficult if the original friable surface layer has been eroded away. Erosion also reduces the productivity of soils that tend to be droughty and are shallow over bedrock, such as Gasconade and Basehor soils.

Erosion on farmland results in the sedimentation of streams, lakes, and ponds. Controlling erosion minimizes this pollution and improves the quality of water for municipal use, for recreation, and for fish and wildlife. Also, it prolongs the useful life of ponds and lakes by keeping them from filling up with sediments.

Erosion-control practices help to maintain a protective surface cover, help to control runoff, and increase the rate of water infiltration. A cropping system that keeps a cover of plants or crop residue on the surface can hold erosion losses to amounts that will not reduce the productive capacity of the soils. Growing grasses and legumes for pasture and hay is very effective in controlling erosion. Including legumes, such as clover and alfalfa, in the crop rotation improves tilth and provides nitrogen for the following crop.

If the soil is not suited to terraces or a farmer prefers not to construct terraces, other conservation practices can effectively control erosion. Contour stripcropping is an example. The contoured strips are generally used for hay, and the areas between the strips are cultivated. Row crops are planted on the contour. No-till systems are becoming more common in the county. They can be effective in controlling erosion on many of the sloping soils in the county, but the eroded soils require special management.

Frequent flooding can be a problem on Racket, Cedargap, and Nolin soils. The flooding commonly occurs during the period November through May.

Soil fertility is naturally lower in most of the eroded or shallow soils than in the other soils in the county. All of the soils, however, require additional plant nutrients for maximum production. Most of the soils are naturally acid in the upper part of the root zone and require applications of ground limestone to raise the pH and calcium level sufficiently for optimum crop growth. On all of the soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the desired level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime that should be applied.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. Regularly adding crop residue, manure, and other organic material improves soil structure and tilth. All of the eroded soils on uplands have more clay in the surface layer than the uneroded upland soils. Also, tilth is poorer, the rate of water infiltration is slower, and runoff is more rapid. Measures that prevent further erosion are needed.

Field crops are grown on only 2,200 acres in Dallas County. They are grown mainly for on-farm use. Wheat is the most common close-growing crop. It was grown on about 1,400 acres in 1982. Oats and rye can be grown. Grasses and legumes also can be grown for the production of seed.

Pasture and hay crops suited to the soils and climate of Dallas County include several legumes, cool-season grasses, and warm-season grasses. Alfalfa and red clover are the most common legumes grown for hay. They also are grown along with bromegrass, tall fescue, orchardgrass, or timothy for hay and pasture.

Warm-season grasses adapted to the county are native grasses, such as big bluestem, indiangrass, and switchgrass, and introduced grasses, such as Caucasian bluestem and little bluestem. These grasses grow well during the summer and require different management than cool-season grasses.

Deep, well drained soils, such as Claiborne and Peridge soils, are best suited to alfalfa. Legumes and grasses can be grown successfully on most soils. Species that can tolerate wetness should be selected for planting on Bado, Gerald, Hartville, and Sampsel soils.

The major management concern on most of the pasture in the county is overgrazing, which increases the susceptibility to erosion. Grazing should be controlled so that the plants survive and achieve maximum production. Keeping the grasses at a desirable height reduces the runoff rate and thus the hazard of erosion.

Specialty crops are grown on a small acreage in Dallas County. These crops require special equipment, management, and propagation techniques.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(19)*. Only class and subclass are used in this survey.

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

Class I soils have few limitations or hazards that restrict their use.

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

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

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

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

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

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

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

Class I, V, and VIII soils do not occur in Dallas County.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, or *s*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the 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); and *s* shows that the soil is limited mainly because it is shallow, droughty, or stony.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w* or *s* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

James L. Robinson, forester, Soil Conservation Service, helped prepare this section.

About 40 percent of the land area in Dallas County is forested *(21)*.

Knowledge of soils helps to provide a basic understanding of how forest types develop and tree growth occurs. Some of the relationships between soils and tree growth have been recognized for a long time. White oak, for example, grows well on deep, moist soils, and hickories, post oak, and chinkapin oak are more prevalent where the rooting depth is restricted or the moisture supply is limited. The soil serves as a reservoir for the available nutrients. Soil properties that directly or indirectly affect growth requirements include reaction, fertility, drainage, texture, structure, and depth. Position on the landscape also is important.

Available water capacity is influenced mainly by texture, rooting depth, and content of stones, shale, and chert. Deep soils that have a surface layer of silt loam, such as the Peridge soils in the Hoberg-Sampsel-Peridge association, have a high available water capacity. The depth to bedrock limits the amount of available water in Basehor soils and restricts root development. These limitations reduce the productive potential of the site. Little can be done to change these physical limitations; however, their adverse effects can be reduced by management of the species best adapted to these conditions.

The nutrient supply also affects tree growth. Many upland soils have a subsoil that is leached and has few nutrients. Most of the soils on bottom land have a substratum that contains larger amounts of nutrients.

Decomposition of leaf litter on the surface recycles nutrients that have accumulated in the forest ecosystem for a long time. Fire, excessive trampling by livestock, and erosion can result in loss of these nutrients. Forest management should include prevention of wildfires and protection from overgrazing.

Other site characteristics that affect tree growth include aspect and position on the landscape. These influence such factors as the amount of available sunlight, air drainage, soil temperature, and available water capacity. North- and east-facing slopes generally are the best upland sites for tree growth.

Very few areas of the Hoberg-Sampsel-Peridge, Hobson-Bolivar-Basehor, and Viraton-Wilderness associations are forested. The dominant natural vegetation on the Hoberg, Sampsel, and Bolivar soils was prairie grasses. Forest species typical of oak-hickory forests were common on the Peridge, Hobson, Viraton, and Wilderness soils. Most areas of these soils currently are used for forage production. The remaining forested areas are typically grazed and of low quality. Peridge soils can be intensively managed for black walnut plantations.

The Goss-Gepp-Bardley and Viraton-Ocie-Goss associations support significant amounts of forest species. The major timber type is white oak-northern red oak-hickory. Other species include black oak, post oak, chinkapin oak, white ash, sugar maple, elm, and black walnut. Pure stands of white oak are in some areas of Gepp, Goss, and Ocie soils on north- and east-facing slopes. These soils can produce good-quality trees if the stand is properly managed. The areas of these soils on south- and west-facing slopes and the sites that are heavily grazed tend to support lower quality stands of hickories and oaks, such as post oak and blackjack oak. Only low-intensity management, such as protection from fire and grazing, is warranted. Bardley soils generally cannot produce good-quality timber.

The Racket-Claiborne-Nolin association on bottom land has some forested narrow strips along the riparian areas of the major rivers and tributaries and in frequently flooded areas. The typical species include cottonwood, silver maple, black willow, green ash, hackberry, black walnut, American elm, and boxelder. These soils are well suited to black walnut. They are highly productive and can be intensively managed for timber.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

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

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

James L. Robinson, forester, Soil Conservation Service, helped prepare this section.

Farmstead windbreaks, feedlot windbreaks, or both are needed in much of Dallas County, especially in areas of the Hobson-Bolivar-Basehor, Hoberg-Sampsel-Peridge, and Viraton-Wilderness associations. Farmstead windbreaks protect the farmstead area from windblown snow, reduce windchill, beautify the area, and reduce home heating costs as much as 33 percent *(3)*. Windbreaks also moderate the local climate, thus protecting livestock, fruit trees, and gardens, and provide habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are predicted to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Pat Graham, biologist, Soil Conservation Service, helped prepare this section.

Much of the natural beauty of Dallas County has remained unchanged since the pioneer days. Although logging and cattle production are major industries, the population density is low and only a few large towns are in the county. As a result, the county provides opportunities for outdoor recreational activities, such as camping, hiking, sightseeing, and canoeing. Because of the forest-covered Ozark hills, the clear, free-flowing streams and rivers, and the interspersed agricultural land, the county is an important center for these activities.

The county is adjacent to two major reservoirs—Pomme de Terre Lake and Lake of the Ozarks. The Niangua River, which bisects the county, provides the major opportunities for water-based recreation (fig. 11). Bennett Spring Trout Park is along the northeast edge of the county along with the Niangua River Trout Management Area. Goose Creek and Lead Mine State Forests also provide public opportunities for recreational activities, such as hiking, camping, and horseback riding.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Figure 11.—The Niangua River provides excellent areas for recreational activities in Dallas County.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Bob Schroeppel, wildlife biologist, Missouri Department of Conservation, helped prepare this section.

Dallas County is in the south-central part of Missouri, and its topography, soils, and vegetation are characteristic of the border areas where the Osage Plains grade into the forests of the Ozarks. The county is divided nearly in half by two different natural sections in the Ozark Natural Division. These are the Springfield Plateau and Upper Ozark sections *(16)*. Early records indicate that the county included about 63 square miles

Figure 12.—Flow from Bennett Spring provides habitat for rainbow trout.

of presettlement tall grass prairie. The county had numerous "oak openings," grass-covered areas with a few large post oaks. Each spring the oak sprouts emerged from the root-filled ground, only to be burnt back each fall *(14)*. Today, with the control of natural fire, about 41 percent of the county is forested. Nearly 6,000 acres of this forest is in the Lead Mine State Forest, in the northeast corner of the county. Other public lands include Bennett Spring Trout Park (fig. 12), Goose Creek State Forest, Berry Bluff, Hackler Ford, and Louisburg Tracts, and three river accesses—Bennett Spring, Big John, and Moon Valley.

A total of 225 fish and wildlife species are known to inhabit Dallas County, and another 167 species are listed as "likely to occur," according to the Missouri Fish and Wildlife Information System, Missouri Department of Conservation, 1987. Typical nongame species include Ozark minnow, rough green snake, red-tailed hawk, northern mockingbird, and eastern chipmunk. The most common game species are white-tailed deer, wild turkey, raccoon, eastern cottontail rabbit, smallmouth bass, rainbow trout, and northern bobwhite.

Several rare or endangered species inhabit Dallas County. Examples are Niangua darter, red-shouldered hawk, osprey, common barn owl, black-tailed jackrabbit, and long-tailed weasel.

The county has a good diversity of furbearers. The species harvested for fur in 1986 and 1987 were opossum, striped skunk, muskrat, raccoon, mink, red fox, gray fox, coyote, bobcat, and beaver *(11)*. The county has a higher population of gray fox, bobcat, raccoon, turkey, and white-tailed deer than the state average.

The primary woodland game species are white-tailed deer, wild turkey, squirrel, and raccoon. Misuse of the timber resource is a major concern in Dallas County. The grazing of timberland, which is very common in the county, can result in tree damage, destruction of wildlife habitat, erosion, and soil compaction. This practice, along with the closed canopy characteristic of most timber stands in the county, also results in poor understory growth. The poor understory adversely affects many wildlife species, especially nongame birds such as indigo bunting, gray catbird, golden-crowned kinglet, Kentucky warbler, and wood thrush.

The population of openland wildlife, such as bobwhite quail and eastern cottontail rabbit, is generally low because of the management of the grassland in the county and the scarcity of available cropland. Only about 1 percent of the acreage in the county is used for crops. Also, the grassland is generally overgrazed and offers little diversity for upland wildlife because it typically supports tall fescue with few or no legumes or warm-season grasses.

Very little wetland wildlife habitat is available in Dallas County. It occurs almost exclusively as small streams and rivers. The principal waterfowl species is wood duck. Four great blue heron rookeries are active in the county. In 1986, the largest had 35 individual birds and 32 active nests. The major water areas in the county are the Niangua and Little Niangua Rivers and Greasy, Lindley, and Dusinbury Creeks. The fish caught in these rivers and creeks include rainbow trout, largemouth bass, spotted bass, channel cat, rock bass (goggle-eye), bluegill, flathead catfish, bullhead, and white crappie.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are soybeans, grain sorghum, and winter wheat.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are big bluestem, little bluestem, bromegrass, clover, alfalfa, lespedeza, bluegrass, trefoil, crownvetch, switchgrass, and indiangrass.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are goldenrod, beggarweed, foxtail, croton, and partridge pea.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwoods and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, cherry, deciduous holly, persimmon, sassafras, wild plum, dogwood, hickory, and hazelnut.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are shortleaf pine and eastern redcedar.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, rushes, and sedges.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreation uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

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

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, the shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good: and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and the contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

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

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

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

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

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

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone and by soil reaction.

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

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

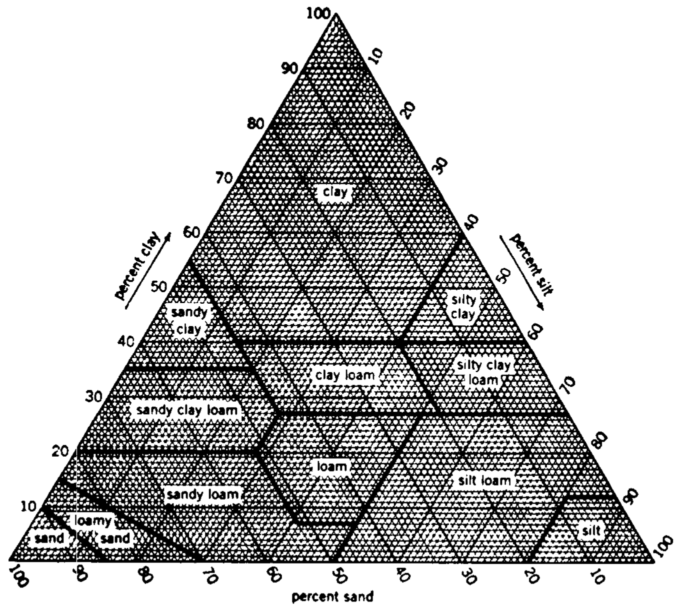

Figure 13.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 13). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "cherty." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated content of clay in each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17. Only saturated zones within a depth of about 6 feet are indicated.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(20)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fragiudalfs, (*Fragi*, meaning fragipan, plus *udalf*, the suborder of the Alfisols that has a humid moisture regime).

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

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

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (18)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (20)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Bado Series

The Bado series consists of deep, poorly drained soils on uplands. These soils formed in loess and dolomite residuum. They have a fragipan. Permeability is slow above the fragipan and very slow in the fragipan. Slopes range from 0 to 2 percent.

The Bado soils in this county have a lower base saturation at a depth of 30 inches below the upper boundary of the fragipan than is defined for Alfisols. This difference, however, does not significantly affect the use and management of the soils.

Typical pedon of Bado silt loam, about 450 feet south and 500 feet west of the northeast corner of sec. 13, T. 34 N., R. 18 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak thin platy structure parting to weak fine granular; friable; many fine roots; medium acid; abrupt smooth boundary.

E—5 to 9 inches; grayish brown (10YR 5/2) silt loam; weak thin platy structure parting to weak fine granular; friable; many fine roots; strongly acid; clear smooth boundary.

Bt1—9 to 15 inches; dark grayish brown (10YR 4/2) silty clay; few fine faint brown (10YR 5/3) mottles; weak medium and coarse angular blocky structure; firm; few fine roots; many prominent clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—15 to 26 inches; dark grayish brown (10YR 4/2) silty clay; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium and coarse angular blocky structure; firm; few fine roots; many prominent clay films on faces of peds; strongly acid; abrupt wavy boundary.

2Btx—26 to 49 inches; brownish yellow (10YR 6/6) silt loam; common fine distinct strong brown (7.5YR 4/6) mottles; weak thin platy structure parting to weak fine subangular blocky; very firm; thick accumulations of gray (10YR 5/1) illuvial clay along bleached vertical planes; about 5 percent chert fragments; very strongly acid; abrupt wavy boundary.

3Bt1—49 to 59 inches; mottled brownish yellow (10YR 6/6) and red (10R 4/8) very cherty silty clay loam; weak fine subangular blocky structure; firm; few distinct clay films on faces of peds; about 50 percent chert fragments; very strongly acid; clear smooth boundary.

3Bt2—59 to 66 inches; red (10R 4/8) very cherty silty clay loam; few fine prominent brownish yellow (10YR 6/6) mottles; weak fine subangular blocky structure; firm; few distinct clay films on faces of peds; about 60 percent chert fragments; very strongly acid.

The depth to bedrock is more than 60 inches. Depth to the fragipan ranges from 23 to 35 inches. The content of chert is 0 to 5 percent in the part of the Bt horizon above the fragipan, ranges from 5 to 25 percent in the fragipan, and is as much as 60 percent below the fragipan.

The A horizon has value of 3 to 5 and chroma of 1 to 3. The Bt horizon is silty clay loam, silty clay, or clay. It has value of 4 or 5. The 2Btx horizon is silt loam, cherty silt loam, silty clay loam, or cherty silty clay loam. It has hue of 10YR or 7.5YR and value of 4 to 6. The 3Bt horizon has mottled colors with hue of 10R, 7.5YR, or 10YR, value of 4 to 6, and chroma of 4 to 8.

Bardley Series

The Bardley series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in cherty sediments and in the underlying cherty dolomite and sandstone residuum. Slopes range from 5 to 50 percent.

Typical pedon of Bardley very cherty loam, in an area of Gepp-Goss-Bardley complex, 5 to 50 percent slopes; about 300 feet east and 1,200 feet south of the northwest corner of sec. 16, T. 35 N., R. 18 W.

A—0 to 2 inches; dark grayish brown (10YR 4/2) very cherty loam, light gray (10YR 7/2) dry; weak very fine granular structure; friable; common fine roots; about 40 percent chert fragments and 5 percent flagstones; slightly acid; abrupt smooth boundary.

BE—2 to 7 inches; yellowish red (5YR 5/6) cherty silty clay loam; light yellowish brown (10YR 6/4) silt pockets; weak fine subangular blocky structure; firm; common fine roots; about 20 percent chert fragments; medium acid; clear smooth boundary.

2Bt1—7 to 17 inches; red (2.5YR 4/6) clay; moderate fine subangular blocky structure; firm; common fine and few coarse roots; few faint clay films on faces of peds; strongly acid; clear wavy boundary.

2Bt2—17 to 24 inches; red (2.5YR 4/6) clay; moderate fine subangular blocky structure; firm; few fine and few coarse roots; few faint clay films on faces of peds; medium acid; abrupt smooth boundary.

2R—24 inches; hard sandstone and interbedded chert and dolomite.

The depth to bedrock ranges from 20 to 40 inches. The A horizon typically is very cherty loam, but the range includes very cherty silt loam. This horizon has chroma of 2 or 3. The 2Bt horizon is silty clay or clay. It has hue of 2.5YR or 5YR and chroma of 4 to 6.

Basehor Series

The Basehor series consists of shallow, well drained soils on uplands. These soils formed in sandstone residuum. Permeability is moderately rapid. Slopes range from 3 to 14 percent.

Typical pedon of Basehor loam, in an area of Bolivar-Basehor loams, 3 to 14 percent slopes; about 1,950 feet east and 300 feet south of the northwest corner of sec. 17, T. 32 N., R. 19 W.

A—0 to 8 inches; dark brown (10YR 4/3) loam, light yellowish brown (10YR 6/4) dry; weak very fine granular structure; friable; many fine roots; about 5 percent chert and sandstone fragments; neutral; clear smooth boundary.

Bw—8 to 15 inches; strong brown (7.5YR 4/6) loam; very weak fine subangular blocky structure; friable; common fine roots; about 5 percent chert and sandstone fragments; strongly acid; abrupt smooth boundary.

R—15 inches; hard, reddish yellow, fine grained sandstone bedrock.

The depth to bedrock ranges from 11 to 20 inches. The A horizon has value of 3 or 4 and chroma of 2 or 3. The Bw horizon has hue of 10YR or 7.5YR and value of 4 or 5.

Bolivar Series

The Bolivar series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in sandstone residuum. Slopes range from 3 to 14 percent.

The Bolivar soils in this county have a mesic temperature regime, which is not definitive for the series. This difference, however, does not significantly affect the use and management of the soils.

Typical pedon of Bolivar loam, in an area of Basehor-Bolivar loams, 3 to 14 percent slopes; about 100 feet east and 10 feet north of the southwest corner of sec. 31, T. 33 N., R. 20 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; very weak very fine granular structure; very friable; many fine and few medium roots; less than 5 percent chert fragments; medium acid; clear smooth boundary.

E—4 to 14 inches; yellowish brown (10YR 5/4) loam; very weak very fine granular structure; very friable; few fine and medium roots; strongly acid; clear smooth boundary.

Bt—14 to 22 inches; strong brown (7.5YR 5/8) clay loam; very weak very fine subangular blocky structure; very friable; few fine roots; few distinct clay films on faces of peds; less than 5 percent chert fragments; strongly acid; abrupt smooth boundary.

R—22 inches; hard, fine grained sandstone bedrock.

The depth to bedrock ranges from 20 to 35 inches. The A horizon has value of 3 or 4 and chroma of 2 or 3. The E horizon has value of 4 or 5 and chroma of 3 or 4. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 5 to 8.

Cedargap Series

The Cedargap series consists of deep, well drained and somewhat excessively drained, moderately permeable soils on small, narrow flood plains. These soils formed in cherty alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Cedargap silt loam, about 1,850 feet north and 500 feet west of the southeast corner of sec. 7, T. 35 N., R. 18 W.

A1—0 to 7 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; weak thin platy structure; friable; many fine roots; common fine pores; common fine worm casts; about 7 percent chert fragments; neutral; clear wavy boundary.

A2—7 to 19 inches; very dark gray (10YR 3/1) cherty silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; common fine and few medium roots; common fine pores; common fine worm casts; about 20 percent chert fragments; neutral; clear wavy boundary.

A3—19 to 29 inches; black (10YR 2/1) cherty loam, dark gray (10YR 4/1) dry; weak fine prismatic structure parting to moderate very fine and fine granular; very friable; common fine and few medium roots; common fine pores; common fine worm casts; about 15 percent chert fragments; neutral; gradual wavy boundary.

C1—29 to 48 inches; mixed dark brown (7.5YR 3/2 and 3/4) extremely cherty clay loam; many coarse distinct very dark gray (10YR 3/1) mottles; moderate very fine and fine granular structure; firm; few fine and few medium roots; about 70 percent chert fragments; neutral; gradual wavy boundary.

C2—48 to 60 inches; brown (7.5YR 4/4) extremely cherty clay loam; weak fine granular structure; firm; coarse very dark grayish brown (10YR 3/2) silty clay flows; about 85 percent chert fragments; neutral.

The content of chert in the control section ranges from 35 to 60 percent. The A horizon is silt loam or cherty silt loam. It has value of 2 or 3 and chroma of 1 or 2. The C horizon is very cherty or extremely cherty silty clay loam or very cherty or extremely cherty clay loam. It has hue of 10YR or 7.5YR and value and chroma of 2 to 4.

Celt Series

The Celt series consists of deep, somewhat poorly drained soils on uplands. These soils formed in loess and limestone residuum. They have a fragipan. Permeability is moderately slow above the fragipan and very slow in the fragipan. Slopes range from 2 to 5 percent.

Typical pedon of Celt silt loam, 2 to 5 percent slopes, 360 feet south and 1,500 feet west of the northeast corner of sec. 13, T. 34 N., R. 18 W.

A—0 to 3 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak thin platy structure parting to weak fine granular; very friable; many fine and common medium roots; strongly acid; clear smooth boundary.

E—3 to 10 inches; yellowish brown (10YR 5/4) silt loam; moderate thin platy structure; friable; common fine and medium roots; very strongly acid; clear wavy boundary.

Bt1—10 to 20 inches; brown (7.5YR 4/4) silty clay; few fine prominent grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; few fine and medium roots; few distinct clay films on faces of peds; extremely acid; clear smooth boundary.

Bt2—20 to 24 inches; grayish brown (10YR 5/2) silty clay loam; common fine prominent brown (7.5YR 4/4) and reddish brown (2.5YR 4/4) mottles; weak fine subangular blocky structure; firm; few fine and medium roots; few distinct clay films on faces of peds; about 10 percent chert fragments; extremely acid; clear wavy boundary.

2Bx1—24 to 30 inches; mottled light brownish gray (10YR 6/2), brownish yellow (10YR 6/6), and strong brown (7.5YR 5/6) very cherty silty clay loam; weak thick platy structure; very firm; brittle; about 55 percent chert fragments; extremely acid; clear wavy boundary.

2Bx2—30 to 40 inches; mottled light brownish gray (10YR 6/2), brownish yellow (10YR 6/6), and red (2.5YR 4/6) extremely cherty silt loam; weak thick platy structure; very firm; brittle; about 70 percent chert fragments; extremely acid; diffuse irregular boundary.

3Bt1—40 to 46 inches; red (2.5YR 4/6) very cherty clay; common medium distinct yellowish red (5YR 5/6) mottles; weak fine subangular blocky structure; firm; few distinct clay films on faces of peds; about 45 percent chert fragments; extremely acid; clear wavy boundary.

3Bt2—46 to 60 inches; red (2.5YR 4/6) cherty clay; common medium prominent strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure; firm; few distinct clay films on faces of peds; about 15 percent chert fragments; extremely acid.

The depth to bedrock is more than 60 inches. Depth to the fragipan ranges from 20 to 30 inches. The content of chert ranges from 0 to 10 percent above the fragipan and from 40 to 70 percent in the fragipan.

The A horizon has value of 3 or 4 and chroma of 1 to 3. The E horizon has chroma of 2 to 4. The Bt horizon has chroma of 2 to 6. The 3Bt horizon has hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 3 to 6.

Claiborne Series

The Claiborne series consists of deep, well drained, moderately permeable soils on foot slopes. These soils formed in alluvium and colluvium derived from dolomite residuum. Slopes range from 2 to 9 percent.

Typical pedon of Claiborne silt loam, 5 to 9 percent slopes, eroded, about 1,200 feet north and 1,140 feet west of the southeast corner of sec. 8, T. 36 N., R. 19 W.

Ap—0 to 6 inches; dark yellowish brown (10YR 3/4) silt loam, light yellowish brown (10YR 6/4) dry; weak very fine granular structure; friable; common fine roots; about 5 percent chert fragments; medium acid; abrupt smooth boundary.

BA—6 to 13 inches; yellowish red (5YR 5/6) silt loam; weak very fine subangular blocky structure; friable; common fine roots; about 5 percent chert fragments; very strongly acid; clear smooth boundary.

Bt1—13 to 18 inches; red (2.5YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; about 10 percent chert fragments; very strongly acid; clear smooth boundary.

Bt2—18 to 51 inches; red (2.5YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; many prominent clay films on faces of peds; common fine iron and manganese stains and a few concretions; about 10 percent chert fragments; very strongly acid; gradual smooth boundary.

Bt3—51 to 60 inches; red (2.5YR 4/6) silty clay loam; weak fine subangular blocky structure; firm; many prominent clay films on faces of peds; common iron and manganese stains and a few concretions; about 10 percent chert fragments; very strongly acid.

The depth to bedrock is more than 60 inches. The content of chert ranges from 5 to 25 percent throughout the profile.

The A horizon has value and chroma of 3 or 4. The Bt horizon is silty clay loam, clay loam, or cherty clay loam. It has hue of 7.5YR, 5YR, or 2.5YR and value of 4 or 5.

Dunning Series

The Dunning series consists of deep, very poorly drained, slowly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

The Dunning soils in this county have a thicker mollic epipedon than is definitive for the series. This difference, however, does not significantly affect the use and management of the soils.

Typical pedon of Dunning silty clay loam, about 125 feet north and 2,550 feet east of the southwest corner of sec. 4, T. 36 N., R. 20 W.

Ap—0 to 4 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak thin platy structure parting to weak fine granular; firm; common fine and few medium roots; neutral; abrupt smooth boundary.

A1—4 to 9 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; firm; common fine and few medium roots; neutral; clear smooth boundary.

A2—9 to 23 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure; firm; few fine and medium roots; neutral; gradual smooth boundary.

Bg1—23 to 33 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak fine subangular blocky structure; firm; few fine roots; neutral; gradual smooth boundary.

Bg2—33 to 39 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; common fine distinct very dark grayish brown (2.5Y 3/2) mottles; weak fine subangular blocky structure; firm; few fine roots; neutral; clear smooth boundary.

Bg3—39 to 46 inches; very dark gray (N 3/0) silty clay loam, gray (N 5/0) dry; common medium prominent dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; firm; few fine roots; neutral; gradual smooth boundary.

Cg—46 to 60 inches; dark gray (N 4/0) silty clay, gray (N 5/0) dry; moderate coarse prismatic structure parting to weak fine angular blocky; very firm; few fine roots; about 10 percent chert fragments; neutral.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bg horizon has value of 3 to 5 and chroma of 2 or less. The Cg horizon is silty clay or clay. It has hue of 10YR or 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 1 or less.

Eldon Series

The Eldon series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in cherty dolomite residuum. Slopes range from 3 to 14 percent.

Typical pedon of Eldon cherty silt loam, in an area of Eldon-Keeno cherty silt loams, 3 to 14 percent slopes; about 160 feet north and 2,610 feet west of the southeast corner of sec. 30, T. 35 N., R. 19 W.

Ap—0 to 4 inches; very dark brown (10YR 2/2) cherty silt loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; very friable; about 15 percent chert fragments; slightly acid; clear smooth boundary.

A—4 to 9 inches; very dark brown (10YR 2/2) cherty silt loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; very friable; about 20 percent chert fragments; strongly acid; clear smooth boundary.

BA—9 to 13 inches; dark yellowish brown (10YR 3/4) very cherty silty clay loam; moderate fine subangular blocky structure; friable; few worm casts; about 50 percent chert fragments; very strongly acid; clear smooth boundary.

Bt1—13 to 19 inches; brown (7.5YR 4/4) very cherty silty clay loam; moderate very fine subangular blocky structure; friable; few faint clay films on faces of peds; about 60 percent chert fragments; very strongly acid; clear wavy boundary.

Bt2—19 to 29 inches; red (2.5YR 4/6) very cherty silty clay; few fine prominent brownish yellow (10YR 6/6) mottles; moderate and strong fine angular blocky structure; firm; common prominent clay films on faces of peds; about 40 percent chert fragments; very strongly acid; gradual smooth boundary.

Bt3—29 to 55 inches; dark red (2.5YR 3/6) very cherty silty clay; common medium prominent weak red (2.5YR 5/2), dark gray (5YR 4/1), and gray (5YR 5/1) mottles; moderate medium angular blocky structure; very firm; common faint clay films on faces of peds; about 40 percent chert fragments; very strongly acid; clear smooth boundary.

Bt4—55 to 60 inches; mixed red (2.5YR 4/6) and brownish yellow (10YR 6/6) clay; many coarse distinct light reddish brown (2.5YR 6/4) and prominent light gray (2.5Y 7/2) mottles; moderate medium angular blocky structure; very firm; common faint clay films on faces of peds; about 10 percent chert fragments; very strongly acid.

The content of chert ranges from 15 to 30 percent in the A horizon, from 40 to 65 percent in the upper part of the Bt horizon, and from 10 to 20 percent in the lower part.

The A horizon has value of 2 or 3. The Bt horizon is the very cherty or extremely cherty analogs of silty clay loam, silty clay, or clay. It has value of 3 or 4 and chroma of 3 to 6.

Gasconade Series

The Gasconade series consists of shallow, somewhat excessively drained soils on uplands. These soils formed in dolomite residuum. Permeability is moderately slow. Slopes range from 2 to 60 percent.

Typical pedon of Gasconade flaggy silty clay loam, in an area of Gasconade-Rock outcrop complex, 2 to 14 percent slopes; about 2,520 feet north and 25 feet west of the southeast corner of sec. 22, T. 34 N., R. 19 W.

A—0 to 4 inches; very dark gray (10YR 3/1) flaggy silty clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common fine roots; about 15 percent dolomite fragments; mildly alkaline; clear smooth boundary.

Bw—4 to 12 inches; very dark grayish brown (10YR 3/2) very flaggy silty clay, dark grayish brown (10YR 4/2) dry; few medium distinct dark yellowish brown (10YR 4/4) mottles; moderate fine subangular blocky structure; firm; common fine roots; about 50 percent dolomite fragments; mildly alkaline; abrupt irregular boundary.

R—12 inches; hard dolomite bedrock.

The depth to bedrock ranges from 2 to 20 inches. The content of coarse fragments ranges from 15 percent in the surface layer to as much as 80 percent in the B horizon.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 10YR or 2.5Y and chroma of 2 or 3.

Gatewood Series

The Gatewood series consists of moderately deep, moderately well drained, slowly permeable soils on uplands. These soils formed in cherty sediments and in the underlying dolomite residuum. Slopes range from 5 to 25 percent.

Typical pedon of Gatewood very cherty silt loam, in an area of Ocie-Goss-Gatewood complex, 5 to 9 percent slopes; about 750 feet south of the northwest corner of sec. 23, T. 33 N., R. 19 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) very cherty silt loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; many medium and fine roots; about 40 percent chert fragments; slightly acid; abrupt wavy boundary.

E—4 to 7 inches; brown (10YR 5/3) very cherty silt loam; weak very fine granular structure; friable; many fine roots; about 40 percent chert fragments; medium acid; clear smooth boundary.

Bt1—7 to 12 inches; dark yellowish brown (10YR 4/6) cherty silty clay; weak fine subangular blocky structure; friable; many fine roots; few distinct clay films on faces of peds; about 30 percent chert fragments; strongly acid; clear wavy boundary.

Bt2—12 to 18 inches; dark yellowish brown (10YR 4/6) clay; moderate fine subangular blocky structure; firm; common fine roots; few distinct clay films on faces of peds; about 5 percent chert fragments; medium acid; clear smooth boundary.

2Bt3—18 to 25 inches; dark yellowish brown (10YR 4/4) clay; moderate medium angular blocky structure; firm; common fine roots; neutral; abrupt smooth boundary.

2R—25 inches; hard dolomite bedrock.

The depth to bedrock ranges from 20 to 40 inches. The A horizon is cherty or very cherty silt loam. It has value of 3 or 4 and chroma of 2 or 3. The E horizon is very cherty or extremely cherty silt loam. It has value of 4 or 5 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6.

Gepp Series

The Gepp series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in cherty sediments and dolomite residuum. Slopes range from 5 to 50 percent.

Typical pedon of Gepp very cherty silt loam, in an area of Gepp-Goss very cherty silt loams, 5 to 14 percent slopes; about 600 feet north and 2,250 feet west of the southeast corner of sec. 23, T. 36 N., R. 18 W.

A—0 to 1 inch; very dark grayish brown (10YR 3/2) very cherty silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; friable; many fine roots; about 35 percent chert fragments; slightly acid; abrupt smooth boundary.

E—1 to 9 inches; brown (10YR 4/3) very cherty silt loam; weak very fine granular structure; friable; many fine roots; about 60 percent chert fragments; medium acid; clear irregular boundary.

BE—9 to 12 inches; red (2.5YR 4/8) cherty silty clay loam; common coarse prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; firm; few fine, medium, and coarse roots; about 25 percent chert fragments; very strongly acid; clear wavy boundary.

2Bt1—12 to 20 inches; red (2.5YR 4/6) clay; strong fine angular blocky structure; firm; few fine and medium roots; many prominent clay films on faces of peds; about 10 percent chert fragments; very strongly acid; gradual irregular boundary.

2Bt2—20 to 32 inches; red (2.5YR 4/6) clay; common medium prominent reddish brown (5YR 5/4) mottles; moderate medium angular blocky structure; firm; few fine and coarse roots; few faint clay films on faces of peds; about 10 percent chert fragments; very strongly acid; gradual wavy boundary.

2Bt3—32 to 42 inches; dark red (2.5YR 3/6) clay; common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to weak fine angular blocky; firm; few fine and medium roots; many prominent clay films on faces of peds; about 5 percent chert fragments; very strongly acid; clear irregular boundary.

2Bt4—42 to 57 inches; red (2.5YR 4/6) clay; few fine prominent strong brown (7.5YR 5/6) and common fine prominent light brownish gray (10YR 6/2) and light gray (10YR 7/1) mottles; weak fine prismatic structure parting to weak very fine subangular blocky; firm; few fine roots; few faint clay films on faces of peds; strongly acid; gradual wavy boundary.

2Bt5—57 to 63 inches; mottled dark red (2.5YR 3/6), yellowish brown (10YR 5/6), and light gray (10YR 7/1) clay; weak very fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; strongly acid.

The depth to bedrock is more than 60 inches. The A horizon typically is very cherty silt loam, but the range includes cherty silt loam. This horizon has value of 3 or 4 and chroma of 1 to 3. The E horizon is cherty or very cherty silt loam. It has value of 4 to 6 and chroma of 3 or 4. The Bt horizon is clay, cherty clay, or very cherty clay. It has hue of 7.5YR or 2.5YR, value of 3 or 4, and chroma of 6 to 8.

Gerald Series

The Gerald series consists of deep, somewhat poorly drained soils on uplands. These soils formed in loess and in the underlying dolomite residuum. They have a fragipan. Permeability is very slow in the fragipan and moderately slow below the fragipan. Slopes range from 0 to 2 percent.

Typical pedon of Gerald silt loam, about 1,815 feet north and 825 feet east of the southwest corner of sec. 34, T. 34 N., R. 20 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

BE—9 to 14 inches; mixed dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; weak and moderate very fine subangular blocky structure; friable; common fine iron and manganese concretions; medium acid; clear smooth boundary.

Bt1—14 to 21 inches; mixed dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silty clay; many fine prominent yellowish red (5YR 4/6) mottles; strong and moderate fine angular and subangular blocky structure; firm; common faint clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—21 to 27 inches; grayish brown (10YR 5/2) silty clay; few fine prominent yellowish red (5YR 4/6) and strong brown (7.5YR 5/6) mottles; moderate medium and fine angular blocky structure; very firm;

common fine iron and manganese concretions and stains; common prominent clay films on faces of peds; very strongly acid; clear wavy boundary.

2Bx—27 to 38 inches; mottled grayish brown (10YR 5/2), pale brown (10YR 6/3), strong brown (7.5YR 5/6), and yellowish red (5YR 4/6) silty clay loam; weak thick platy structure parting to weak coarse and medium subangular blocky; very firm; few chert fragments; very strongly acid; clear wavy boundary.

3Bt1—38 to 50 inches; mixed red (2.5YR 4/6) and dark red (2.5YR 3/6) silty clay loam; common medium and coarse prominent pinkish gray (5YR 6/2) mottles; weak and moderate medium prismatic structure parting to coarse angular blocky; firm; common faint clay films on faces of peds; few chert fragments; very strongly acid; gradual smooth boundary.

3Bt2—50 to 60 inches; mixed red (2.5YR 4/6) and dark red (2.5YR 3/6) extremely cherty silty clay; common medium and coarse prominent pinkish gray (5YR 6/2) mottles; weak and moderate medium prismatic structure parting to coarse angular blocky; firm; common faint clay films on faces of peds; about 75 percent chert fragments; very strongly acid.

The depth to bedrock is more than 60 inches. Depth to the fragipan ranges from 20 to 40 inches. The content of chert above the fragipan is 5 percent or less by volume.

The A horizon has value of 3 or 4 and chroma of 2 or 3. The part of the Bt horizon above the fragipan is silty clay loam or silty clay. It has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 1 to 4. The fragipan is silty clay loam or cherty or very cherty silty clay loam. It has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 2 to 6. The part of the Bt horizon below the fragipan is silty clay loam, silty clay, clay, or the cherty, very cherty, or extremely cherty analogs of those textures. It has hue of 10YR to 2.5YR, value of 3 to 7, and chroma of 2 to 6.

Goss Series

The Goss series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in cherty dolomite residuum. Slopes range from 3 to 50 percent.

Typical pedon of Goss cherty silt loam, in an area of Goss-Wilderness cherty silt loams, 3 to 9 percent slopes; about 2,180 feet north and 140 feet west of the southeast corner of sec. 29, T. 34 N., R. 20 W.

A—0 to 8 inches; brown (10YR 4/3) cherty silt loam, pale brown (10YR 6/3) dry; moderate fine and weak very fine granular structure; very friable; common fine roots; about 15 percent chert fragments; medium acid; clear smooth boundary.

BE—8 to 13 inches; brown (7.5YR 5/4) very cherty silty clay loam; moderate very fine subangular blocky structure; friable; common fine roots; about 45 percent chert fragments; very strongly acid; clear smooth boundary.

Bt1—13 to 20 inches; reddish brown (5YR 4/4) very cherty silty clay loam; few fine distinct yellowish red (5YR 4/6) and brown (7.5YR 5/4) mottles; moderate fine subangular blocky structure; friable; common fine roots; few distinct clay films on faces of peds; about 60 percent chert fragments; very strongly acid; clear smooth boundary.

Bt2—20 to 34 inches; red (2.5YR 4/6) and dark red (2.5YR 3/6) extremely cherty clay; few moderate prominent yellowish brown (10YR 5/4) mottles; moderate very fine and fine angular blocky structure; firm; few fine roots; few distinct clay films on faces of peds; few fine and medium black stains; about 65 percent coarse fragments; very strongly acid; gradual smooth boundary.

Bt3—34 to 44 inches; dark red (2.5YR 3/6) very cherty clay; few medium distinct yellowish brown (10YR 5/4) mottles; moderate fine angular blocky structure; very firm; few fine roots; few faint clay films on faces of peds; common fine to coarse black stains; about 35 percent chert fragments; very strongly acid; clear smooth boundary.

Bt4—44 to 60 inches; yellowish red (5YR 4/6) very cherty clay; common medium distinct yellowish brown (10YR 5/4) and few fine faint red (2.5YR 4/6) mottles; moderate very fine and fine angular blocky structure; very firm; few fine roots; few faint clay films on faces of peds; many fine to coarse black stains; about 45 percent chert fragments; very strongly acid.

The content of chert ranges from 30 to 70 percent in the surface layer and from 30 to 80 percent in the subsoil. The A horizon is cherty or very cherty silt loam. It has value of 3 to 5 and chroma of 2 or 3. Some pedons have an E horizon. This horizon is cherty or very cherty silt loam. It has chroma of 2 or 3. The Bt horizon has hue of 10R to 7.5YR, value of 3 to 5, and chroma of 4 to 6. It is the very cherty or extremely cherty analogs of silty clay loam, silty clay, or clay.

Hartville Series

The Hartville series consists of deep, somewhat poorly drained, slowly permeable soils on high flood plains. These soils formed in alluvium. Slopes range from 1 to 4 percent.

Typical pedon of Hartville silt loam, 1 to 4 percent slopes, about 1,250 feet north and 500 feet west of the southeast corner of sec. 2, T. 32 N., R. 19 W.

Ap—0 to 5 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; few fine prominent strong brown (7.5YR 4/6) mottles; weak very fine granular structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.

A—5 to 14 inches; dark brown (10YR 4/3) silt loam; few fine prominent strong brown (7.5YR 4/6) mottles; weak very fine granular structure; friable; common fine roots; medium acid; clear smooth boundary.

E—14 to 20 inches; brown (10YR 5/3) silty clay loam; common medium prominent strong brown (7.5YR 4/6) mottles; weak fine granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

Btg1—20 to 42 inches; dark grayish brown (10YR 4/2) silty clay; common medium prominent dark red (2.5YR 3/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; many faint clay films on faces of peds; about 5 percent chert fragments; medium acid; clear smooth boundary.

Btg2—42 to 57 inches; yellowish brown (10YR 5/6) silty clay; common medium prominent dark gray (10YR 4/1) mottles; weak very fine subangular blocky structure; firm; few fine roots; many distinct clay films on faces of peds; common medium irregular iron and manganese concretions and stains; about 14 percent chert fragments; slightly acid; clear smooth boundary.

Btg3—57 to 62 inches; yellowish brown (10YR 5/6) silty clay; common fine distinct grayish brown (10YR 5/2) and common medium prominent dark gray (10YR 4/1) mottles; weak very fine subangular blocky structure; firm; many distinct clay films on faces of peds; about 14 percent chert fragments; common medium irregular iron and manganese concretions and stains; slightly acid.

The content of chert fragments ranges from 0 to 10 percent in the solum. The A horizon has value of 4 or 5 and chroma of 2 or 3. The E horizon is silt loam or silty clay loam. It has value of 4 or 5 and chroma of 2 to 4. The Bt horizon is silty clay loam or silty clay.

Hoberg Series

The Hoberg series consists of deep, moderately well drained soils on uplands. These soils formed in loess and cherty dolomite residuum. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 2 to 5 percent.

Typical pedon of Hoberg silt loam, 2 to 5 percent slopes, about 1,800 feet south and 2,400 feet east of the northwest corner of sec. 4, T. 33 N., R. 20 W.

Ap1—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

Ap2—3 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak thin platy structure parting to weak very fine granular; friable; many fine roots; slightly acid; clear smooth boundary.

A—9 to 16 inches; dark brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; friable; about 5 percent chert fragments; many fine roots; slightly acid; clear smooth boundary.

Bt—16 to 24 inches; dark yellowish brown (10YR 4/6) silty clay loam; common fine prominent light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; firm; many fine roots; common distinct clay films on faces of peds; common fine distinct black stains; about 10 percent chert fragments; strongly acid; gradual wavy boundary.

2Bx—24 to 48 inches; red (2.5YR 4/6) very cherty silty clay loam; massive; very firm; brittle; about 60 percent chert fragments; very strongly acid; gradual wavy boundary.

2Bt—48 to 60 inches; red (2.5YR 4/6) very cherty clay; common medium prominent light brownish gray (10YR 6/2) mottles; very weak very fine subangular structure; firm; few faint clay films on faces of peds; about 35 percent chert fragments; medium acid.

Depth to the fragipan ranges from 19 to 26 inches. The content of chert fragments ranges from 0 to 5 percent in the A horizon and from 5 to 12 percent in the Bt horizon and is as much as 60 percent in the fragipan. It ranges from 35 to more than 60 percent in the 2Bt horizon.

The A horizon has chroma of 2 or 3. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. The 2Bx horizon has hue of 10YR to 2.5YR, value of 4 or 5, and chroma of 5 or 6. The 2Bt horizon has value of 3 or 4 and chroma of 4 to 6.

Hobson Series

The Hobson series consists of deep, moderately well drained soils on uplands. These soils formed in sandstone residuum. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 2 to 9 percent.

Typical pedon of Hobson silt loam, 2 to 5 percent slopes, 1,250 feet south and 2,250 feet west of the northeast corner of sec. 18, T. 32 N., R. 19 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine, common medium, and few coarse roots; medium acid; abrupt wavy boundary.

E—4 to 7 inches; brown (10YR 5/3) silt loam; weak very fine granular structure; very friable; common fine roots; medium acid; abrupt wavy boundary.

BE—7 to 12 inches; light yellowish brown (10YR 6/4) loam; weak very fine subangular blocky structure; very friable; few fine roots; strongly acid; clear wavy boundary.

Bt1—12 to 18 inches; brown (7.5YR 4/4) clay loam; weak fine subangular blocky structure; firm; few fine roots; common fine distinct light yellowish brown (10YR 6/4) silt pockets; few distinct clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—18 to 26 inches; reddish brown (5YR 4/4) clay loam; strong fine subangular blocky structure; firm; few fine roots; common fine prominent light yellowish brown (10YR 6/4) silt coatings; few distinct clay films on faces of peds; strongly acid; clear wavy boundary.

2Ex1—26 to 37 inches; mottled strong brown (7.5YR 5/6) and light gray (10YR 6/1) fine sandy loam; weak thin platy structure; very firm; brittle; few fine and medium roots in polygonal streaks; common medium distinct gray clay flows in polygonal cracks; strongly acid; clear smooth boundary.

2Ex2—37 to 42 inches; mottled strong brown (7.5YR 4/6) and reddish yellow (7.5YR 6/6) fine sandy loam; weak thin platy structure; very firm; brittle; few coarse roots in polygonal streaks; thick light brownish gray clay flows in polygonal cracks; very strongly acid; clear smooth boundary.

2Bx—42 to 49 inches; strong brown (7.5YR 4/6) sandy clay loam; few medium prominent grayish brown (10YR 5/2) mottles; weak thin platy structure parting to weak very fine subangular blocky; very firm; brittle; few fine roots in polygonal cracks; very strongly acid; clear smooth boundary.

2Bt—49 to 60 inches; red (2.5YR 4/6) clay loam; many medium prominent strong brown (7.5YR 4/6) and few fine prominent grayish brown (10YR 5/2) mottles; weak very fine subangular blocky structure; firm; few faint clay films on faces of peds; strongly acid.

Depth to the fragipan ranges from 20 to 27 inches. The A horizon has value of 3 or 4 and chroma of 2 or 3. It is silt loam or loam. The part of the Bt horizon above the fragipan has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 8. The 2Bx horizon is fine sandy loam, loam, sandy clay loam, or clay loam. It has hue of 10YR or 7.5YR and value of 4 to 6. The 2Bt horizon is silty clay or clay loam. It has hue of 10YR to 2.5YR, value of 4 or 5, and chroma of 4 to 6.

Keeno Series

The Keeno series consists of deep, moderately well drained soils on uplands. These soils formed in cherty limestone residuum. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 3 to 14 percent.

Typical pedon of Keeno cherty silt loam, in an area of Eldon-Keeno cherty silt loams, 3 to 14 percent slopes; about 150 feet north and 2,120 feet west of the southeast corner of sec. 30, T. 35 N., R. 19 W.

A—0 to 10 inches; very dark brown (10YR 2/2) cherty silt loam, dark grayish brown (10YR 4/2) dry; moderate fine and very fine granular structure; very friable; many fine roots; about 25 percent chert fragments; medium acid; clear smooth boundary.

BA—10 to 17 inches; dark brown (7.5YR 3/2) very cherty silty clay loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; friable; many fine roots; about 40 percent chert fragments; strongly acid; clear smooth boundary.

Bt1—17 to 28 inches; dark brown (10YR 3/3) very cherty silty clay loam, brown (10YR 5/3) dry; moderate very fine and fine subangular blocky structure; friable; common fine roots; few faint clay films on faces of peds; about 55 percent chert fragments; strongly acid; clear wavy boundary.

2Ex—28 to 34 inches; mottled brown (10YR 5/3) and light yellowish brown (10YR 6/4) extremely cherty silty clay loam; weak medium platy structure parting to weak fine subangular blocky; very firm; few fine roots, which are restricted to vertical cracks; about 70 percent chert fragments; strongly acid; clear smooth boundary.

2Bx—34 to 44 inches; mottled yellowish red (5YR 5/6) and pale brown (10YR 6/3) extremely cherty silty clay loam; weak medium platy structure; very firm; about 75 percent chert fragments; very strongly acid; clear wavy boundary.

3Bt—44 to 60 inches; red (2.5YR 4/6) clay; few fine prominent light reddish brown (5YR 6/4) and few fine distinct light reddish brown (2.5YR 6/4) mottles; moderate fine angular blocky structure; firm; common faint clay films on faces of peds; about 5 percent chert fragments; very strongly acid.

Depth to the fragipan ranges from 20 to 30 inches. The content of chert ranges from 15 to 25 percent in the surface layer, from 40 to 60 percent in the Bt horizon, and from 60 to 75 percent in the fragipan.

The A horizon typically is cherty silt loam, but the range includes very cherty silt loam. This horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon is very cherty or extremely cherty silty clay loam. It has value and chroma of 3 or 4. The fragipan has hue of 10YR, 7.5YR, or 5YR, value of 4 to 7, and chroma of 3 to 8.

Lebanon Series

The Lebanon series consists of deep, moderately well drained soils on uplands. These soils formed in loess and dolomite residuum. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 2 to 5 percent.

Typical pedon of Lebanon silt loam, 2 to 5 percent slopes, about 45 feet north and 700 feet east of the southwest corner of sec. 21, T. 34 N., R. 20 W.

Ap—0 to 5 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine and very fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

BE—5 to 8 inches; strong brown (7.5YR 4/6) silty clay loam; few medium faint brown (7.5YR 5/4) mottles; weak fine and medium subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bt1—8 to 17 inches; mixed brown (7.5YR 4/4) and reddish brown (5YR 4/4) silty clay loam; moderate and weak fine and very fine angular and subangular blocky structure; firm; few prominent clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—17 to 21 inches; brown (7.5YR 5/4) silty clay loam; few fine prominent yellowish red (5YR 4/6) and common medium faint dark brown (7.5YR 4/4) mottles; few fine prominent grayish brown (10YR 5/2) mottles in the lower inch; moderate fine angular and subangular blocky structure; firm; few prominent clay films on faces of peds; very strongly acid; clear wavy boundary.

2Ex—21 to 29 inches; mottled light brownish gray (10YR 6/2) and dark grayish brown (10YR 4/2) extremely cherty silty clay loam; weak thick platy structure; very firm; about 70 percent chert fragments; very strongly acid; gradual smooth boundary.

2Bx—29 to 39 inches; mottled dark grayish brown (10YR 4/2) and pale brown (10YR 6/3) extremely cherty silty clay loam; massive; very firm; about 75 percent chert fragments; very strongly acid; clear wavy boundary.

2Bt1—39 to 46 inches; reddish brown (5YR 4/4) very cherty silty clay; few fine prominent red (2.5YR 4/6) and pale brown (10YR 6/3) mottles; moderate and weak fine subangular blocky structure; firm; few faint clay films on faces of peds; about 50 percent chert fragments; very strongly acid; clear smooth boundary.

2Bt2—46 to 60 inches; dark red (2.5YR 3/6) very cherty clay; few fine prominent yellowish brown (10YR 5/4) mottles; moderate fine angular blocky structure; firm; few faint clay films on faces of peds; about 60 percent chert fragments; very strongly acid.

The depth to bedrock is more than 60 inches. Depth to the fragipan ranges from 18 to 24 inches. The content of chert ranges from 0 to 15 percent above the fragipan and is as much as 75 percent in the fragipan.

The A horizon has value of 4 or 5 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The fragipan is the very cherty or extremely cherty analogs of silt loam or silty clay loam. It has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 3. The 2Bt horizon is silty clay loam, silty clay, clay, or the very cherty analogs of those textures.

Nolin Series

The Nolin series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 1 to 3 percent.

Typical pedon of Nolin silt loam, 1 to 3 percent slopes, about 500 feet south and 1,900 feet east of the northwest corner of sec. 12, T. 35 N., R. 18 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A—7 to 15 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few fine roots; neutral; clear smooth boundary.

Bw1—15 to 28 inches; brown (10YR 4/3) silt loam; weak very fine subangular blocky structure; friable; few fine roots; neutral; gradual smooth boundary.

Bw2—28 to 43 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw3—43 to 60 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; neutral.

The Ap and A horizons have value of 3 or 4 and chroma of 2 or 3. The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4.

Ocie Series

The Ocie series consists of deep, moderately well drained, slowly permeable soils on uplands. These soils formed in cherty sediments and in the underlying dolomite residuum. Slopes range from 5 to 25 percent.

Typical pedon of Ocie cherty silt loam, in an area of Ocie-Goss-Gatewood complex, 9 to 25 percent slopes; about 50 feet north of the southwest corner of sec. 36, T. 33 N., R. 19 W.

A—0 to 1 inch; dark brown (10YR 3/3) cherty silt loam, brown (10YR 4/3) dry; moderate very fine granular structure; very friable; many fine roots and pores; about 30 percent chert fragments; slightly acid; abrupt wavy boundary.

E1—1 to 4 inches; light yellowish brown (10YR 6/4) cherty silt loam; moderate fine granular structure; very friable; many fine and few coarse roots; about 30 percent chert fragments; strongly acid; clear smooth boundary.

E2—4 to 11 inches; yellowish brown (10YR 5/4) very cherty silt loam; weak fine granular structure; very friable; common fine roots; many medium distinct light yellowish brown (10YR 6/4) silt coatings on faces of peds and chert fragments; about 60 percent chert fragments; strongly acid; gradual irregular boundary.

Bt1—11 to 17 inches; yellowish brown (10YR 5/6) very cherty silty clay loam; moderate fine subangular blocky structure; firm; few fine and medium roots; few faint clay films and few faint silt coatings on faces of peds; about 45 percent chert fragments; strongly acid; gradual wavy boundary.

2Bt2—17 to 28 inches; strong brown (7.5YR 5/6) clay; many medium prominent dark red (2.5YR 3/6) mottles; moderate medium subangular blocky structure; firm; few fine and few medium roots; common fine prominent silt coatings and few distinct clay films on faces of peds; about 14 percent chert fragments; strongly acid; gradual wavy boundary.

2Bt3—28 to 54 inches; yellowish brown (10YR 5/6) clay; many coarse prominent dark red (2.5YR 3/6) and common medium prominent gray (10YR 6/1) mottles; moderate fine subangular blocky structure; firm; few fine roots; few distinct clay films on faces of peds; evidence of slickensides; about 10 percent chert fragments; strongly acid; clear smooth boundary.

2C—54 to 59 inches; yellowish brown (10YR 5/6) clay; many coarse prominent dark red (2.5YR 3/6) and common fine prominent gray (10YR 6/1) mottles; massive; very firm; about 10 percent chert fragments; neutral; abrupt smooth boundary.

2R—59 inches; hard, cherty dolomite bedrock.

The depth to bedrock ranges from 40 to 60 inches. The content of chert fragments ranges from 30 to 65 percent in the upper part of the solum, from 0 to 15 percent in the lower part, and from 0 to 10 percent in the C horizon.

The A horizon typically is cherty silt loam, but the range includes very cherty silt loam. This horizon has chroma of 2 or 3. The E horizon is cherty to extremely cherty silt loam. It has value of 5 or 6 and chroma of 3 or 4. The 2Bt horizon is cherty silty clay, silty clay, or clay.

Peridge Series

The Peridge series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and limestone residuum. Slopes range from 1 to 9 percent.

Typical pedon of Peridge silt loam, 1 to 5 percent slopes, about 790 feet north and 2,400 feet east of the southwest corner of sec. 18, T. 34 N., R. 20 W.

Ap—0 to 6 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; weak and moderate very fine and fine granular structure; friable; many fine roots; medium acid; abrupt smooth boundary.

BA—6 to 10 inches; brown (7.5YR 4/4) silty clay loam; few medium prominent yellowish red (5YR 4/6) mottles; moderate very fine subangular blocky structure; friable; common fine roots; common faint silt coatings on faces of peds; strongly acid; clear smooth boundary.

Bt1—10 to 17 inches; yellowish red (5YR 4/6) silty clay loam; strong medium and fine subangular blocky structure; firm; common fine roots; common faint clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—17 to 32 inches; yellowish red (5YR 4/6) silty clay loam; strong medium and fine subangular blocky structure; firm; common fine roots; common distinct clay films on faces of peds; about 5 percent chert fragments; common fine and medium black concretions; strongly acid; gradual smooth boundary.

Bt3—32 to 45 inches; yellowish red (5YR 4/6 and 5/6) silty clay loam; few medium distinct red (2.5YR 4/6) mottles; weak medium and coarse subangular blocky structure; firm; few fine roots; common prominent clay films on faces of peds; about 5 percent chert fragments; common fine and medium black concretions; strongly acid; gradual smooth boundary.

Bt4—45 to 60 inches; yellowish red (5YR 5/6 and 4/6) silty clay loam; common medium distinct red (2.5YR 4/6) mottles; weak medium and coarse subangular blocky structure; firm; few fine roots; common prominent clay films on faces of peds; about 10 percent chert fragments; many medium and large black concretions; strongly acid.

The content of chert ranges from 0 to 10 percent in the upper 40 inches and from 0 to 35 percent below that depth. The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon is silty clay loam or silty clay. It has hue of 5YR or 2.5YR and value and chroma of 4 to 6.

Racket Series

The Racket series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 1 to 3 percent.

Typical pedon of Racket silt loam, loamy substratum, 1 to 3 percent slopes, about 1,300 feet south and 975 feet east of the northwest corner of sec. 24, T. 36 N., R. 18 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak thin and medium platy structure parting to weak very fine granular; friable; many fine roots; common fine and medium pores; common worm casts; neutral; clear smooth boundary.

A—7 to 12 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; very dark gray (10YR 3/1) coatings on peds; weak fine granular structure; friable; common fine roots; neutral; clear smooth boundary.

Bw—12 to 42 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; very dark gray (10YR 3/1) ped faces; weak fine subangular blocky structure; friable; few fine roots; few fine and medium pores; few worm casts; neutral; clear smooth boundary.

C1—42 to 57 inches; brown (10YR 4/3) loam; weak medium and fine subangular blocky structure parting to weak fine granular; friable; few fine roots; few fine pores; neutral; clear smooth boundary.

C2—57 to 66 inches; brown (10YR 4/3) loam; moderate fine and medium subangular blocky structure; friable; few fine roots; few fine pores; neutral.

The thickness of the mollic epipedon ranges from 30 to 45 inches. The A horizon has value and chroma of 2 or 3. The Bw horizon is silt loam or loam. It has chroma of 2 or 3. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is silt loam, loam, fine sandy loam, or the cherty analogs of those textures.

Sampsel Series

The Sampsel series consists of deep, poorly drained, slowly permeable soils on foot slopes and uplands. These soils formed in colluvium and shale residuum. Slopes range from 2 to 5 percent.

Typical pedon of Sampsel silt loam, 2 to 5 percent slopes, about 2,150 feet south and 900 feet east of the northwest corner of sec. 16, T. 36 N., R. 20 W.

Ap—0 to 6 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

BA—6 to 12 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure parting to weak fine granular; friable; common fine roots; neutral; clear smooth boundary.

Bt—12 to 22 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; few fine prominent dark yellowish brown (10YR 4/6) and brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; slightly acid; clear smooth boundary.

Btg1—22 to 38 inches; dark gray (10YR 4/1) silty clay; few fine prominent dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; very firm; few fine and medium roots; few faint clay films on faces of peds; medium acid; gradual smooth boundary.

Btg2—38 to 57 inches; dark gray (10YR 4/1) silty clay; common fine prominent yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; very firm; few fine roots; few faint clay films on faces of peds; slightly acid; gradual smooth boundary.

BCg—57 to 70 inches; mottled grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/6) silty clay loam; weak fine subangular blocky structure; very firm; few fine roots; few medium black iron and manganese concretions; slightly acid.

The mollic epipedon ranges from 17 to 30 inches in thickness. The Ap horizon typically is silt loam, but the range includes silty clay loam. This horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has value of 3 or 4 and chroma of 1 or 2.

Viraton Series

The Viraton series consists of deep, moderately well drained soils on uplands. These soils formed in loess and cherty dolomite residuum. They have a fragipan. Permeability is moderate above the fragipan and very slow in the fragipan. Slopes range from 2 to 9 percent.

Typical pedon of Viraton silt loam, 5 to 9 percent slopes, about 15 feet north and 2,630 feet east of the southwest corner of sec. 4, T. 35 N., R. 19 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium platy structure parting to weak fine granular; friable; many fine roots; about 5 percent chert fragments; neutral; abrupt smooth boundary.

E—5 to 9 inches; yellowish brown (10YR 5/4) silt loam; few coarse prominent strong brown (7.5YR 5/6) mottles; moderate thin platy structure parting to moderate fine granular; very friable; common fine roots; about 5 percent chert fragments; medium acid; clear smooth boundary.

BE—9 to 12 inches; strong brown (7.5YR 5/6) silt loam; weak fine subangular blocky structure; friable; few fine and medium roots; few medium pores; about 5 percent chert fragments; common medium silt pockets and coatings on faces of peds; strongly acid; clear wavy boundary.

Bt1—12 to 22 inches; strong brown (7.5YR 4/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine, medium, and coarse roots; few medium pores; common faint clay films on faces of peds; about 5 percent chert fragments; strongly acid; clear irregular boundary.

Bt2—22 to 26 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine and medium and common coarse roots; many prominent clay films on faces of peds; about 10 percent chert fragments; strongly acid; abrupt wavy boundary.

2Ex—26 to 39 inches; mottled light brownish gray (10YR 6/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 4/6) cherty silt loam; few coarse distinct yellowish red (5YR 4/6) mottles; weak medium platy structure; very firm; brittle; few fine and medium roots in dark grayish brown (10YR 4/2) illuvial material between coarse polygons; about 30 percent chert fragments; very strongly acid; gradual irregular boundary.

2Bx—39 to 54 inches; mottled reddish brown (5YR 4/4), light brownish gray (10YR 6/2), and strong brown (7.5YR 4/6) very cherty silty clay loam; coarse medium prominent dark red (2.5YR 3/6) mottles; weak very coarse prismatic structure; very firm; brittle; few medium roots in dark grayish brown (10YR 4/2) illuvial material between coarse polygons; about 45 percent chert fragments; strongly acid; clear irregular boundary.

3Bt—54 to 60 inches; dark red (2.5YR 3/6) very cherty clay; common medium prominent brown (10YR 5/3) mottles; weak fine subangular blocky structure; firm; few faint clay films on faces of peds; about 60 percent chert fragments; neutral.

Depth to the fragipan ranges from 16 to 33 inches. The content of chert ranges from 0 to 35 percent above the fragipan, from 25 to 70 percent in the fragipan, and from 5 to 60 percent below the fragipan.

The A horizon has value of 3 or 4 and chroma of 2 to 4. The E horizon has value of 4 to 6 and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR and chroma of 4 to 6. The fragipan is the cherty, very cherty, or extremely cherty analogs of silt loam or silty clay loam. It has hue of 10YR, 7.5YR, or 5YR, value of 4 to 6, and chroma of 2 to 6. The 3Bt horizon has hue of 10YR to 2.5YR, value of 3 or 4, and chroma of 6 to 8. It is silty clay or the cherty, very cherty, or extremely cherty analogs of silty clay or clay.

Wilderness Series

The Wilderness series consists of deep, moderately well drained soils on uplands. The soils formed in cherty dolomite residuum. They have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. Slopes range from 2 to 9 percent.

Typical pedon of Wilderness cherty silt loam, 2 to 9 percent slopes, about 1,500 feet south and 1,650 feet west of the northeast corner of sec. 23, T. 36 N., R. 18 W.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) cherty silt loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; very friable; many fine roots; about 16 percent chert fragments; strongly acid; abrupt smooth boundary.

E—3 to 8 inches; yellowish brown (10YR 5/4) cherty silt loam; weak very fine granular structure; very friable; common fine and few medium roots; about 20 percent chert fragments; very strongly acid; clear wavy boundary.

Bt1—8 to 11 inches; brown (7.5YR 4/4) very cherty silty clay loam; weak very fine subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; about 50 percent chert fragments; very strongly acid; abrupt smooth boundary.

Bt2—11 to 15 inches; strong brown (7.5YR 4/6) very cherty silty clay loam; very weak very fine subangular blocky structure; firm; common fine and few coarse and medium roots; about 55 percent chert fragments; few faint clay films on faces of peds; very strongly acid; abrupt smooth boundary.

Bx1—15 to 21 inches; brown (7.5YR 4/4) extremely cherty silt loam; common fine prominent light brownish gray (10YR 6/2) mottles; massive with some tendency toward very weak very thin platy structure; very firm; brittle; few fine roots in the top inch; about 75 percent chert fragments; few faint clay films on faces of peds; strongly acid; gradual smooth boundary.

Bx2—21 to 33 inches; brown (7.5YR 4/4) extremely cherty silt loam; common medium distinct brown (10YR 5/3) mottles; massive; very firm; brittle; about 80 percent chert fragments; very strongly acid; gradual irregular boundary.

2Bt1—33 to 43 inches; strong brown (7.5YR 5/6) very cherty clay; moderate to very fine subangular blocky structure; very firm; few fine roots; few faint clay films on faces of peds; about 55 percent chert fragments; very strongly acid; clear smooth boundary.

2Bt2—43 to 48 inches; brown (7.5YR 5/4) extremely cherty clay; common medium prominent red (2.5YR 4/6) mottles; weak very fine subangular blocky structure; very firm; few faint clay films on faces of peds; about 70 percent chert fragments; very strongly acid; clear smooth boundary.

3Bt—48 to 60 inches; dark red (10R 3/6) clay; common medium prominent strong brown (7.5YR 5/6) and few fine prominent light gray (10YR 7/1) mottles; moderate very fine subangular blocky structure; very firm; few medium roots; few faint clay films on faces of peds; very strongly acid.

Depth to the fragipan ranges from 15 to 25 inches. The content of chert fragments ranges from 20 to 60 percent above the fragipan, from 60 to 85 percent in the fragipan, and from 20 to 85 percent below the fragipan.

The A horizon typically is cherty silt loam, but the range includes very cherty silt loam. This horizon has value of 3 to 5 and chroma of 2 or 3. The E horizon is cherty or very cherty silt loam. It has value of 5 or 6 and chroma of 3 or 4. The Bt horizon is the very cherty or extremely cherty analogs of silt loam or silty clay loam. It has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The fragipan is the extremely cherty analogs of silt loam or silty clay loam. It has hue of 10YR, 7.5YR, or 5YR and value and chroma of 4 to 6. The 2Bt horizon is cherty, very cherty, or extremely cherty clay or clay. It has hue of 10YR to 10R, value of 3 to 5, and chroma of 4 to 8.

Factors of Soil Formation

Soil forms through processes that act on accumulated or deposited geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of the parent material into a soil that has distinct horizons. Generally, a long time is required for the formation 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 others.

Parent Material

Parent material, the weathered mass in which a soil forms, determines the textural, chemical, and mineralogical composition of the soil. Even soil drainage and color are influenced by the kind of parent material. The soils in Dallas County formed in material weathered from dolomite, sandstone, and limestone; in alluvium; in loess; or in a combination of these.

Dolomite bedrock tends to weather to clay containing varying amounts of chert. The soils that formed in this material include Goss, Eldon, Ocie, and Gatewood soils.

Sandstone weathers to clay loam and other loamy material. Hobson, Bolivar, and Basehor soils formed in this material.

Soils that formed in limestone residuum tend to be clayey. The soils that formed in this material are limited to some mounds at the southwest edge of the county. These are generally the Gasconade soils.

Alluvium is material that has been transported by water. The origin of this material varies greatly. The soils that formed in alluvial material include Racket, Cedargap, Dunning, and Hartville soils.

Loess is material deposited by the wind. None of the soils in Dallas County formed solely in this material. The influence of this material is evident, however, on broad ridge crests where the soils have a fragipan. The soils that show this influence in their surface layer include Celt, Hoberg, Lebanon, Viraton, and Wilderness soils.

Climate

Climate has been an important factor in the formation of the soils in Dallas County. The humid continental climate in the county is marked by distinct seasonal temperature changes and a predictable rainfall distribution. The climate pattern generally has been stable for the brief period of recorded history.

Variations in temperature from high to low elevations have had only a slight influence on soil formation. The effects of temperature differences resulting from aspect are more evident. Thinner horizons and inferior tree growth are evident in areas of Goss and Ocie soils on warm slopes. Precipitation has been adequate to leach bases, to lower natural fertility and soil reaction, and to translocate silicate clays in soils on uplands.

Some evidence suggests that changes in climate have occurred over geologic time. Geologic erosion, stone lines, loess deposition, and changes in plants indicate conditions different from those prevalent today.

Relief

Relief influences soil formation mainly through its effect on drainage, runoff, and erosion and to some extent through its effect on exposure to sunlight and the wind.

The amount of water entering and passing through the soil depends on the slope, the permeability of the soil material, and the amount and intensity of rainfall. Runoff is rapid on steep soils. Little water passes through these soils. Consequently, distinct horizons do not form. On gently sloping or nearly level soils, runoff is slow. Most of the water received by these soils penetrates the surface. As a result, the soils are characterized by maximum profile development. If slopes are similar, soils that are rapidly permeable form more slowly than soils that are slowly permeable.

In general, soils that formed in similar kinds of parent material are more droughty on the steeper south-facing slopes than on north-facing slopes. This difference results from more direct sunlight. Droughtiness influences soil formation through its effect on the amount and kind of vegetation, erosion, and freezing and thawing.

Plants and Animals

Living organisms in and on the soil have contributed to the alteration of the parent material and the properties of the soil. Plants, bacteria and fungi, burrowing animals, and human activities have had varying impacts on soil formation. They have influenced the content of organic matter and nitrogen, reaction, color, thickness and kinds of horizons, structure, aeration, and other soil properties.

Plants greatly influence soil formation. Throughout time, plant communities have varied, depending on soil fertility, available water capacity, drainage, and depth. In most of Dallas County, trees have been the dominant plants during soil formation. Soils formed under native grasses in about 10 percent of the county. The thick, dark surface layer of Hoberg soils is characteristic of soils that formed under native grasses. The annual return of grass residue to the soil affects the physical, biological, and chemical composition of the surface layer.

Micro-organisms play an important part in the decay and decomposition of plant residue. By reducing raw materials to humus, they release plant nutrients, enhance soil structure, and improve the general physical condition of the surface layer. Soil properties that favor biological activity are a high content of organic matter, medium acid to neutral reaction, aeration, low bulk density, and medium texture.

Intensive cultivation, clearing of trees, and other human activities also influence soil formation. In some areas cultivation has mixed the surface layer with the subsurface layer, lowered the organic matter content, inhibited biological activity in the soil, and decreased the stability of soil structure, and in many areas it has removed the original surface layer, thereby lowering the fertility and productivity of the soil. The introduction of new crops and applications of chemicals, such as fertilizer and lime, also have altered soil formation.

Time

Time allows climate, living organisms, and relief to exert their influence on the parent material. Climate and living organisms begin to alter soil properties as soon as the parent material is deposited. The degree to which soil-forming processes have changed the parent material determines the age of a soil. The maturity or relative age of a soil is therefore inferred from its morphology. Some of the soil properties that are used to ascertain the age of the soils in Dallas County are the development of an argillic horizon or a fragipan and the depth of weathering.

Goss, Gatewood, and Ocie are examples of soils having a distinct argillic horizon that has a high content of translocated clays. Hobson, Hoberg, Lebanon, and Viraton are examples of soils that have a fragipan. Some time is required for the formation of a fragipan.

The youngest soils in the county formed in alluvial deposits. Racket, Cedargap, and Dunning soils are examples.

Geology

Dallas County is situated on the Salem Plateau. Remnants of the Springfield Plateau in the county are of minor extent *(4)*. The county generally is underlain by sedimentary rocks of Ordovician age. These are consolidated bedrock outcrops of the Gasconade, Roubidoux, and Jefferson City Formations. In areas of isolated monadnocks in the west-central part of the county, the rocks are of Mississippian age. These are the Compton, the Northview, and Pierson Formations and Burlington-Keokuk Limestone *(12, 13, 17)*. The county has several structural features. The few faults and grabens, however, have relatively little impact on soil patterns *(8)*.

The oldest geologic formation outcropping in the county is the Gasconade Formation. This formation is light brownish gray, cherty dolomite, the lower part of which is coarsely crystalline and is characterized by large amounts of chert. The formation crops out in the northeast corner of the county, at the base of the Niangua River bluffs and along the river as far south as Buffalo. The lowest part of the formation is a sandstone unit, the Gunter member. Several springs flow from the Gunter member as well as from the Gasconade Formation *(12)*.

Overlying the Gasconade Formation is the Roubidoux Formation, which is along the Niangua River and in an area in the southeast corner of the county where extensive faulting has occurred. The Roubidoux Formation consists of sandstone, dolomitic sandstone, and cherty dolomite. Although exposures of the sandstone unit for the most part are rare in Dallas County, pieces of sandstone as large as boulders are common *(12)*.

The Jefferson City Formation and Cotter Dolomite overlie the Roubidoux Formation. They are separate formations, but the soils associated with them are similar. The Cotter Dolomite generally is a silty, gray to brown, cherty dolomite like the Jefferson City Formation. The Cotter Dolomite, however, has a sandstone unit known as Swan Creek, which is not continuous throughout the county. Sandstone exposures can be examined along road cuts and commonly in stream channels in the southwest corner of the county *(12)*.

The limited exposures of Mississippian material contribute little to soil formation. These are easily recognized because they are almost 200 feet higher than the surrounding areas. Generally, the rock formations of Mississippian age are made up of fossiliferous limestone, shale, and siltstone; limestone and dolomite with occasional chert fragments; and white to gray crinoidal limestone with some nodular or bedded chert *(12, 13, 17)*.

Unconsolidated surficial deposits include residuum, loess, colluvium, and alluvium. The soils in the county formed in these deposits. Residuum and colluvium are dominant in all areas of the county, except for relatively small areas that have a thin mantle of loess or alluvium. The consolidated bedrock exposed in the county is conspicuous and locally significant in areas of rock outcrops and shallow soils.

References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(2) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) Bates, Carlo G. 1945. Shelterbelt influences II: The value of shelterbelts in house heating. J. of For. 43: 176-196.

(4) Bretz, J.H. 1965. Geomorphic history of the Ozarks of Missouri. Missouri Geol. Surv. and Water Resour., Vol. XLI, 2nd Ser., 147 pp., illus.

(5) Dallas County Historical Society. 1974. The Dallas County, Missouri, story. 434 pp., illus.

(6) Goodspeed Publishing Company. 1889. History of Laclede, Camden, Dallas, Webster, Wright, Texas, Pulaski, Phelps and Dent Counties. Reprinted in 1974. 1,219 pp., illus.

(7) Hemphill, Elva M. 1954. Early days in Dallas County. 115 pp., illus.

(8) McCracken, M.H. 1971. Structural features of Missouri. Missouri Geol. Surv. and Water Resour., Rep. of Invest. No. 49, 99 pp., illus., map.

(9) Missouri Agricultural Statistics Office. 1986. Missouri farm facts. 63 pp., illus.

(10) Missouri Crop and Livestock Reporting Service. 1985. Dallas County agri-facts. 4 pp., illus.

(11) Missouri Department of Conservation. 1987. Fur harvest tabulations.

(12) Missouri Geological Survey and Water Resources. 1961. The stratigraphic succession in Missouri. 185 pp., illus.

(13) Moore, Raymond C. 1928. Early Mississippian formations in Missouri. Missouri Bur. of Geol. and Mines, 283 pp.

(14) Schroeder, Walter A. 1981. Presettlement prairies of Missouri. Missouri Dep. of Conserv., 37 pp., illus.

(15) Skinner, Glenn. 1979. The Big Niangua River. 200 pp., illus.

(16) Thom, Richard H., and James H. Wilson. 1980. The natural divisions of Missouri. Trans. of the Missouri Acad. of Sci. 14: 9-23.

(17) Thompson, T.L., and K.H. Anderson. 1976. The Mississippian System. Missouri Dep. of Nat. Resour., suppl. 1, vol. 40, 85 pp., illus. [Supplements The stratigraphic succession in Missouri]

(18) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(19) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(20) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(21) United States Department of Agriculture. 1982. National resource inventory. (Available in the State Office of the Soil Conservation Service at Columbia, Missouri)

(22) Vineyard, Jerry D., and Gerald L. Feder. 1974. Springs of Missouri. Missouri Geol. Surv. and Water Resour., 267 pp., illus.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

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

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

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

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

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

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

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

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

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

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

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

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

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

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

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

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

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

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

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

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

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

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

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

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

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

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

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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

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

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

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

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

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

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

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

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

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

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

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

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

Percolation. The downward movement of water through the soil.

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

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

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

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

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

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

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

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

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

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

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

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

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

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

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

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

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

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediments of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

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

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

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

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

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-84 at Marshfield, Missouri)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	41.6	21.1	31.4	70	0	12	1.80	0.66	2.73	4	4.0
February----	47.0	25.8	36.4	74	0	19	2.04	.93	2.98	4	4.3
March-------	55.7	33.6	44.7	83	9	82	3.45	1.98	4.75	7	2.7
April-------	67.9	44.9	56.4	87	24	225	3.79	2.31	5.10	7	.3
May---------	76.1	54.0	65.1	90	33	468	4.62	2.50	6.48	8	.0
June--------	84.1	62.8	73.5	95	46	705	4.41	1.70	6.67	7	.0
July--------	89.2	67.4	78.3	100	52	877	3.65	1.46	5.48	6	.0
August------	88.3	65.9	77.1	99	51	840	3.01	1.41	4.37	5	.0
September---	80.8	58.5	69.7	96	39	591	3.93	1.27	6.10	6	.0
October-----	69.9	47.3	58.6	89	26	285	3.76	1.40	5.72	6	.0
November----	55.6	35.2	45.4	77	11	43	3.06	1.20	4.60	5	1.5
December----	45.4	26.4	35.9	71	11	20	2.80	1.18	4.17	5	2.4
Yearly:											
Average---	66.8	45.2	56.0	---	---	---	---	---	---	---	---
Extreme---	---	---	---	101	11	---	---	---	---	---	---
Total-----	---	---	---	---	---	4,167	40.32	32.17	47.98	70	15.2

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-84 at Marshfield, Missouri)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 9	Apr. 17	May 1
2 years in 10 later than--	Apr. 3	Apr. 12	Apr. 25
5 years in 10 later than--	Mar. 24	Apr. 4	Apr. 15
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 27	Oct. 18	Oct. 7
2 years in 10 earlier than--	Nov. 2	Oct. 23	Oct. 12
5 years in 10 earlier than--	Nov. 12	Nov. 1	Oct. 20

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-84 at Marshfield, Missouri)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	207	191	170
8 years in 10	216	198	176
5 years in 10	233	210	188
2 years in 10	249	223	199
1 year in 10	258	230	205

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
02B	Celt silt loam, 2 to 5 percent slopes	3,750	1.1
03C	Wilderness cherty silt loam, 2 to 9 percent slopes	28,000	8.1
04	Bado silt loam	750	0.2
05	Gerald silt loam	2,250	0.6
06B	Hoberg silt loam, 2 to 5 percent slopes	9,500	2.7
07B	Lebanon silt loam, 2 to 5 percent slopes	20,250	5.8
08B	Viraton silt loam, 2 to 5 percent slopes	29,750	8.6
08C	Viraton silt loam, 5 to 9 percent slopes	20,250	5.8
09B	Hobson silt loam, 2 to 5 percent slopes	5,300	1.5
09C	Hobson loam, 5 to 9 percent slopes	2,350	0.7
14G	Gepp-Goss-Bardley complex, 5 to 50 percent slopes	34,000	9.8
17D	Gepp-Goss very cherty silt loams, 5 to 14 percent slopes	10,400	3.0
18D	Gasconade-Rock outcrop complex, 2 to 14 percent slopes	1,450	0.4
18G	Gasconade-Rock outcrop complex, 14 to 60 percent slopes	6,500	1.9
20C	Ocie-Goss-Gatewood complex, 5 to 9 percent slopes	31,500	9.1
20E	Ocie-Goss-Gatewood complex, 9 to 25 percent slopes	55,000	15.8
24E	Goss very cherty silt loam, 5 to 20 percent slopes, very stony	13,000	3.7
25C	Goss-Wilderness cherty silt loams, 3 to 9 percent slopes	4,068	1.2
33C	Eldon-Keeno cherty silt loams, 3 to 14 percent slopes	6,900	2.0
42B	Peridge silt loam, 1 to 5 percent slopes	6,400	1.8
42C	Peridge silt loam, 5 to 9 percent slopes	1,950	0.6
51B	Claiborne silt loam, 2 to 5 percent slopes	2,050	0.6
51C2	Claiborne silt loam, 5 to 9 percent slopes, eroded	3,550	1.0
52B	Hartville silt loam, 1 to 4 percent slopes	990	0.3
55A	Nolin silt loam, 1 to 3 percent slopes	1,450	0.4
59A	Racket silt loam, loamy substratum, 1 to 3 percent slopes	16,800	4.8
62B	Sampsel silt loam, 2 to 5 percent slopes	8,400	2.4
64A	Cedargap cherty silt loam, 0 to 3 percent slopes	3,900	1.1
65	Cedargap silt loam	8,500	2.5
69	Dunning silty clay loam	2,100	0.6
72D	Bolivar-Basehor loams, 3 to 14 percent slopes	5,400	1.6
	Water	870	0.3
	Total	347,328	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
07B	Lebanon silt loam, 2 to 5 percent slopes
42B	Peridge silt loam, 1 to 5 percent slopes
51B	Claiborne silt loam, 2 to 5 percent slopes
52B	Hartville silt loam, 1 to 4 percent slopes
55A	Nolin silt loam, 1 to 3 percent slopes (where protected from flooding or not frequently flooded during the growing season)
59A	Racket silt loam, loamy substratum, 1 to 3 percent slopes (where protected from flooding or not frequently flooded during the growing season)
62B	Sampsel silt loam, 2 to 5 percent slopes (where drained)
65	Cedargap silt loam (where protected from flooding or not frequently flooded during the growing season)
69	Dunning silty clay loam (where drained and either protected from flooding or not frequently flooded during the growing season)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Tall fescue hay	Orchardgrass hay	Tall fescue-red clover hay	Alfalfa hay	Switchgrass pasture	Caucasian bluestem pasture*	Little bluestem pasture
		Tons	Tons	Tons	Tons	Tons	Tons	Tons
02B------------- Celt	IIIe	2.5	1.5	2.5	---	5.0	5.0	3.0
03C------------- Wilderness	IVs	2.0	1.5	2.0	2.0	4.5	5.0	4.0
04-------------- Bado	IIIw	2.0	1.0	2.0	---	4.0	4.0	---
05-------------- Gerald	IIIw	2.0	1.5	2.0	---	4.0	4.0	---
06B------------- Hoberg	IIIe	3.0	2.5	3.0	4.0	5.0	5.0	4.0
07B------------- Lebanon	IIe	3.0	2.0	3.0	3.5	5.0	5.0	4.0
08B------------- Viraton	IIIe	3.0	2.0	3.0	3.0	4.5	5.0	3.5
08C------------- Viraton	IIIe	3.0	2.0	3.0	3.0	4.5	5.0	3.5
09B------------- Hobson	IIe	3.0	2.0	3.0	2.5	4.5	5.0	3.5
09C------------- Hobson	IIIe	3.0	2.0	3.0	2.5	4.5	5.0	3.5
14G------------- Gepp-Goss-Bardley	VIIe	2.5	1.5	---	---	3.0	4.0	3.0
17D------------- Gepp-Goss	VIe	2.5	1.5	2.5	2.5	4.0	4.0	3.0
18D------------- Gasconade-Rock outcrop	VIs	1.0	0.5	---	---	1.5	2.0	1.5
18G------------- Gasconade-Rock outcrop	VIIs	---	---	---	---	1.5	2.0	1.5
20C------------- Ocie-Goss-Gatewood	IVe	3.0	2.5	3.0	3.0	4.0	5.0	4.0
20E------------- Ocie-Goss-Gatewood	VIIe	2.5	2.0	2.5	---	4.0	5.0	4.0
24E------------- Goss	VIs	---	---	---	---	3.5	3.5	3.0

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Tall fescue hay	Orchardgrass hay	Tall fescue-red clover hay	Alfalfa hay	Switchgrass pasture	Caucasian bluestem pasture*	Little bluestem pasture
		Tons	Tons	Tons	Tons	Tons	Tons	Tons
25C------------- Goss-Wilderness	IVe	2.5	1.5	2.5	3.0	4.0	4.0	3.0
33C------------- Eldon-Keeno	IVe	2.5	2.0	2.5	3.0	4.0	4.0	3.5
42B------------- Peridge	IIe	3.0	3.0	3.5	5.5	5.0	6.0	5.0
42C------------- Peridge	IIIe	3.0	2.5	3.0	5.0	4.5	5.5	4.5
51B------------- Claiborne	IIe	3.0	3.0	3.5	5.0	5.0	6.0	5.5
51C2------------ Claiborne	IIIe	3.0	2.5	3.0	4.5	4.5	5.5	4.5
52B------------- Hartville	IIe	3.0	2.5	3.0	---	5.0	6.0	3.5
55A------------- Nolin	IIw	3.0	2.5	3.0	5.0	5.0	6.0	4.5
59A------------- Racket	IIw	3.0	2.5	3.0	5.0	5.0	6.0	4.5
62B------------- Sampsel	IIe	2.5	2.0	2.5	---	5.0	5.0	---
64A, 65--------- Cedargap	IIIw	3.0	2.5	3.0	3.0	5.0	5.0	4.0
69-------------- Dunning	IIIw	2.0	1.5	1.5	---	4.0	4.0	---
72D------------- Bolivar-Basehor	VIe	1.5	1.0	1.5	---	3.0	3.0	3.0

* Similar yields can be expected for big bluestem and indiangrass.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

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

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
02B------------- Celt	3D	Slight	Slight	Slight	Moderate	Black oak----------- Post oak------------ Blackjack oak--------	60 --- ---	43 --- ---	Shortleaf pine, post oak, black oak.
03C------------- Wilderness	3D	Slight	Slight	Moderate	Moderate	White oak----------- Black oak-----------	55 ---	38 ---	White oak, shortleaf pine, black oak.
04-------------- Bado	2W	Slight	Severe	Moderate	Moderate	White oak----------- Black oak----------- Post oak------------	48 52 50	32 36 34	Black oak, pin oak, green ash.
06B------------- Hoberg	3D	Slight	Slight	Slight	Moderate	White oak----------- Black oak----------- Shortleaf pine------	60 --- ---	43 --- ---	White oak, shortleaf pine, black oak.
07B------------- Lebanon	3D	Slight	Slight	Slight	Moderate	White oak----------- Black oak----------- Shortleaf pine------	55 60 ---	38 38 ---	Shortleaf pine, white oak, black oak.
08B, 08C-------- Viraton	3D	Slight	Slight	Moderate	Moderate	White oak----------- Black oak----------- Shortleaf pine------	55 60 ---	38 43 ---	White oak, black oak, shortleaf pine.
09B, 09C-------- Hobson	3D	Slight	Slight	Moderate	Moderate	White oak----------- Black oak----------- Shortleaf pine------	55 60 ---	38 43 ---	Shortleaf pine, white oak, black oak.
14G:									
Gepp-----------	3R	Moderate	Moderate	Slight	Slight	White oak----------- Shortleaf pine------ Black oak----------- Northern red oak----	65 67 67 67	48 49 49 49	White oak, shortleaf pine, black oak.
Goss-----------	3R	Moderate	Moderate	Moderate	Slight	White oak----------- Shortleaf pine------ Post oak------------ Blackjack oak------- Black oak-----------	60 --- --- --- ---	43 --- --- --- ---	Shortleaf pine, northern red oak, white ash.
Bardley--------	2R	Moderate	Moderate	Moderate	Moderate	Post oak------------	45	30	Shortleaf pine, black oak.
17D:									
Gepp-----------	3A	Slight	Slight	Slight	Slight	White oak----------- Shortleaf pine------ Black oak----------- Northern red oak----	65 67 67 67	48 49 49 49	White oak, shortleaf pine, black oak.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Common trees	Site index	Volume*	
17D:									
Goss-----------	3F	Slight	Moderate	Moderate	Slight	White oak-----------	60	43	Shortlead pine, northern red oak, white ash.
						Shortleaf pine------	---	---	
						Post oak------------	---	---	
						Blackjack oak-------	---	---	
						Black oak-----------	---	---	
18D:									
Gasconade------	2D	Slight	Moderate	Severe	Severe	Chinkapin oak-------	40	26	Eastern redcedar, shortleaf pine.
						Eastern redcedar----	30	32	
						Mockernut hickory---	---	---	
						Post oak------------	---	---	
						Blackjack oak-------	---	---	
Rock outcrop.									
18G:									
Gasconade------	2R	Slight	Severe	Severe	Severe	Chinkapin oak-------	40	26	Eastern redcedar.
						Eastern redcedar----	30	32	
						Mockernut hickory---	---	---	
						Post oak------------	---	---	
						Blackjack oak-------	---	---	
Rock outcrop.									
20C:									
Ocie-----------	3A	Slight	Slight	Slight	Slight	White oak-----------	57	40	Shortleaf pine, northern red oak.
						Black oak-----------	58	41	
						Northern red oak----	---	---	
Goss-----------	3F	Slight	Moderate	Moderate	Slight	White oak-----------	60	43	Shortleaf pine, northern red oak, white ash.
						Shortleaf pine------	---	---	
						Post oak------------	---	---	
						Blackjack oak-------	---	---	
						Black oak-----------	---	---	
Gatewood-------	2A	Slight	Slight	Slight	Slight	White oak-----------	45	30	Black oak, shortleaf pine.
						Eastern redcedar----	---	---	
20E:									
Ocie-----------	3R	Moderate	Moderate	Slight	Slight	White oak-----------	57	40	Shortleaf pine, northern red oak.
						Black oak-----------	58	41	
						Northern red oak----	---	---	
Goss-----------	3R	Moderate	Moderate	Moderate	Slight	White oak-----------	60	43	Shortleaf pine, northern red oak, white ash.
						Shortleaf pine------	---	---	
						Post oak------------	---	---	
						Blackjack oak-------	---	---	
						Black oak-----------	---	---	
Gatewood-------	2R	Moderate	Moderate	Moderate	Slight	White oak-----------	45	30	Black oak, shortleaf pine.
						Eastern redcedar----	---	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
24E------------- Goss	3X	Slight	Moderate	Moderate	Slight	White oak-----------	60	43	Shortleaf pine, northern red oak, white ash.
						Post oak------------	---	---	
						Blackjack oak-------	---	---	
						Black oak-----------	---	---	
						Shortleaf pine------	---	---	
25C: Goss-----------	3F	Slight	Slight	Moderate	Slight	White oak-----------	60	43	Shortleaf pine, northern red oak, white ash.
						Shortleaf pine------	---	---	
						Post oak------------	---	---	
						Blackjack oak-------	---	---	
						Black oak-----------	---	---	
Wilderness-----	3D	Slight	Slight	Moderate	Moderate	White oak-----------	55	38	White oak, shortleaf pine, black oak.
						Black oak-----------	---	---	
42B, 42C-------- Peridge	4A	Slight	Slight	Slight	Slight	Northern red oak----	70	52	Shortleaf pine, northern red oak.
						Shortleaf pine------	70	52	
						Black walnut--------	---	---	
						White oak-----------	---	---	
51B, 51C2------- Claiborne	4A	Slight	Slight	Slight	Slight	Northern red oak----	70	52	Black walnut, shortleaf pine, northern red oak.
						Shortleaf pine------	---	---	
						White oak-----------	70	52	
						Black oak-----------	70	52	
52B------------- Hartville	3C	Slight	Slight	Severe	Severe	White oak-----------	55	38	Eastern cottonwood, white oak, pin oak.
55A------------- Nolin	8W	Slight	Moderate	Slight	Slight	Eastern cottonwood--	97	120	Eastern cottonwood, green ash, pin oak.
						Cherrybark oak------	---	---	
						American sycamore---	---	---	
59A------------- Racket	5A	Slight	Slight	Slight	Slight	Black walnut--------	72	54	Black walnut.
						Northern red oak----	---	---	
						American sycamore---	---	---	
						Black cherry--------	---	---	
						White oak-----------	---	---	
64A------------- Cedargap	3F	Slight	Slight	Moderate	Slight	Black oak-----------	66	48	Black oak, black walnut, shortleaf pine.
65-------------- Cedargap	3A	Slight	Slight	Slight	Slight	Black oak-----------	66	48	Black oak, black walnut, shortleaf pine.
69-------------- Dunning	5W	Slight	Severe	Severe	Severe	Pin oak-------------	95	77	Pin oak, American sycamore.
						Eastern cottonwood--	100	128	
						American sycamore---	---	---	
						Boxelder------------	---	---	
						Black willow--------	---	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
72D:									
Bolivar--------	3D	Slight	Slight	Slight	Moderate	White oak-----------	57	40	White oak, white ash, shortleaf pine.
						Black oak-----------	---	---	
						Northern red oak----	---	---	
						Black walnut--------	---	---	
Basehor--------	2D	Slight	Slight	Moderate	Severe	Northern red oak----	40	26	Shortleaf pine.
						White oak-----------	---	---	
						Hackberry-----------	---	---	
						Green ash-----------	---	---	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

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

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
02B Celt	Lilac	Amur maple, Amur honeysuckle, autumn olive, Manchurian crabapple.	Eastern redcedar, green ash, Russian olive, hackberry, jack pine, Austrian pine.	Honeylocust	---
03C Wilderness	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Honeylocust, Austrian pine, hackberry, eastern redcedar, green ash, bur oak, Russian olive.	Siberian elm	---
04 Bado	Lilac	Manchurian crabapple, autumn olive, Amur honeysuckle, Amur maple.	Hackberry, Austrian pine, green ash, Russian olive, jack pine, eastern redcedar.	Honeylocust	---
05 Gerald	Lilac	Manchurian crabapple, Amur honeysuckle, Amur maple, autumn olive.	Eastern redcedar, Austrian pine, hackberry, green ash, jack pine, Russian olive.	Honeylocust	---
06B Hoberg	Lilac	Manchurian crabapple, Amur honeysuckle, Amur maple, autumn olive.	Eastern redcedar, Austrian pine, hackberry, green ash, jack pine, Russian olive.	Honeylocust	---
07B Lebanon	Lilac	Amur honeysuckle, Amur maple, autumn olive, Manchurian crabapple.	Austrian pine, eastern redcedar, jack pine, green ash, Russian olive, hackberry.	Honeylocust	---
08B, 08C Viraton	Lilac	Manchurian crabapple, Amur honeysuckle, Amur maple, autumn olive.	Eastern redcedar, Austrian pine, hackberry, green ash, jack pine, Russian olive.	Honeylocust	---
09B, 09C Hobson	Lilac	Amur honeysuckle, Amur maple, Manchurian crabapple, autumn olive.	Hackberry, jack pine, Russian olive, Austrian pine, eastern redcedar, green ash.	Honeylocust	---
14G: Gepp.					

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
14G:					
Goss	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian olive.	Siberian elm	---
Bardley	Lilac, fragrant sumac, Amur honeysuckle.	Autumn olive	Russian olive, hackberry, eastern redcedar, bur oak, green ash, Austrian pine, honeylocust.	Siberian elm	---
17D:					
Gepp.					
Goss	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian olive.	Siberian elm	---
18D, 18G:					
Gasconade.					
Rock outcrop.					
20C, 20E:					
Ocie	Lilac, Amur honeysuckle, fragrant sumac.	Autumn olive	Russian olive, green ash, honeylocust, bur oak, eastern redcedar, hackberry, Austrian pine.	Siberian elm	---
Goss	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian olive.	Siberian elm	---
Gatewood	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Russian olive, eastern redcedar, hackberry, bur oak, green ash, Austrian pine.	Honeylocust, Siberian elm.	---
24E Goss	Fragrant sumac, lilac, Amur honeysuckle.	Autumn olive	Eastern redcedar, hackberry, Russian olive, bur oak, green ash, Austrian pine, honeylocust.	Siberian elm	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
25C:					
Goss	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian olive.	Siberian elm	---
Wilderness	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Honeylocust, Austrian pine, hackberry, eastern redcedar, green ash, bur oak, Russian olive.	Siberian elm	---
33C:					
Eldon	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Green ash, hackberry, honeylocust, bur oak, Russian olive, Austrian pine, eastern redcedar.	Siberian elm	---
Keeno	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian olive.	Siberian elm	---
42B, 42C Peridge	---	Amur honeysuckle, lilac, Amur maple, autumn olive.	Eastern redcedar, Russian olive, hackberry.	Norway spruce, green ash, honeylocust, pin oak, eastern white pine.	---
51B, 51C2 Claiborne	---	Amur honeysuckle, lilac, Amur maple, autumn olive.	Eastern redcedar, Russian olive, hackberry.	Norway spruce, green ash, honeylocust, pin oak, eastern white pine.	---
52B Hartville	Lilac	Amur honeysuckle, Amur maple, autumn olive, Manchurian crabapple.	Austrian pine, hackberry, green ash, jack pine, Russian olive, eastern redcedar.	Honeylocust	---
55A Nolin	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, blue spruce, northern whitecedar, white fir, Austrian pine.	Norway spruce	Pin oak, eastern white pine.
59A. Racket					

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
62B Sampsel	Lilac	Amur maple, Manchurian crabapple, Amur honeysuckle, Russian olive, autumn olive.	Eastern redcedar, green ash, hackberry, Austrian pine, jack pine.	Honeylocust	---
64A, 65 Cedargap	---	Amur maple, Amur honeysuckle, autumn olive, lilac.	Eastern redcedar	Hackberry, Austrian pine, eastern white pine, green ash, honeylocust, pin oak.	Eastern cottonwood.
69. Dunning					
72D:					
Bolivar	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Green ash, hackberry, bur oak, Russian olive, Austrian pine, eastern redcedar.	Siberian elm, honeylocust.	---
Basehor.					

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
02B Celt	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: wetness.	Moderate: wetness.
03C Wilderness	Severe: wetness.	Moderate: wetness, small stones.	Severe: slope, small stones, wetness.	Moderate: wetness.	Severe: droughty.
04 Bado	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
05 Gerald	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, droughty.
06B Hoberg	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
07B Lebanon	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, droughty.
08B Viraton	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Severe: erodes easily.	Moderate: wetness.
08C Viraton	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: wetness.
09B Hobson	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness.
09C Hobson	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: wetness.
14G:					
Gepp	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, slope.
Goss	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.
Bardley	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, slope.
17D:					
Gepp	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
17D:					
Goss	Moderate: slope.	Moderate: slope.	Severe: slope, small stones.	Slight	Severe: droughty.
18D:					
Gasconade	Severe: thin layer.	Severe: thin layer.	Severe: large stones, slope, thin layer.	Moderate: large stones.	Severe: large stones, thin layer.
Rock outcrop.					
18G:					
Gasconade	Severe: large stones, thin layer, slope.	Severe: large stones, thin layer, slope.	Severe: large stones, slope, thin layer.	Severe: large stones, slope.	Severe: large stones, slope, thin layer.
Rock outcrop.					
20C:					
Ocie	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Slight	Severe: small stones.
Goss	Slight	Slight	Severe: slope, small stones.	Slight	Severe: droughty.
Gatewood	Moderate: large stones.	Moderate: large stones.	Severe: slope, large stones.	Slight	Moderate: small stones.
20E:					
Ocie	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Moderate: slope.	Severe: small stones, slope.
Goss	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: droughty, slope.
Gatewood	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Moderate: slope.	Severe: slope.
24E Goss	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: large stones.	Severe: large stones, droughty.
25C:					
Goss	Slight	Slight	Severe: slope, small stones.	Slight	Severe: droughty.
Wilderness	Severe: wetness.	Moderate: wetness, small stones.	Severe: slope, small stones, wetness.	Moderate: wetness.	Severe: droughty.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
33C:					
Eldon	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, large stones, slope.
Keeno	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Moderate: large stones, wetness.	Severe: small stones, large stones, droughty.
42B Peridge	Slight	Slight	Moderate: slope.	Slight	Slight.
42C Peridge	Slight	Slight	Severe: slope.	Slight	Slight.
51B Claiborne	Slight	Slight	Moderate: small stones.	Slight	Moderate: small stones.
51C2 Claiborne	Slight	Slight	Severe: slope.	Slight	Moderate: small stones.
52B Hartville	Severe: flooding.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, flooding.
55A Nolin	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
59A Racket	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
62B Sampsel	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, erodes easily.	Severe: wetness.
64A Cedargap	Severe: flooding, small stones.	Severe: small stones.	Severe: small stones, flooding.	Severe: small stones.	Severe: small stones, flooding.
65 Cedargap	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
69 Dunning	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
72D:					
Bolivar	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, thin layer, area reclaim.
Basehor	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Slight	Severe: thin layer, area reclaim.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
02B Celt	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
03C Wilderness	Poor	Poor	Very poor.	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
04 Bado	Fair	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
05 Gerald	Fair	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
06B Hoberg	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
07B Lebanon	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
08B, 08C Viraton	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
09B, 09C Hobson	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
14G:										
Gepp	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Goss	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Bardley	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
17D:										
Gepp	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Goss	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
18D, 18G:										
Gasconade	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
20C:										
Ocie	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Goss	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Gatewood	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
20E:										
Ocie	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
20E:										
Goss	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Gatewood	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
24E Goss	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
25C:										
Goss	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Wilderness	Poor	Poor	Very poor.	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
33C:										
Eldon	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Keeno	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.
42B Peridge	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
42C Peridge	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
51B Claiborne	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
51C2 Claiborne	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
52B Hartville	Fair	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
55A Nolin	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Fair	Very poor.
59A Racket	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
62B Sampsel	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
64A, 65 Cedargap	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
69 Dunning	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
72D:										
Bolivar	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Basehor	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
02B: Celt	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
03C: Wilderness	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Severe: droughty.
04: Bado	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
05: Gerald	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
06B: Hoberg	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
07B: Lebanon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength.	Moderate: wetness, droughty.
08B: Viraton	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness.
08C: Viraton	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness, frost action.	Moderate: wetness.
09B: Hobson	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness.
09C: Hobson	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness, frost action.	Moderate: wetness.
14G:						
Gepp	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: small stones, slope.
Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Bardley	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: small stones, slope.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
17D:						
Gepp	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Severe: small stones.
Goss	Moderate: too clayey, large stones, slope.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Severe: droughty.
18D:						
Gasconade	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, thin layer.
Rock outcrop.						
18G:						
Gasconade	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, slope, thin layer.
Rock outcrop.						
20C:						
Ocie	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: small stones.
Goss	Moderate: too clayey, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, slope, large stones.	Moderate: shrink-swell, frost action.	Severe: droughty.
Gatewood	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: small stones.
20E:						
Ocie	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: small stones, slope.
Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Gatewood	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
24E: Goss	Moderate: too clayey, large stones, slope.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Severe: large stones, droughty.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
25C:						
Goss	Moderate: too clayey, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, large stones.	Moderate: shrink-swell, slope, large stones.	Moderate: shrink-swell, frost action.	Severe: droughty.
Wilderness	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Severe: droughty.
33C:						
Eldon	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: small stones, large stones, slope.
Keeno	Severe: wetness.	Moderate: wetness, slope, large stones.	Severe: wetness.	Severe: slope.	Moderate: wetness, slope, frost action.	Severe: small stones, large stones, droughty.
42B Peridge	Moderate: too clayey.	Slight	Slight	Slight	Severe: low strength.	Slight.
42C Peridge	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
51B Claiborne	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: small stones.
51C2 Claiborne	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: small stones.
52B Hartville	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Moderate: wetness, flooding.
55A Nolin	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
59A Racket	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
62B Sampsel	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
64A Cedargap	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: small stones, flooding.
65 Cedargap	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
69---------------- Dunning	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
72D:						
Bolivar----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, shrink-swell.	Moderate: slope, thin layer, area reclaim.
Basehor----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: thin layer, area reclaim.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "poor," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
02B----------------- Celt	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack, small stones.
03C----------------- Wilderness	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, small stones.
04------------------ Bado	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: wetness, thin layer.
05------------------ Gerald	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
06B----------------- Hoberg	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
07B----------------- Lebanon	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, small stones.
08B----------------- Viraton	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, small stones.
08C----------------- Viraton	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, small stones.
09B----------------- Hobson	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, small stones.
09C----------------- Hobson	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, small stones.
14G:					
Gepp----------------	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Goss----------------	Severe: slope.	Severe: seepage, slope.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, small stones, slope.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
14G:					
Bardley	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, too clayey, hard to pack.
17D:					
Gepp	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Goss	Moderate: percs slowly, slope, large stones.	Severe: seepage, slope, large stones.	Severe: too clayey, large stones.	Moderate: slope.	Poor: too clayey, small stones.
18D:					
Gasconade	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, too clayey, large stones.
Rock outcrop.					
18G:					
Gasconade	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, too clayey, large stones.
Rock outcrop.					
20C:					
Ocie	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, hard to pack.
Goss	Moderate: percs slowly, large stones.	Severe: seepage, slope, large stones.	Severe: too clayey, large stones.	Slight	Poor: too clayey, small stones.
Gatewood	Severe: thin layer, seepage, percs slowly.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
20E:					
Ocie	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Goss	Severe: slope.	Severe: seepage, slope, large stones.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, small stones, slope.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
20E: Gatewood	Severe: thin layer, seepage, percs slowly.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, slope, seepage.	Severe: slope.	Poor: area reclaim, too clayey, hard to pack.
24E Goss	Moderate: percs slowly, slope, large stones.	Severe: seepage, slope, large stones.	Severe: too clayey, large stones.	Moderate: slope.	Poor: too clayey, small stones.
25C: Goss	Moderate: percs slowly, large stones.	Severe: seepage.	Severe: too clayey, large stones.	Slight	Poor: too clayey, small stones.
Wilderness	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, small stones.
33C: Eldon	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Keeno	Severe: wetness, percs slowly.	Severe: seepage, slope, wetness.	Severe: wetness, large stones.	Severe: seepage.	Poor: small stones.
42B Peridge	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
42C Peridge	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
51B Claiborne	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
51C2 Claiborne	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
52B Hartville	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
55A Nolin	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey.
59A Racket	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Fair: too clayey.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
62B----------------- Sampsel	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
64A, 65------------- Cedargap	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: small stones.
69------------------ Dunning	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
72D:					
Bolivar------------	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: seepage, slope.	Poor: area reclaim, thin layer.
Basehor------------	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, thin layer.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
02B: Celt	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
03C: Wilderness	Fair: large stones, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
04: Bado	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
05: Gerald	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
06B: Hoberg	Fair: thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
07B: Lebanon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
08B, 08C: Viraton	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
09B, 09C: Hobson	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
14G:				
Gepp	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Goss	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Bardley	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
17D:				
Gepp	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
17D:				
Goss	Fair: shrink-swell, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
18D, 18G:				
Gasconade	Poor: area reclaim, large stones, thin layer.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, thin layer.
Rock outcrop.				
20C:				
Ocie	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
Goss	Fair: shrink-swell, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Gatewood	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
20E:				
Ocie	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
Goss	Fair: shrink-swell, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Gatewood	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
24E Goss	Fair: shrink-swell, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
25C:				
Goss	Fair: shrink-swell, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Wilderness	Fair: large stones, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
33C:				
Eldon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
33C:				
Keeno	Fair: large stones, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
42B, 42C Peridge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
51B, 51C2 Claiborne	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
52B Hartville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
55A Nolin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
59A Racket	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
62B Sampsel	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
64A, 65 Cedargap	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
69 Dunning	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
72D:				
Bolivar	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
Basehor	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, thin layer.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
02B Celt	Moderate: seepage, slope.	Severe: hard to pack.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, rooting depth, percs slowly.
03C Wilderness	Moderate: slope, seepage.	Moderate: large stones, wetness.	Large stones, slope, percs slowly.	Slope, large stones, wetness.	Large stones, wetness, rooting depth.	Large stones, wetness, rooting depth.
04 Bado	Slight	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
05 Gerald	Slight	Moderate: piping, wetness.	Percs slowly, frost action.	Wetness, droughty.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, droughty.
06B Hoberg	Moderate: seepage, slope.	Moderate: thin layer, large stones, wetness.	Percs slowly, large stones, slope.	Slope, wetness, droughty.	Large stones, erodes easily, wetness.	Large stones, wetness, erodes easily.
07B Lebanon	Moderate: slope.	Severe: hard to pack.	Percs slowly, slope.	Slope, wetness, droughty.	Erodes easily, wetness.	Wetness, erodes easily.
08E, 08C Viraton	Moderate: seepage, slope.	Moderate: piping, wetness.	Percs slowly, slope.	Slope, wetness, droughty.	Erodes easily, wetness.	Erodes easily, droughty.
09B, 09C Hobson	Moderate: seepage, slope.	Moderate: wetness.	Percs slowly, slope.	Slope, wetness.	Erodes easily, wetness.	Erodes easily, rooting depth.
14G:						
Gepp	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
Goss	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Bardley	Severe: slope.	Severe: piping, hard to pack.	Deep to water	Slope, droughty, thin layer.	Slope, depth to rock, area reclaim.	Slope, droughty, depth to rock.
17D:						
Gepp	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
Goss	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
18D:						
Gasconade	Severe: depth to rock, seepage.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, droughty.	Large stones, depth to rock.	Large stones, droughty.
Rock outcrop.						
18G:						
Gasconade	Severe: depth to rock, seepage, slope.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
20C:						
Ocie	Moderate: depth to rock, slope.	Moderate: thin layer, hard to pack, large stones.	Deep to water	Slope, droughty, percs slowly.	Large stones	Large stones.
Goss	Moderate: seepage, slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Large stones	Large stones, droughty.
Gatewood	Moderate: depth to rock, seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty, percs slowly.	Large stones, depth to rock.	Large stones, depth to rock.
20E:						
Ocie	Severe: slope.	Moderate: thin layer, hard to pack, large stones.	Deep to water	Slope, droughty, percs slowly.	Slope, large stones.	Large stones, slope.
Goss	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Gatewood	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, percs slowly.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
24E Goss	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
25C:						
Goss	Moderate: seepage, slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Large stones	Large stones, droughty.
Wilderness	Moderate: slope, seepage.	Moderate: large stones, wetness.	Large stones, slope, percs slowly.	Slope, large stones, wetness.	Large stones, wetness, rooting depth.	Large stones, wetness, rooting depth.
33C:						
Eldon	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
33C:						
Keeno	Severe: seepage, slope.	Severe: large stones.	Percs slowly, large stones, slope.	Slope, large stones, wetness.	Slope, large stones, wetness.	Large stones, slope, droughty.
42B Peridge	Moderate: seepage.	Moderate: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
42C Peridge	Moderate: seepage.	Moderate: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
51B, 51C2 Claiborne	Moderate: seepage, slope.	Moderate: piping, thin layer.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
52B Hartville	Slight	Moderate: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
55A Nolin	Severe: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.
59A Racket	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
62B Sampsel	Moderate: slope.	Severe: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
64A Cedargap	Moderate: seepage.	Severe: piping.	Deep to water	Droughty, flooding.	Large stones	Large stones.
65 Cedargap	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
69 Dunning	Slight	Severe: wetness.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
72D:						
Bolivar	Severe: slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim.	Slope, area reclaim.
Basehor	Severe: depth to rock, seepage, slope.	Severe: piping, thin layer.	Deep to water	Slope, soil blowing, thin layer.	Slope, depth to rock, area reclaim.	Slope, depth to rock, area reclaim.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated. Some soils may have Unified classifications and USDA textures in addition to those shown. In general, the dominant classifications and textures are shown)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
02B------------- Celt	0-10	Silt loam--------	CL-ML, ML	A-4	0-5	100	95-100	90-100	70-90	<25	NP-6
	10-24	Silty clay loam, silty clay, clay.	CL, CH	A-7	0-5	85-100	80-100	75-95	65-85	40-55	20-35
	24-30	Very cherty silty clay loam, gravelly silt loam.	CL-ML, CL, GC, GM-GC	A-2, A-4, A-6	0-10	35-75	30-75	30-75	25-70	25-35	5-15
	30-40	Extremely cherty silt loam, extremely cherty silty clay loam.	GC, GM-GC	A-4, A-6, A-2, A-1	0-10	25-55	20-50	20-50	15-45	25-40	5-20
	40-60	Very cherty clay, cherty clay, cherty silty clay.	CL, CH, GC, SC	A-7, A-2-7	0-5	35-75	30-75	30-70	25-65	45-60	30-45
03C------------- Wilderness	0-8	Cherty silt loam	SM-SC, SC, SP-SC, GC	A-1, A-4, A-2-4	0-10	60-85	50-75	20-50	10-40	20-30	5-10
	8-15	Very cherty silty clay loam, extremely cherty silty clay loam.	GC, GP-GC, SC, SP-SC	A-6, A-2-6	5-15	40-70	20-60	10-50	10-40	25-40	10-20
	15-33	Extremely cherty silt loam, very cherty silty clay loam.	GM-GC, GC, GP-GC	A-1, A-2-4, A-2-6	10-40	30-60	10-45	10-40	5-35	20-40	5-15
	33-60	Very cherty clay, extremely cherty clay, clay.	GC, GP-GC	A-2-6	10-40	30-60	10-45	10-40	5-35	25-40	15-25
04-------------- Bado	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	90-100	75-95	25-35	5-15
	9-26	Clay, silty clay	CL, CH	A-7	0	95-100	85-100	80-100	75-100	45-70	30-45
	26-49	Silt loam, silty clay loam, cherty silty clay loam.	CL	A-6, A-7	0	65-95	60-95	55-90	50-90	30-45	15-25
	49-66	Very cherty silty clay loam, very cherty silty clay.	CL, CH, SC, GC	A-6, A-7	0	55-75	40-70	35-70	35-70	35-60	20-35
05-------------- Gerald	0-9	Silt loam--------	CL	A-6	0-5	95-100	85-100	80-95	75-90	30-40	11-20
	9-27	Silty clay loam, silty clay, clay.	CL, CH	A-7	0-5	85-100	70-100	65-95	60-90	40-55	20-30
	27-38	Silt loam, silty clay loam, cherty silty clay loam.	SC, CL, GC	A-2-6, A-2-7, A-6, A-7	0-5	65-95	35-85	30-80	30-70	35-45	14-21
	38-50	Cherty clay, cherty silty clay, silty clay loam.	SC, CL, CH, GC	A-7	0-5	50-90	50-85	50-85	45-80	40-65	20-40
	50-60	Very cherty silty clay, extremely cherty silty clay.	GC	A-2-7, A-7	0-5	40-50	20-50	20-50	15-50	40-65	20-40

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
06B----------------- Hoberg	0-16	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	85-100	75-100	70-95	65-90	25-35	7-15
	16-24	Silt loam, silty clay loam, cherty silty clay loam.	SC, CL, GC	A-6	0-10	60-95	50-90	45-85	40-80	30-40	11-20
	24-48	Very cherty silty clay loam, very cherty silt loam.	GC, SC	A-2-6, A-6	0-40	40-85	35-65	20-50	20-45	30-40	11-20
	48-60	Very cherty clay, very cherty silty clay.	GC, SC, MH, CH	A-7, A-2-7	0-25	40-85	35-65	30-65	25-60	50-75	25-40
07B----------------- Lebanon	0-5	Silt loam--------	CL-ML, CL	A-4, A-6	0-5	85-100	85-100	80-95	60-75	22-35	5-15
	5-17	Silt loam, silty clay loam.	CL	A-6	0-5	85-95	80-95	75-95	60-75	30-40	11-20
	17-21	Silty clay loam, silty clay.	CL	A-7	0-5	85-95	70-95	65-90	55-75	40-50	20-30
	21-39	Cherty silty clay loam, extremely cherty silty clay loam.	CL, GC	A-2, A-6, A-7	0-10	55-75	30-75	25-70	20-55	35-45	15-20
	39-60	Very cherty silty clay, very cherty clay, silty clay.	CL, CH, SC, GC	A-7, A-2-7	0-10	65-95	30-90	25-90	20-85	45-80	25-45
08B, 08C--------- Viraton	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	90-100	75-100	70-95	60-75	20-30	5-11
	9-26	Silt loam, silty clay loam, cherty silty clay loam.	CL, GC, SC	A-4, A-6	0-5	55-100	50-100	50-95	45-75	25-35	8-15
	26-54	Very cherty silt loam, very cherty silty clay loam.	GC, CL, SC	A-2, A-4, A-6	0-15	25-70	20-70	20-65	20-55	25-35	8-15
	54-60	Very cherty clay, extremely cherty clay, extremely cherty silty clay.	GC	A-2, A-6, A-7	0-10	25-50	20-50	20-45	15-40	30-50	11-25
09B----------------- Hobson	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	90-100	90-100	70-100	65-90	20-30	5-12
	7-26	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6	0	85-100	85-100	70-95	35-75	25-40	8-15
	26-49	Cherty clay loam, sandy clay loam, fine sandy loam.	GM-GC, GC, CL, SM-SC	A-2, A-4, A-6, A-1	0-10	45-90	45-90	25-80	20-70	20-35	4-15
	49-60	Cherty clay, clay loam, cherty sandy clay loam.	GC, GP-GC	A-2	0-10	20-50	20-50	20-45	12-35	35-65	11-35
09C----------------- Hobson	0-7	Loam-------------	CL, CL-ML	A-4, A-6	0	90-100	90-100	70-100	65-90	20-30	5-12
	7-27	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6	0	85-100	85-100	70-95	35-75	25-40	8-15
	27-49	Cherty clay loam, sandy clay loam, fine sandy loam.	GM-GC, GC, CL, SM-SC	A-2, A-4, A-6, A-1	0-10	45-90	45-90	25-80	20-70	20-35	4-15
	49-60	Cherty clay, clay loam, cherty sandy clay loam.	GC, GP-GC	A-2	0-10	20-50	20-50	20-45	12-35	35-65	11-35

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
14G:											
Gepp------------	0-7	Very cherty silt loam.	GM, GC, SM-SC, SM	A-1, A-2	10-30	30-70	20-50	10-40	5-20	<30	NP-10
	7-9	Cherty silty clay loam, cherty silt loam, silty clay loam.	CL	A-6, A-4	0-15	65-100	65-100	55-95	51-90	25-40	8-20
	9-48	Clay-------------	MH, CH	A-7	0-5	90-100	90-100	85-100	80-95	51-75	25-40
	48-65	Clay, cherty clay	MH, CH	A-7	0-15	70-100	70-100	65-100	60-95	51-75	25-40
Goss------------	0-8	Cherty silt loam	ML, CL, CL-ML	A-4	0-10	65-85	65-75	65-75	65-75	20-30	2-10
	8-33	Very cherty silty clay loam, very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	33-65	Cherty silty clay loam, extremely cherty clay, very cherty clay.	GC, SC	A-7, A-2-7	10-45	45-70	20-65	20-50	20-45	50-70	30-40
Bardley---------	0-2	Very cherty loam	GC, CL, SC	A-6, A-2	0-15	40-90	30-75	30-70	25-65	30-40	10-20
	2-7	Extremely cherty silt loam, cherty silty clay loam.	GC, GP-GC	A-2	0-15	15-30	10-25	5-25	5-25	35-45	15-20
	7-24	Silty clay, clay, cherty clay.	GM, SM, MH	A-7	0-10	70-95	50-95	50-90	40-85	50-70	20-35
	24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
17D:											
Gepp------------	0-9	Very cherty silt loam.	GM, GC, SM-SC, SM	A-1, A-2	10-30	30-70	20-50	10-40	5-20	<30	NP-10
	9-12	Cherty silty clay loam, cherty silt loam, silty clay loam.	CL	A-6, A-4	0-15	65-100	65-100	55-95	51-90	25-40	8-20
	12-63	Clay-------------	MH, CH	A-7	0-5	90-100	90-100	85-100	80-95	51-75	25-40
Goss------------	0-3	Very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	3-17	Very cherty silty clay loam, very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	17-55	Cherty silty clay loam, cherty silty clay, very cherty clay.	GC, SC	A-7, A-2-7	10-45	45-70	20-65	20-50	20-45	50-70	30-40
	55-65	Silty clay, clay, cherty clay.	CL, CH	A-7	0-10	70-100	70-100	70-95	70-95	45-65	20-35

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
18D:											
Gasconade	0-4	Flaggy silty clay loam.	CL	A-6	20-50	75-90	70-85	60-75	55-65	30-40	15-25
	4-12	Flaggy silty clay, flaggy clay, very flaggy silty clay.	GC	A-2-7	20-70	45-55	40-50	30-40	20-35	55-65	35-45
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
18G:											
Gasconade	0-6	Very flaggy silty clay loam.	CL	A-6	50-80	75-90	70-85	60-75	55-65	30-40	15-25
	6-9	Flaggy silty clay, flaggy clay, very flaggy silty clay.	GC	A-2-7	20-70	45-55	40-50	30-40	20-35	55-65	35-45
	9	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
20C, 20E:											
Ocie	0-4	Cherty silt loam	CL-ML, CL, SC, SM-SC	A-4, A-1, A-2	0-15	40-75	40-70	30-65	20-60	<25	4-10
	4-11	Very cherty silt loam, very cherty loam, extremely cherty silt loam.	GC, GM-GC	A-2-4, A-2-6, A-1-b	5-20	40-55	20-50	20-45	15-35	20-30	5-15
	11-17	Very cherty silty clay loam, very cherty clay loam.	GC	A-2, A-6, A-7	10-30	40-55	20-50	20-45	15-40	35-50	15-30
	17-59	Cherty clay, clay, silty clay.	CH	A-7	0-15	70-95	65-90	65-90	60-80	50-70	30-40
	59	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Goss	0-9	Very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	9-20	Very cherty silty clay loam, cherty silty clay loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	20-66	Cherty silty clay loam, extremely cherty silty clay, very cherty clay.	GC, SC	A-7, A-2-7	10-45	45-70	20-65	20-50	20-45	50-70	30-40

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
20C, 20E: Gatewood	0-7	Very cherty silt loam.	SC, GC	A-4, A-6, A-2	15-30	30-80	20-70	15-65	10-60	25-35	7-15
	7-25	Cherty silty clay, cherty clay, clay.	CH	A-7	0-10	80-95	60-90	55-90	50-85	55-75	30-45
	25	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
24E Goss	0-3	Very cherty silt loam.	ML, CL, CL-ML	A-4	15-50	65-90	65-90	65-90	65-85	20-30	2-8
	3-21	Very cherty silt loam, very cherty silty clay loam.	GC	A-2-6	15-50	40-60	35-55	30-50	25-35	30-40	11-18
	21-60	Very cherty silty clay loam, extremely cherty clay.	GC	A-7, A-2-7	10-50	45-70	20-65	20-50	20-45	50-70	30-40
25C: Goss	0-8	Cherty silt loam	ML, CL, CL-ML	A-4	0-10	65-85	65-75	65-75	65-75	20-30	2-10
	8-20	Very cherty silty clay loam, very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	20-60	Cherty silty clay loam, extremely cherty clay, very cherty clay.	GC, SC	A-7, A-2-7	10-45	45-70	20-65	20-50	20-45	50-70	30-40
Wilderness	0-8	Cherty silt loam	SM-SC, SC, SP-SC, GC	A-1, A-4, A-2-4	0-10	60-85	50-75	20-50	10-40	20-30	5-10
	8-18	Very cherty silty clay loam, extremely cherty silty clay loam.	GC, GP-GC, SC, SP-SC	A-6, A-2-6	5-15	40-70	20-60	10-50	10-40	25-40	10-20
	18-40	Very cherty silt loam, extremely cherty silty clay loam.	GM-GC, GC, GP-GC	A-1, A-2-4, A-2-6	10-40	30-60	10-45	10-40	5-35	20-40	5-15
	40-60	Very cherty silty clay, very cherty clay, extremely cherty silty clay.	GC, GP-GC	A-2-6	10-40	30-60	10-45	10-40	5-35	25-40	15-25
33C: Eldon	0-9	Cherty silt loam	ML, CL-ML, CL	A-4	5-25	70-95	65-90	60-85	55-80	20-30	2-8
	9-19	Very cherty silty clay loam, cherty silty clay loam.	GC, CH, CL	A-2-7, A-7	5-15	40-60	30-55	20-55	20-55	40-60	20-30
	19-55	Very cherty silty clay, very cherty clay.	GC	A-2-7, A-7	0-10	35-55	30-50	25-50	25-50	40-60	25-45
	55-60	Silty clay, clay, cherty silty clay.	CL, CH, ML, MH	A-7	0-15	80-100	65-100	65-100	65-100	45-95	25-50

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
33C:											
Keeno-----------	0-10	Cherty silt loam	SM, GC, GM, SC	A-2-4, A-4	0-35	55-90	50-75	30-70	30-65	15-25	2-10
	10-28	Extremely cherty silty clay loam, very cherty silty clay loam.	GC, GM-GC, GP-GC	A-2-4, A-2-6, A-6, A-4	0-35	10-50	10-50	5-40	5-40	20-35	5-15
	28-44	Very cherty silt loam, extremely cherty silty clay loam.	GC, GP-GC	A-2, A-6, A-7	15-55	10-60	10-60	5-50	5-45	30-45	11-20
	44-60	Very cherty clay, clay, extremely cherty clay.	CL, CH, GC, SC	A-2-7, A-7	0-40	40-90	30-90	25-85	20-85	40-70	25-40
42B-------------- Peridge	0-6	Silt loam--------	ML, CL-ML	A-4	0	95-100	90-100	85-100	70-90	<25	3-7
	6-17	Silty clay loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	85-95	70-95	25-40	7-15
	17-60	Gravelly silty clay loam, silty clay loam.	CL	A-6	0	55-100	50-100	50-95	50-90	4-40	13-18
42C-------------- Peridge	0-6	Silt loam--------	ML, CL-ML	A-4	0	95-100	90-100	85-100	70-90	<25	3-7
	6-17	Silty clay loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	85-95	70-95	25-40	7-15
	17-45	Gravelly silty clay loam, silty clay loam.	CL	A-6	0	55-100	50-100	50-95	50-90	4-40	13-18
	45-60	Silty clay, cherty clay, gravelly silty clay.	CL, CH	A-7, A-6	0	55-100	50-100	50-95	50-95	35-60	13-28
51B, 51C2-------- Claiborne	0-13	Silt loam--------	ML, CL, CL-ML	A-4	0-5	85-100	70-95	65-90	55-80	24-35	4-10
	13-60	Silty clay loam, cherty silty clay loam.	CL	A-4, A-6	0-5	85-100	70-95	65-90	60-80	28-40	8-20
52B-------------- Hartville	0-14	Silt loam--------	ML, CL	A-4, A-6	0-5	95-100	95-100	80-95	70-90	30-40	7-15
	14-20	Silt loam, silty clay loam.	CL	A-6, A-7	0-10	95-100	95-100	90-98	85-95	35-45	20-25
	20-62	Silty clay, clay, silty clay loam.	CH	A-7	0-10	95-100	95-100	90-98	85-95	50-60	30-40
55A-------------- Nolin	0-15	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	15-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
59A-------------- Racket	0-12	Silt loam--------	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	55-85	25-35	5-12
	12-42	Silt loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	55-95	25-40	5-20
	42-66	Loam, fine sandy loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0	85-100	80-100	60-95	35-75	25-35	5-12
62B-------------- Sampsel	0-6	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	30-40	10-20
	6-70	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	95-100	95-100	52-75	35-47

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
64A---------------- Cedargap	0-9	Cherty silt loam	SM, GM	A-1, A-2-4, A-4	2-15	40-85	30-75	20-60	15-50	25-35	3-9
	9-34	Very cherty silty clay loam, extremely cherty loam, very cherty loam.	GC, GM-GC	A-2-4, A-2-6, A-1-b	5-20	25-50	20-45	15-40	15-35	20-35	5-20
	34-60	Very cherty silty clay loam, extremely cherty clay loam, extremely cherty loam.	GC	A-2-6	5-20	25-50	20-45	15-40	15-35	30-40	11-20
65---------------- Cedargap	0-7	Silt loam--------	ML	A-4	0-5	90-100	85-95	75-95	70-95	25-35	3-9
	7-29	Very cherty loam, cherty silt loam, cherty loam.	SM, GM, ML	A-1, A-2, A-4	2-15	40-85	25-75	25-70	20-65	25-35	3-9
	29-60	Very cherty silty clay loam, extremely cherty clay loam, extremely cherty loam.	GC	A-2-6	5-20	25-50	20-45	15-40	15-35	30-40	11-20
69---------------- Dunning	0-23	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	85-95	34-42	15-22
	23-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-5	90-100	70-100	60-100	60-100	45-70	20-40
72D: Bolivar----------	0-14	Loam--------------	ML	A-4	0	100	90-100	70-95	55-75	20-30	NP-5
	14-22	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-10	85-100	85-100	70-95	45-80	25-40	10-25
	22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Basehor----------	0-15	Loam--------------	ML, CL	A-4	0-15	80-100	80-100	70-95	50-75	<30	NP-10
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
02B	0-10	12-20	1.20-1.50	0.6-2.0	0.14-0.18	4.5-7.3	Low	0.43	4	.5-2
Celt	10-24	27-45	1.30-1.50	0.2-0.6	0.10-0.12	3.6-5.5	Moderate	0.32		
	24-30	20-32	1.60-1.90	<0.06	0.04-0.10	3.6-5.0	Low	0.24		
	30-40	20-32	1.60-1.90	<0.06	0.03-0.08	3.6-5.0	Low	0.24		
	40-60	40-55	1.30-1.50	0.6-2.0	0.06-0.12	3.6-5.0	Moderate	0.24		
03C	0-8	18-27	1.20-1.45	2.0-6.0	0.07-0.12	4.5-6.5	Low	0.28	2	.5-2
Wilderness	8-15	25-35	1.30-1.50	0.6-2.0	0.03-0.10	4.5-6.0	Low	0.28		
	15-33	20-35	1.70-2.00	0.06-0.2	0.01-0.05	3.6-5.5	Low	0.28		
	33-60	40-70	1.50-1.70	0.6-2.0	0.02-0.06	4.5-6.0	Moderate	0.28		
04	0-9	15-25	1.20-1.50	0.2-0.6	0.22-0.24	3.6-6.0	Low	0.43	3	.5-2
Bado	9-26	40-55	1.30-1.50	0.06-0.2	0.09-0.11	3.6-5.5	High	0.43		
	26-49	25-35	1.50-1.70	<0.06	0.07-0.10	3.6-5.5	Moderate	0.43		
	49-66	35-70	1.30-1.60	0.06-0.2	0.05-0.10	4.5-6.0	Moderate	0.43		
05	0-9	20-25	1.30-1.50	0.6-2.0	0.15-0.18	4.5-6.0	Low	0.37	3	.5-2
Gerald	9-27	35-45	1.40-1.60	<0.06	0.11-0.13	4.5-6.0	High	0.37		
	27-38	25-35	1.60-1.80	<0.06	0.01-0.05	4.5-5.5	Low	0.28		
	38-50	35-60	1.40-1.60	0.2-0.6	0.02-0.06	4.5-5.5	Moderate	0.28		
	50-60	40-60	1.35-1.50	0.2-0.6	0.02-0.06	4.5-5.5	Moderate	0.24		
06B	0-16	15-25	1.30-1.60	0.6-2.0	0.17-0.22	5.1-7.3	Low	0.37	4	1-3
Hoberg	16-24	20-30	1.50-1.70	0.6-2.0	0.12-0.15	5.1-6.5	Low	0.37		
	24-48	20-30	1.60-1.90	0.06-0.2	0.01-0.05	3.6-6.0	Low	0.28		
	48-60	40-75	1.10-1.40	0.2-0.6	0.04-0.10	3.6-6.0	Moderate	0.28		
07B	0-5	10-20	1.20-1.50	0.6-2.0	0.18-0.22	5.6-7.3	Low	0.43	4	.5-2
Lebanon	5-17	20-30	1.30-1.50	0.6-2.0	0.14-0.20	4.5-6.5	Low	0.43		
	17-21	35-45	1.30-1.50	0.2-0.6	0.13-0.20	4.5-5.5	Moderate	0.32		
	21-39	25-40	1.60-1.90	<0.06	0.06-0.10	4.5-5.5	Low	0.32		
	39-60	40-80	1.40-1.60	0.06-0.2	0.02-0.06	4.5-5.5	Moderate	0.32		
08B, 08C	0-9	15-25	1.30-1.50	0.6-2.0	0.18-0.22	4.5-7.3	Low	0.43	4	.5-2
Viraton	9-26	18-35	1.30-1.50	0.6-2.0	0.08-0.16	4.5-6.0	Low	0.43		
	26-54	18-30	1.60-1.90	<0.06	0.01-0.05	3.6-5.5	Low	0.32		
	54-60	30-60	1.10-1.40	0.2-0.6	0.06-0.10	4.5-7.3	Moderate	0.24		
09B	0-7	16-27	1.20-1.40	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.37	4	.5-2
Hobson	7-26	24-35	1.25-1.45	0.6-2.0	0.14-0.18	4.5-5.5	Moderate	0.37		
	26-49	16-32	1.60-1.90	0.06-0.2	0.06-0.10	4.5-5.5	Low	0.28		
	49-60	30-70	1.20-1.40	0.2-0.6	0.04-0.08	4.5-5.5	Moderate	0.24		
09C	0-7	16-27	1.20-1.40	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.37	4	.5-2
Hobson	7-27	24-35	1.25-1.45	0.6-2.0	0.14-0.18	4.5-5.5	Moderate	0.37		
	27-49	16-32	1.60-1.90	0.06-0.2	0.06-0.10	4.5-5.5	Low	0.28		
	49-60	30-70	1.20-1.40	0.2-0.6	0.04-0.08	4.5-5.5	Moderate	0.24		
14G:										
Gepp	0-7	10-25	1.25-1.45	0.6-2.0	0.06-0.12	5.1-6.5	Low	0.24	4	2-4
	7-9	25-40	1.20-1.40	0.6-2.0	0.10-0.22	4.5-6.0	Low	0.28		
	9-48	65-85	1.15-1.30	0.6-2.0	0.10-0.18	4.5-6.0	Moderate	0.28		
	48-65	65-85	1.15-1.30	0.6-2.0	0.08-0.18	5.1-6.5	Moderate	0.28		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
14G:										
Goss	0-8	10-27	1.10-1.30	2.0-6.0	0.06-0.17	4.5-6.5	Low	0.24	2	.5-2
	8-33	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low	0.10		
	33-65	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate	0.10		
Bardley	0-2	25-35	1.40-1.55	0.6-2.0	0.12-0.17	4.5-6.5	Moderate	0.28	3	.5-2
	2-7	25-35	1.40-1.55	0.6-2.0	0.04-0.08	4.5-6.5	Low	0.32		
	7-24	50-85	1.20-1.40	0.6-2.0	0.08-0.12	4.5-6.5	Moderate	0.28		
	24	---	---	---	---	---	-------------	----		
17D:										
Gepp	0-9	10-25	1.25-1.45	0.6-2.0	0.06-0.12	5.1-6.5	Low	0.24	4	2-4
	9-12	25-40	1.20-1.40	0.6-2.0	0.10-0.22	4.5-6.0	Low	0.28		
	12-63	65-85	1.15-1.30	0.6-2.0	0.10-0.18	4.5-6.0	Moderate	0.28		
Goss	0-3	20-27	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.5	Low	0.10	2	.5-2
	3-17	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low	0.10		
	17-55	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate	0.10		
	55-65	50-90	1.40-1.60	0.6-2.0	0.06-0.10	4.5-7.3	Moderate	0.24		
18D:										
Gasconade	0-4	35-40	1.35-1.50	0.6-2.0	0.10-0.12	6.1-7.8	Moderate	0.20	2	2-4
	4-12	35-60	1.45-1.70	0.2-0.6	0.05-0.07	6.1-7.8	Moderate	0.20		
	12	---	---	---	---	---	-------------	----		
Rock outcrop.										
18G:										
Gasconade	0-6	35-40	1.35-1.50	0.6-2.0	0.05-0.07	6.1-7.8	Moderate	0.20	2	2-4
	6-9	35-60	1.45-1.70	0.2-0.6	0.05-0.07	6.1-7.8	Moderate	0.20		
	9	---	---	---	---	---	-------------	----		
Rock outcrop.										
20C, 20E:										
Ocie	0-4	10-20	1.10-1.40	0.6-2.0	0.12-0.17	4.5-6.5	Low	0.32	3	.5-2
	4-11	15-27	1.10-1.35	0.6-2.0	0.12-0.15	4.5-6.0	Low	0.32		
	11-17	25-35	1.10-1.30	0.2-0.6	0.09-0.12	4.5-6.0	Moderate	0.32		
	17-59	50-80	1.10-1.30	0.06-0.2	0.07-0.10	5.1-7.3	High	0.32		
	59	---	---	---	---	---	-------------	----		
Goss	0-9	20-27	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.5	Low	0.10	2	.5-2
	9-20	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low	0.10		
	20-66	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate	0.10		
Gatewood	0-7	15-25	1.10-1.40	0.6-2.0	0.06-0.12	5.1-7.3	Low	0.28	3	.5-2
	7-25	60-85	1.10-1.30	0.06-0.2	0.09-0.12	5.1-7.3	High	0.32		
	25	---	---	---	---	---	-------------	----		
24E	0-3	15-25	1.20-1.50	2.0-6.0	0.04-0.10	5.1-6.0	Low	0.24	2	.5-2
Goss	3-21	25-35	1.40-1.70	2.0-6.0	0.05-0.10	5.1-6.0	Low	0.24		
	21-60	40-60	1.40-1.70	0.6-2.0	0.04-0.08	5.1-6.0	Moderate	0.24		
25C:										
Goss	0-8	10-27	1.10-1.30	2.0-6.0	0.06-0.17	4.5-6.5	Low	0.24	2	.5-2
	8-20	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low	0.10		
	20-60	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate	0.10		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH				Pct
25C:										
Wilderness------	0-8	18-27	1.20-1.45	2.0-6.0	0.07-0.12	4.5-6.5	Low----------	0.28	2	.5-2
	8-18	25-35	1.30-1.50	0.6-2.0	0.03-0.10	4.5-6.0	Low----------	0.28		
	18-40	20-35	1.70-2.00	0.06-0.2	0.01-0.05	3.6-5.5	Low----------	0.28		
	40-60	40-70	1.50-1.70	0.6-2.0	0.02-0.06	4.5-6.0	Moderate-----	0.28		
33C:										
Eldon-----------	0-9	15-27	1.40-1.55	2.0-6.0	0.13-0.18	4.5-7.3	Low----------	0.24	2	1-3
	9-19	35-60	1.35-1.45	0.6-2.0	0.05-0.14	4.5-7.3	Moderate-----	0.24		
	19-55	40-60	1.35-1.45	0.6-2.0	0.04-0.08	4.5-7.3	Moderate-----	0.24		
	55-60	35-95	1.35-1.45	0.6-2.0	0.10-0.14	4.5-7.8	Moderate-----	0.24		
Keeno-----------	0-10	15-25	1.30-1.60	2.0-6.0	0.13-0.20	4.5-7.3	Low----------	0.24	4	1-3
	10-28	28-35	1.50-1.80	0.6-2.0	0.02-0.10	3.6-5.5	Low----------	0.24		
	28-44	25-35	1.60-1.90	0.06-0.2	0.01-0.05	3.6-5.5	Low----------	0.24		
	44-60	35-80	1.10-1.40	0.6-2.0	0.04-0.10	4.5-5.5	Moderate-----	0.24		
42B-------------- Peridge	0-6	10-20	1.35-1.45	0.6-2.0	0.16-0.24	4.5-6.0	Low----------	0.37	5	1-3
	6-17	18-35	1.30-1.45	0.6-2.0	0.16-0.24	4.5-6.0	Low----------	0.32		
	17-60	30-40	1.30-1.45	0.6-2.0	0.10-0.22	4.5-6.0	Low----------	0.28		
42C-------------- Peridge	0-6	10-20	1.35-1.45	0.6-2.0	0.16-0.24	4.5-6.0	Low----------	0.37	5	1-3
	6-17	18-35	1.30-1.45	0.6-2.0	0.16-0.24	4.5-6.0	Low----------	0.32		
	17-45	30-40	1.30-1.45	0.6-2.0	0.10-0.22	4.5-6.0	Low----------	0.28		
	45-60	30-60	1.15-1.35	0.6-2.0	0.09-0.22	4.5-6.0	Moderate-----	0.24		
51B, 51C2-------- Claiborne	0-13	20-27	1.30-1.50	0.6-2.0	0.17-0.21	4.5-6.0	Low----------	0.37	5	1-3
	13-60	27-35	1.35-1.55	0.6-2.0	0.17-0.20	4.5-5.5	Moderate-----	0.32		
52B-------------- Hartville	0-14	20-27	1.10-1.30	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	3	1-3
	14-20	24-40	1.20-1.40	0.06-0.2	0.18-0.21	4.5-6.0	Moderate-----	0.43		
	20-62	35-60	1.20-1.50	0.06-0.2	0.10-0.12	4.5-6.5	High---------	0.32		
55A-------------- Nolin	0-15	12-35	1.20-1.40	0.6-2.0	0.18-0.23	5.6-8.4	Low----------	0.43	5	2-4
	15-60	18-35	1.25-1.50	0.6-2.0	0.18-0.23	5.6-8.4	Low----------	0.43		
59A-------------- Racket	0-12	15-27	1.25-1.45	0.6-2.0	0.18-0.24	6.1-7.3	Low----------	0.32	5	2-3
	12-42	18-35	1.25-1.45	0.6-2.0	0.14-0.20	6.1-7.3	Moderate-----	0.32		
	42-66	15-27	1.25-1.45	0.6-2.0	0.12-0.16	6.1-7.3	Low----------	0.32		
62B-------------- Sampsel	0-6	25-27	1.30-1.50	0.2-0.6	0.21-0.24	5.6-7.3	Moderate-----	0.37	3-2	3-4
	6-70	35-60	1.40-1.60	0.06-0.2	0.11-0.13	5.6-7.8	High---------	0.37		
64A-------------- Cedargap	0-9	12-25	1.20-1.45	0.6-2.0	0.11-0.18	5.6-7.3	Low----------	0.24	5	1-4
	9-34	18-35	1.40-1.55	0.6-2.0	0.04-0.12	5.6-7.3	Low----------	0.10		
	34-60	25-35	1.40-1.55	0.6-2.0	0.04-0.12	5.6-7.3	Low----------	0.10		
65--------------- Cedargap	0-7	15-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	1-4
	7-29	12-30	1.30-1.50	0.6-2.0	0.10-0.15	5.6-7.3	Low----------	0.24		
	29-60	25-35	1.40-1.55	0.6-2.0	0.04-0.12	5.6-7.3	Low----------	0.10		
69--------------- Dunning	0-23	27-40	1.20-1.40	0.6-2.0	0.19-0.23	5.6-7.8	Moderate-----	0.32	5	2-10
	23-60	35-60	1.40-1.65	0.06-0.2	0.14-0.18	5.6-7.8	Moderate-----	0.28		
72D:										
Bolivar---------	0-14	15-27	1.20-1.40	0.6-2.0	0.19-0.21	5.1-6.0	Low----------	0.32	4	.5-3
	14-22	20-35	1.30-1.50	0.6-2.0	0.12-0.16	4.5-6.0	Moderate-----	0.32		
	22	---	---	---	---	---	-------------	----		
Basehor---------	0-15	8-22	1.30-1.45	2.0-6.0	0.17-0.21	5.1-7.3	Low----------	0.32	2	---
	15	---	---	---	---	---	-------------	----		

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
02B---------------- Celt	C	None---------	---	---	1.5-2.5	Perched	Dec-Apr	>60	---	Moderate	High------	High.
03C---------------- Wilderness	C	None---------	---	---	1.0-2.0	Perched	Dec-Apr	>60	---	Moderate	Moderate	High.
04----------------- Bado	D	None---------	---	---	0-2.0	Perched	Dec-Apr	>60	---	High------	High------	High.
05----------------- Gerald	D	None---------	---	---	1.0-2.0	Perched	Dec-Apr	>60	---	High------	High------	High.
06B---------------- Hoberg	C	None---------	---	---	1.0-3.0	Perched	Dec-Apr	>60	---	Moderate	Moderate	High.
07B---------------- Lebanon	C	None---------	---	---	1.0-2.0	Perched	Dec-Apr	>60	---	Moderate	Moderate	High.
08B, 08C----------- Viraton	C	None---------	---	---	1.5-2.5	Perched	Dec-Apr	>60	---	Moderate	Moderate	High.
09B, 09C----------- Hobson	C	None---------	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	Moderate	Moderate	High.
14G: Gepp---------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	High.
Goss---------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Bardley------------	B	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
17D: Gepp---------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	High.
Goss---------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
18D, 18G: Gasconade----------	D	None---------	---	---	>6.0	---	---	4-20	Hard	Moderate	High------	Low.
Rock outcrop.												
20C, 20E: Ocie---------------	C	None---------	---	---	>6.0	---	---	40-60	Hard	Moderate	High------	Moderate.
Goss---------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
20C, 20E:												
Gatewood---------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Moderate.
24E--------------- Goss	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
25C:												
Goss-------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Wilderness-------	C	None--------	---	---	1.0-2.0	Perched	Dec-Apr	>60	---	Moderate	Moderate	High.
33C:												
Eldon------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Keeno------------	C	None--------	---	---	1.5-2.5	Perched	Dec-Apr	>60	---	Moderate	Moderate	High.
42B, 42C---------- Peridge	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
51B, 51C2--------- Claiborne	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
52B--------------- Hartville	C	Occasional	Very brief	Nov-May	1.5-3.0	Perched	Nov-Apr	>60	---	High-----	Moderate	Moderate.
55A--------------- Nolin	B	Frequent----	Brief to long.	Nov-May	3.0-6.0	Apparent	Nov-Apr	>60	---	Moderate	Low------	Moderate.
59A--------------- Racket	B	Frequent----	Very brief	Nov-May	3.5-6.0	Apparent	Dec-Apr	>60	---	Moderate	Moderate	Low.
62B--------------- Sampsel	D	None--------	---	---	0-1.5	Perched	Dec-Apr	>60	---	High-----	High-----	Low.
64A, 65----------- Cedargap	B	Frequent----	Very brief	Nov-May	>6.0	---	---	>60	---	Moderate	Low------	Low.
69---------------- Dunning	D	Frequent----	Brief-----	Nov-May	0-0.5	Apparent	Dec-Apr	>60	---	High-----	High-----	Moderate.
72D:												
Bolivar----------	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low------	Moderate.
Basehor----------	D	None--------	---	---	>6.0	---	---	11-20	Hard	Moderate	Low------	Moderate.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
*Bado	Fine, mixed, mesic Typic Fragiaqualfs
Bardley	Very fine, mixed, mesic Typic Hapludalfs
Basehor	Loamy, siliceous, mesic Lithic Dystrochrepts
*Bolivar	Fine-loamy, mixed, thermic Ultic Hapludalfs
Cedargap	Loamy-skeletal, mixed, mesic Cumulic Hapludolls
Celt	Clayey, mixed, mesic Aquic Fragiudults
Claiborne	Fine-loamy, siliceous, mesic Typic Paleudults
*Dunning	Fine, mixed, mesic Fluvaquentic Haplaquolls
Eldon	Clayey-skeletal, mixed, mesic Mollic Paleudalfs
Gasconade	Clayey-skeletal, mixed, mesic Lithic Hapludolls
Gatewood	Very fine, mixed, mesic Typic Hapludalfs
Gepp	Very fine, mixed, mesic Typic Paleudalfs
Gerald	Fine, mixed, mesic Umbric Fragiaqualfs
Goss	Clayey-skeletal, mixed, mesic Typic Paleudalfs
Hartville	Fine, mixed, mesic Aquic Hapludalfs
Hoberg	Fine-loamy, siliceous, mesic Mollic Fragiudalfs
Hobson	Fine-loamy, siliceous, mesic Typic Fragiudalfs
Keeno	Loamy-skeletal, siliceous, mesic Mollic Fragiudalfs
Lebanon	Fine, mixed, mesic Typic Fragiudalfs
Nolin	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
Ocie	Loamy-skeletal over clayey, mixed, mesic Typic Hapludalfs
Peridge	Fine-silty, mixed, mesic Typic Paleudalfs
Racket	Fine-loamy, mixed, mesic Cumulic Hapludolls
Sampsel	Fine, montmorillonitic, mesic, sloping Typic Argiaquolls
Viraton	Fine-loamy, siliceous, mesic Typic Fragiudalfs
Wilderness	Loamy-skeletal, siliceous, mesic Typic Fragiudalfs

* The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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