USDA United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with Missouri Department of Natural Resources and Missouri Agricultural Experiment Station

Soil Survey of Chariton County, Missouri

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 Natural Resources Conservation Service (formerly 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 the period 1986 to 1991. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1991. This survey was made cooperatively by the Natural Resources Conservation Service, the Missouri Department of Natural Resources, and the Missouri Agricultural Experiment Station. It is part of the technical assistance furnished to the Chariton 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.

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Cover: The cornstalks in the foreground are in an area of the Tina-Triplett-Shannondale association. The woodland and pasture in the background are in an area of the Menfro-Higginsville-Wakenda association. The barn is a tobacco barn.

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Foreword

This soil survey contains information that can be used in land-planning programs in Chariton 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 Natural Resources Conservation Service or the Cooperative Extension Service.

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Soil Survey of
Chariton County, Missouri

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

CHARITON COUNTY is in the north-central part of Missouri (fig. 1). It borders the Missouri River on the south and the Grand River on the west. It has a total land area of about 484,881 acres, or 757.63 square miles. Keytesville, in the south-central part of the county, is the county seat. In 1992, Chariton County had a population of about 9,200.

Chariton County is in the Central Feed Grains and Livestock Region of the United States. The northwestern part of the county is in the Iowa and Missouri Heavy Till Plains major land resource area, the eastern part is in the Central Mississippi Valley Wooded Slopes major land resource area, and the south-central part is in the Iowa and Missouri Deep Loess Hills major land resource area (USDA, 1981).

Farming is the main enterprise in Chariton County. Soybeans, corn, and wheat are the major crops, and beef cattle and hogs are the principal livestock.

This survey updates an earlier soil survey of Chariton County published in 1937 (USDA and University of Missouri, 1937). It provides additional interpretive information and has larger maps, which show the soils in greater detail.

A small part of Chariton County that occurs on the Saline County side of the Missouri River was mapped as part of the soil survey of Saline County. Most of this area is served by the Soil and Water Conservation District of Saline County.

The current channel of the Grand River is used as the limit for soil survey and in most areas forms the boundary between Chariton and Carroll Counties. Therefore, some small areas of Carroll County are included in the Chariton County soil survey and some small areas of Chariton County will be included in the Carroll County soil survey.

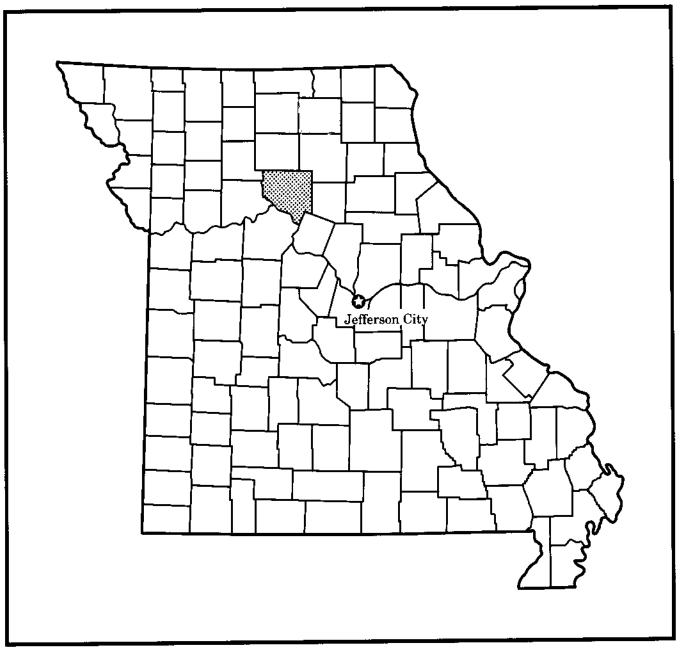

Figure 1.—Location of Chariton County in Missouri.

General Nature of the County

This section provides general information concerning the county. It describes climate; history and development; farming; and physiography, relief, and drainage.

Climate

The consistent pattern of climate in the Chariton County area is one of cold winters and long, hot summers. Heavy rains occur mainly in spring and early in summer, when moist air from the Gulf of Mexico interacts with drier continental air. The annual rainfall is normally adequate for corn, soybeans, and most grain crops.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Salisbury in the period 1961 to 1990. 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 29 degrees F and the average daily minimum temperature is 19 degrees. The lowest temperature on record is -28 degrees. In summer, the average temperature is 75 degrees and the average daily maximum temperature is 86.5 degrees. The highest recorded temperature is 114 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 41 inches. Of this, 26 inches, or about 64 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 15 inches. Thunderstorms occur on about 52 days each year, and most occur in April and May.

The average seasonal snowfall is 21.6 inches. The greatest snow depth at any one time during the period of record was 19 inches. On the average, 8 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 heaviest 1-day snowfall on record was 13.5 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 83 percent. The sun shines 66 percent of the time possible in summer and 49 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 12 miles per hour, in March.

History and Development

Marvin Hutchinson and Dorothy Fitzgerald helped prepare this section.

Chariton County was organized November 16, 1820, about 9 months before Missouri became a state. At the time of its organization, the county included all of the territory now included in Linn, Sullivan, and Putnam Counties and parts of Adair and Schuyler Counties. The first townships were Grand River, Buffalo Lick, Chariton, and Prairie Townships. There were nine townships in 1840, and since 1883, there have been sixteen.

French fur traders were the first European settlers to arrive in the survey area. In 1723, France established Fort Orleans near present-day Brunswick.

The county, the river, the township, and the first town were believed to be named for John Chariton, a leader of a French fur trading expedition that had its headquarters near the confluence of the Chariton and Missouri Rivers.

The town of Chariton was laid out in 1817. Steamboats traveled the Missouri River from St. Louis to Chariton and back. Chariton was a boom town for a decade. At its peak, the population was 1,200. In 1825, flooding on the Chariton and Missouri Rivers brought destruction and disease. Most of the inhabitants either died or moved to higher ground. By 1840, the town had been completely abandoned (Ostertag, 1988).

Keytesville is the oldest remaining town in Chariton County. It was laid out by and named for its founder, James Keyte, a Methodist minister, in 1832. The county seat was moved from Chariton to Keytesville in 1833.

Early settlers came from Virginia, Kentucky, and Tennessee. They made their homes along the rivers and streams where wood for houses and fuel was abundant. These areas also provided abundant fish and wildlife as a readily available food supply. George Jackson, from Kentucky, settled in the southern part of the county before 1812. In 1816, a group from Howard County, led by John Hutchinson, settled on Yellow Creek. German and Irish people also established settlements.

The high prairie was sparsely settled until after the Civil War, but the arrival of the railroads brought more people to the area and made markets available for the abundant crops of tobacco and grain.

Residents of the county fought on both sides during the Civil War. The first courthouse was burned by the Confederates in 1861. Official military records list Frank and Jesse James as participants. The sheriff was among the citizens killed.

Figure 2.—Newcomer School lent its name to a new soil series in Chariton County. It is also the birthplace of the Missouri Farmers Association (MFA).

In 1837, the towns of Chariton, Keytesville, and Brunswick had post offices. In 1897, 26 towns and villages each had one (Ostertag, 1988). At the present time, however, only eight communities have post offices.

Farming and agribusiness have always been the mainstays of the Chariton County economy. Newcomer School, a Missouri historical landmark, is the birthplace of the Missouri Farmers Association (fig. 2). Feed and cereal grains are the principal crops in the county. Beef cattle and hogs are the main livestock raised.

Coal is the most important mineral in the county. For years, it was mined from small shaft mines. Practically all of the mining is now done by strip mining. Strip mining involves leaving the land with approximately the same topography as it had prior to mining. Because the depth of the strip mining ranges from 50 to 100 feet, underground water tables in the immediate area of the mine may be disturbed.

The Chariton County Soil and Water Conservation District was organized in 1967. Its formation was largely a result of the efforts of William F. Knight, who was the extension agent at that time.

Landowners' applications of conservation practices and response to the Conservation Reserve Program may return the Chariton County rolling hills to at least a semblance of the high rolling prairies of two centuries ago.

Farming

The early settlers in Chariton County established their homes along the Missouri River bottom land and foothills where food, water, and fuel were available. They raised a few cows, hogs, and chickens and planted corn, wheat, and tobacco.

In 1900, there were 3,805 farms in Chariton County. The number of farms has declined steadily. In 1982, there were 1,271 farms and the average size was 331 acres (Missouri Department of Conservation, 1991).

Livestock made up about 52 percent and crops about 48 percent of all farm products sold in 1982. In 1984, Chariton County ranked 12th among Missouri's 114 counties in corn production. It ranked 14th in wheat production, 12th in soybean production, and 4th in tobacco production (Missouri Department of Conservation, 1991).

Physiography, Relief, and Drainage

The uplands in Chariton County consist primarily of an old glacial till plain that has been highly dissected by geologic erosion. Thick deposits of loess cover the areas closest to the Missouri River flood plain. These deposits are thinner toward the north, where the glacial till is on the lower side slopes. Residual material is exposed on the steeper landscapes.

Missouri River bottom land in Chariton County is a nearly level flood plain about 5 miles wide at the widest point. Elevation varies from about 600 feet in the southeast corner of the county to about 870 feet in the north-central part of the county.

The main streams are the Missouri, Grand, and Chariton Rivers and their larger tributaries. The Grand River and its tributaries drain most of the western part of the county. The Chariton River and its tributaries drain most of the central and eastern parts of the county. Both the Grand and Chariton Rivers drain in a southerly direction and empty into the Missouri River.

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, landforms, relief, climate, and 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.

The descriptions, names, and delineations of the soils in this survey do not fully agree with those in the surveys of adjacent counties that were published at a different time. Differences result from additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions. In some areas it is more practical to combine small areas of similar soils that respond to use and management in much the same way than it is to map these soils separately and give them different names.

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 two or three 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.

Soil Descriptions

1. Armstrong Association

Very deep, gently sloping to strongly sloping, somewhat poorly drained soils that formed in loess, pedisediments, and glacial till; on uplands

This association consists of soils on narrow ridgetops and dissected side slopes adjacent to drainageways. It makes up about 27 percent of the survey area. It is about 89 percent Armstrong and similar soils and 11 percent soils of minor extent (fig. 3).

Armstrong soils are on narrow, sloping ridgetops and side slopes.

The typical sequence, depth, and composition of the layers of these soils are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable loam

Subsurface layer:
7 to 14 inches, brown, mottled, firm clay loam

Subsoil:
14 to 60 inches, dark yellowish brown and yellowish brown, mottled, firm clay loam

Of minor extent in this association are Bevier, Colo, Dockery, Gosport, Newcomer, Putco, Schuline, Speed, and Zook soils. Bevier soils are in landscape positions similar to those of the Armstrong soils. Gosport and Newcomer soils are moderately deep. They are lower on the side slopes than the Armstrong soils. Gosport soils are moderately well drained, and Newcomer soils are well drained. Colo, Dockery, Speed, and Zook soils formed in alluvial material. They are on flood plains below the Armstrong soils. Putco and Schuline soils have been recently disturbed as a result of surface mining. They are in positions on the landscape similar to those of the Armstrong soils.

General livestock farming and grain farming are the main enterprises in areas of this association. Soybeans, corn, and small grain are grown in the less sloping areas. Most of the steeper areas are used for pasture or hay. Measures that help to control erosion and maintain tilth and fertility are the major management needs.

This association is suited to building site development and sanitary facilities. A high shrink-swell potential, the slope, moderately slow or slow permeability, and wetness are the major limitations.

2. Lagonda-Grundy-Armstrong Association

Very deep, gently sloping to strongly sloping, somewhat poorly drained soils that formed in loess over pedisediment, loess, and pedisediment and in the underlying paleosol derived from glacial till; on uplands

This association consists of soils on ridgetops and side slopes. It makes up about 22 percent of the survey area. It is about 40 percent Lagonda soils, 25 percent Grundy soils, 19 percent Armstrong soils, and 16 percent soils of minor extent (fig. 4).

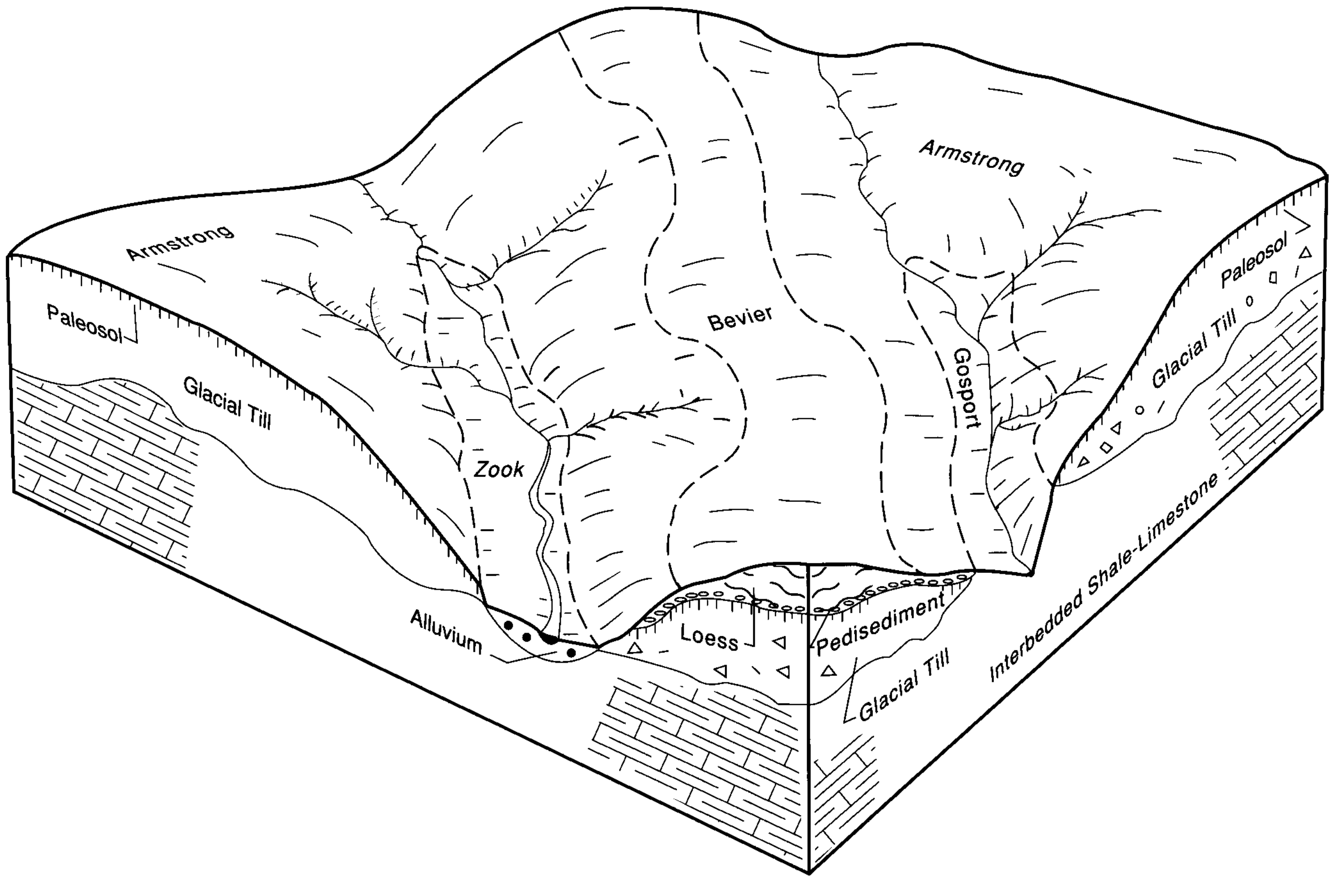

Figure 3.—Pattern of soils and parent material in the Armstrong association.

Lagonda soils generally are on ridgetops and side slopes and at the head of drainageways below the Grundy soils and above the Armstrong soils.

The typical sequence, depth, and composition of the layers of the Lagonda soils are as follows—

Surface layer:

0 to 5 inches, very dark grayish brown, friable silt loam

Subsurface layer:

5 to 9 inches, very dark grayish brown, friable silty clay loam

Subsoil:

9 to 38 inches, multicolored, firm silty clay and silty clay loam

38 to 60 inches, light brownish gray, mottled, firm silty clay loam

Grundy soils are on ridgetops above the Lagonda and Armstrong soils.

The typical sequence, depth, and composition of the layers of the Grundy soils are as follows—

Surface layer:

0 to 8 inches, very dark grayish brown, friable silt loam

Subsurface layer:

8 to 15 inches, very dark grayish brown, friable silt loam

Subsoil:

15 to 26 inches, dark grayish brown, mottled, firm silty clay

26 to 60 inches, grayish brown, mottled, firm silty clay and silty clay loam

Armstrong soils are on ridgetops and side slopes below the Grundy and Lagonda soils.

The typical sequence, depth, and composition of the layers of the Armstrong soils are as follows—

Surface layer:

0 to 9 inches, very dark grayish brown, friable loam

Subsurface layer:

9 to 18 inches, brown, friable loam

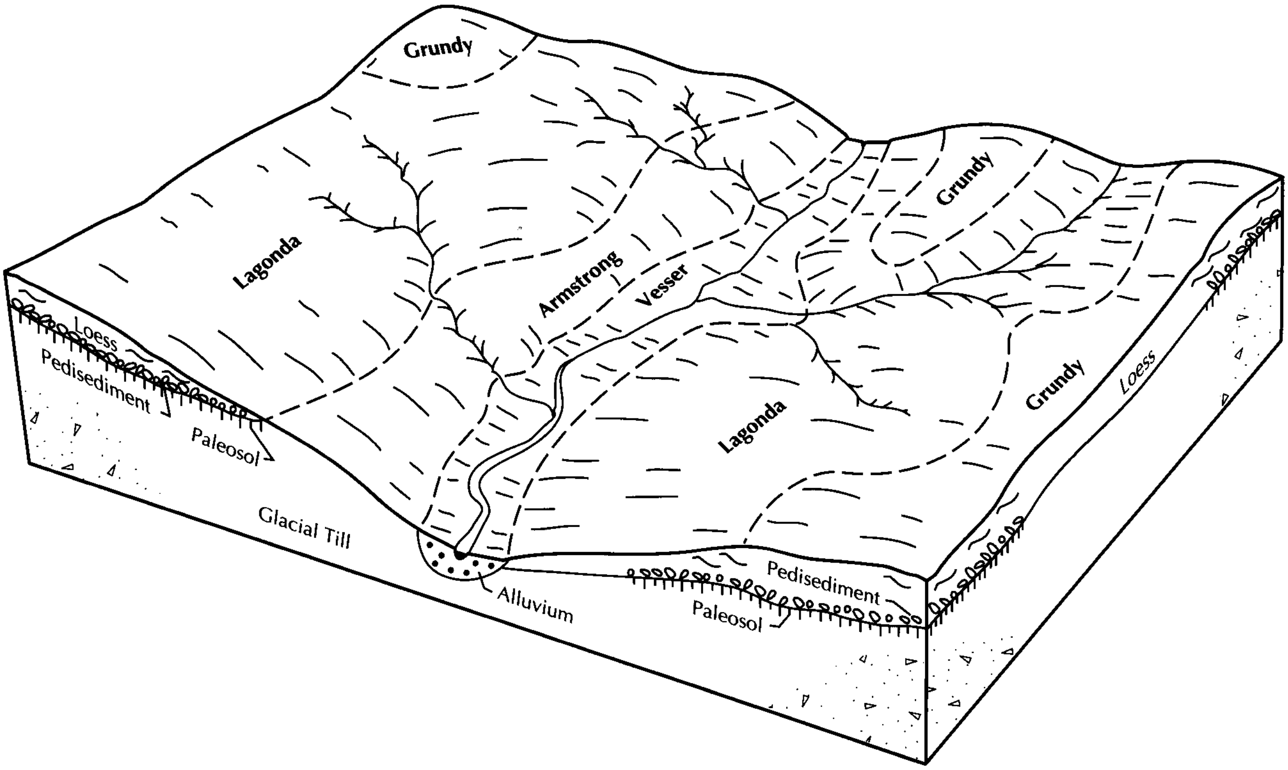

Figure 4.—Pattern of soils and parent material in the Lagonda-Grundy-Armstrong association.

Subsoil:

18 to 22 inches, grayish brown and dark grayish brown, firm clay loam

22 to 35 inches, dark yellowish brown, mottled, firm clay loam

35 to 52 inches, strong brown, mottled, very firm clay

52 to 60 inches, yellowish brown, mottled, very firm clay loam

Of minor extent in this association are Colo, Crestmeade, Dockery, Gosport, Higginsville, Knox, Newcomer, Speed, and Wakenda soils. Gosport and Newcomer soils are moderately deep. They are lower on the side slopes than the major soils. Colo, Dockery, and Speed soils formed in alluvium. They are on flood plains in landscape positions below those of the major soils. Higginsville, Knox, and Wakenda soils contain less clay than the major soils. They are in positions on the landscape similar to those of the major soils. Crestmeade soils are on broad upland ridges above the major soils.

General livestock farming and grain farming are the main enterprises in areas of this association. Soybeans, corn, and small grain are grown in the less sloping areas. Most of the steeper areas are used for pasture or hay. Measures that help to control erosion and maintain tilth and fertility are the major management needs.

This association is suited to building site development and sanitary facilities. A high shrink-swell potential, the slope, restricted permeability, and wetness are the major limitations.

3. Menfro-Higginsville-Wakenda Association

Very deep, gently sloping to steep, well drained and somewhat poorly drained soils that formed in a thick layer of loess; on uplands

This association consists of soils on ridgetops and side slopes. It makes up about 8 percent of the survey area. It is about 37 percent Menfro and similar soils, 19 percent Higginsville soils, 18 percent Wakenda soils, and 26 percent soils of minor extent (fig. 5).

Menfro soils are well drained and are on narrow ridgetops and side slopes.

The typical sequence, depth, and composition of the layers of the Menfro soils are as follows—

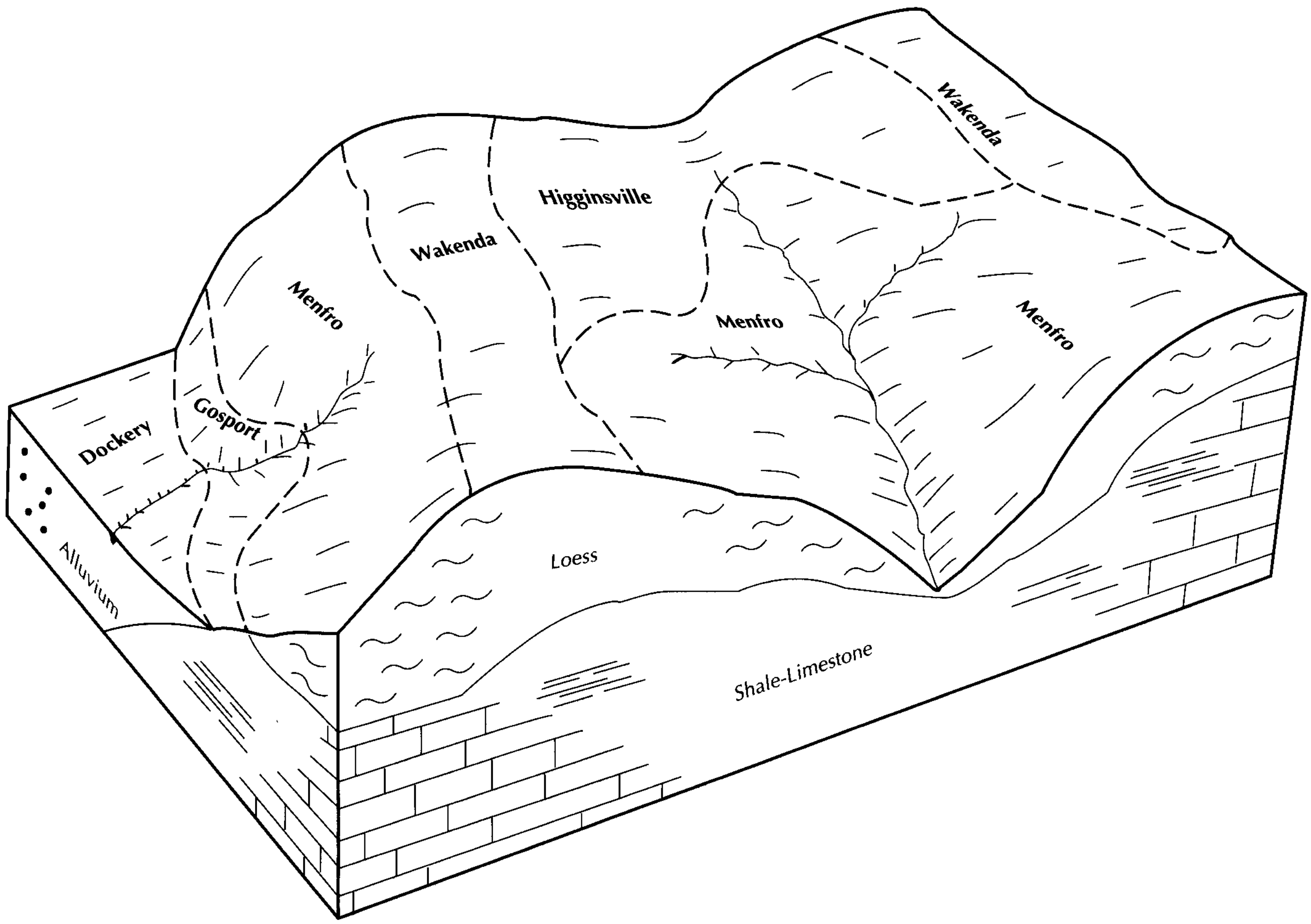

Figure 5.—Pattern of soils and parent material in the Menfro-Higginsville-Wakenda association.

Surface layer:
0 to 4 inches, brown, friable silt loam

Subsoil:
4 to 36 inches, dark yellowish brown, friable silty clay loam
36 to 42 inches, dark yellowish brown, friable silt loam

Substratum:
42 to 60 inches, dark yellowish brown, very friable silt loam

Higginsville soils are somewhat poorly drained and are on narrow ridgetops and concave side slopes.

The typical sequence, depth, and composition of the layers of the Higginsville soils are as follows—

Surface layer:
0 to 6 inches, very dark grayish brown, friable silt loam

Subsoil:
6 to 10 inches, dark yellowish brown, firm silty clay loam
10 to 30 inches, grayish brown, mottled, firm silty clay loam
30 to 60 inches, multicolored, firm silty clay loam

Wakenda soils are well drained and are on ridgetops and side slopes.

The typical sequence, depth, and composition of the layers of the Wakenda soils are as follows—

Surface layer:
0 to 5 inches, very dark grayish brown, very friable silt loam

Subsurface layer:
5 to 14 inches, very dark grayish brown, very friable silt loam

Subsoil:
14 to 20 inches, dark brown, mottled, friable silty clay loam
20 to 28 inches, brown, mottled, friable silty clay loam
28 to 52 inches, dark yellowish brown, mottled, friable silty clay loam

Substratum:
52 to 60 inches, dark yellowish brown and brown, mottled, friable silt loam

Of minor extent in this association are Colo, Dockery, Gosport, Newcomer, and Speed soils. Gosport and Newcomer soils are moderately deep. They are lower on the side slopes than the major soils. Dockery, Speed, and Colo soils formed in alluvium. They are in areas below the major soils on flood plains.

Grain farming and livestock farming are the major enterprises in areas of this association. Soybeans, wheat, and corn are grown in the less sloping areas. Cool-season grasses and legumes are grown for pasture and hay. Measures that help to control erosion are the major management needs if row crops are grown. Overgrazing during wet periods results in rapid erosion of pastures in the steep areas.

The uncleared acreage consists mostly of moderately steep and steep areas of the Menfro soils. Oak and hickory are the predominant trees. The steep slopes restrict the use of logging equipment, and erosion is a hazard along logging roads and skid trails.

This association is suited to building site development and sanitary facilities. The slope, the shrink-swell potential, and the potential for frost action are the major limitations.

4. Tina-Triplett-Shannondale Association

Very deep, nearly level to moderately sloping, somewhat poorly drained and moderately well drained soils that formed in loess, alluvium, or loess over alluvium; on low stream terraces

This association is on low stream terraces along the Missouri River and its major tributaries. It makes up about 11 percent of the survey area. It is about 41 percent Tina soils, 19 percent Triplett soils, 16 percent Shannondale and similar soils, and 24 percent soils of minor extent (fig. 6).

Tina soils are somewhat poorly drained. They are at slightly lower elevations than the Shannondale soils and are in positions similar to those of the Triplett soils on low terraces.

The typical sequence, depth, and composition of the layers of the Tina soils are as follows—

Surface layer:
0 to 6 inches, black, friable silt loam

Subsurface layer:
6 to 12 inches, black, friable silt loam

Subsoil:
12 to 26 inches, very dark gray, firm silty clay loam
26 to 34 inches, dark grayish brown, mottled, firm silty clay
34 to 52 inches, grayish brown, mottled, firm silty clay loam and clay loam

Substratum:
52 to 75 inches, multicolored, friable loam

Triplett soils are somewhat poorly drained. They are at slightly lower elevations than the Shannondale soils. They are in positions similar to those of the Tina soils on the low terraces.

The typical sequence, depth, and composition of the layers of the Triplett soils are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, very friable silt loam

Subsurface layer:
7 to 14 inches, grayish brown, mottled, very friable silt loam

Subsoil:
14 to 33 inches, very dark gray, mottled, firm silty clay
33 to 65 inches, dark grayish brown and grayish brown, mottled, firm silty clay loam

Shannondale soils are moderately well drained. They are on low terrace summits and risers.

The typical sequence, depth, and composition of the layers of the Shannondale soils are as follows—

Surface layer:
0 to 6 inches, very dark grayish brown, very friable silt loam

Subsurface layer:
6 to 18 inches, very dark grayish brown, friable silt loam

Subsoil:
18 to 30 inches, very dark grayish brown, firm silty clay loam
30 to 65 inches, dark yellowish brown, mottled, firm silty clay loam

Of minor extent in this association are Booker, Gifford, and Norborne soils. The well drained Norborne soils are on high flood plains in positions similar to those of the Shannondale soils on low terraces. They

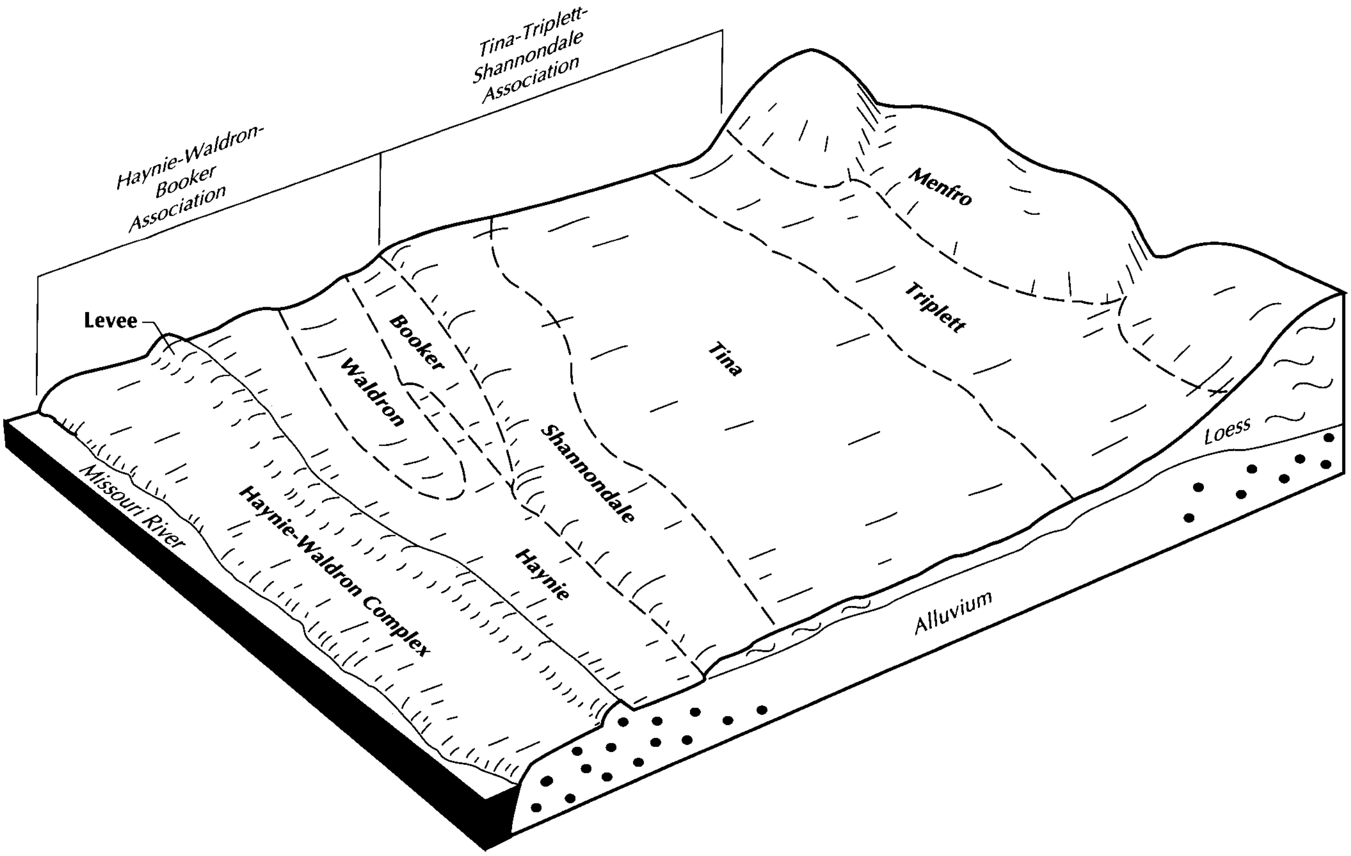

Figure 6.—Pattern of soils and parent material in the Tina-Triplett-Shannondale and Haynie-Waldron-Booker associations.

are coarser textured than the major soils. Gifford soils have a thinner dark surface layer than the major soils. They are at lower elevations than the major soils on low terrace risers. They are on the summits and the upper part of the risers. Booker soils are poorly drained. They are at slightly lower elevations than the major soils.

Grain farming is the main enterprise in areas of this association. Soybeans, wheat, and corn are the major crops. Wetness and a high clay content are the main management concerns in areas of the Tina and Triplett soils.

The soils in this association generally are not used for building site development or sanitary facilities because of wetness and the possibility of flooding. The history of flooding in a given area should be considered when sites for buildings and sanitary facilities are selected.

5. Carlow-Tice-Dockery Association

Very deep, nearly level, poorly drained and somewhat poorly drained soils that formed in alluvium; on flood plains

This association is on flood plains along tributaries of the Missouri River (fig. 7). It makes up about 25 percent of the survey area. It is about 46 percent Carlow and similar soils, 28 percent Tice soils, 25 percent Dockery soils, and 1 percent soils of minor extent.

Carlow soils are poorly drained and are between areas of the Tice soils and the uplands.

The typical sequence, depth, and composition of the layers of the Carlow soils are as follows—

Surface layer:

0 to 3 inches, very dark grayish brown, firm silty clay

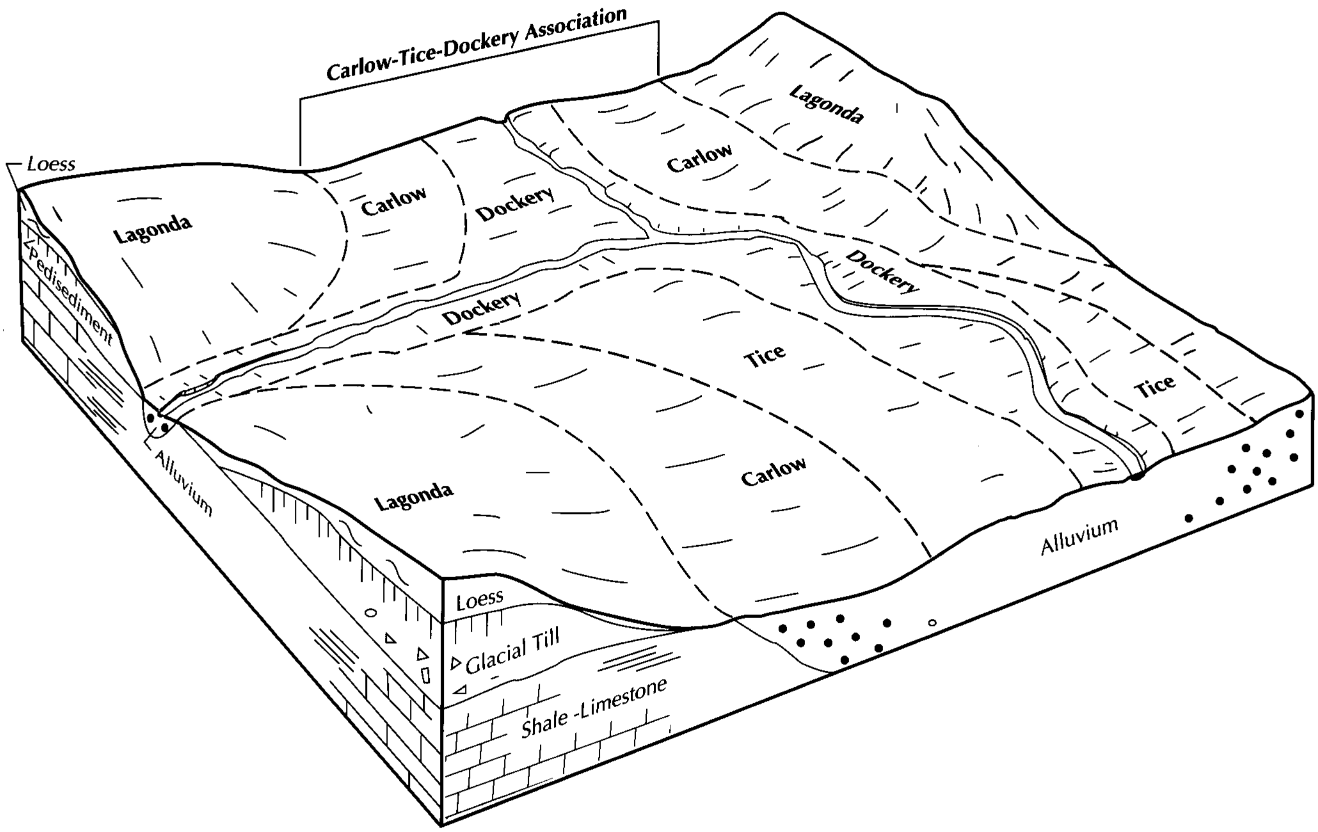

Figure 7.—Pattern of soils and parent material in the Carlow-Tice-Dockery association.

Subsurface layer:

3 to 13 inches, very dark grayish brown, very firm silty clay

Subsoil:

13 to 30 inches, dark grayish brown, mottled, very firm clay

30 to 60 inches, gray, mottled, very firm silty clay

Tice soils are somewhat poorly drained and generally are between the Dockery and Carlow soils.

The typical sequence, depth, and composition of the layers of the Tice soils are as follows—

Surface layer:

0 to 5 inches, very dark grayish brown, friable silt loam

Subsurface layer:

5 to 12 inches, very dark grayish brown, friable silty clay loam

Subsoil:

12 to 35 inches, multicolored, friable silt loam

Substratum:

35 to 80 inches, multicolored, friable silt loam

Dockery soils are stratified and are somewhat poorly drained. They are near the stream channels.

The typical sequence, depth, and composition of the layers of the Dockery soils are as follows—

Surface layer:

0 to 5 inches, very dark grayish brown, very friable silt loam

Substratum:

5 to 60 inches, stratified very dark grayish brown, grayish brown, very dark gray, dark grayish brown, and dark yellowish brown, friable silt loam

Grain farming is the main enterprise in areas of this association. Soybeans, corn, and small grain are the major crops. Flooding and wetness are the major management concerns.

This association generally is not used for building site development or sanitary facilities because of the flooding and the wetness.

6. Haynie-Waldron-Booker Association

Very deep, nearly level, moderately well drained, somewhat poorly drained, and very poorly drained soils that formed in calcareous alluvium; on flood plains along the Missouri River

This association is on the broad flood plains along the Missouri River. A Federal levee system parallels the river, but flooding can occur if the levee fails or tributary streams overflow. The association makes up about 7 percent of the survey area. It is about 34 percent Haynie and similar soils, 31 percent Waldron and similar soils, 30 percent Booker and similar soils, and 5 percent soils of minor extent (fig. 6).

Haynie soils are moderately well drained and are in the slightly higher positions on the flood plains.

The typical sequence, depth, and composition of the layers of the Haynie soils are as follows—

Surface layer:

0 to 9 inches, very dark grayish brown, very friable very fine sandy loam

Substratum:

9 to 60 inches, stratified very dark grayish brown, dark grayish brown, grayish brown, and brown, very friable very fine sandy loam and silt loam

Waldron soils are somewhat poorly drained. They are in the lower areas on the flood plains and are slightly lower in elevation than the Booker soils.

The typical sequence, depth, and composition of the layers of the Waldron soils are as follows—

Surface layer:

0 to 4 inches, very dark grayish brown, firm silty clay

Substratum:

4 to 48 inches, very dark grayish brown, very dark gray, and grayish brown, mottled, firm silty clay that has strata of very fine sandy loam and very fine sand

48 to 60 inches, stratified brown, yellowish brown, and light brownish gray, friable very fine sandy loam

Booker soils are very poorly drained. They generally are slightly lower than the Haynie soils on the flood plains.

The typical sequence, depth, and composition of the layers of the Booker soils are as follows—

Surface layer:

0 to 8 inches, very dark gray, very firm silty clay

Subsurface layer:

8 to 13 inches, very dark gray, very firm silty clay

Subsoil:

13 to 48 inches, dark gray, mottled, very firm silty clay

48 to 60 inches, multicolored, very firm silty clay

Of minor extent in this association are Sarpy soils. Sarpy soils are somewhat excessively drained and are in the higher areas. They contain more sand than the major soils.

Grain farming is the main enterprise in areas of this association. Soybeans, wheat, and corn are the major crops. Wetness and a high clay content are the main management concerns in areas of the Waldron and Booker soils.

This association generally is not used for building site development or sanitary facilities because of the wetness and the possibility of flooding. A high shrink-swell potential, seepage, restricted permeability, and low strength also are 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 the heading "Use and Management of the Soils."

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

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

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

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Lagonda silt loam, 2 to 5 percent slopes, eroded, is a phase of the Lagonda 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. Haynie-Waldron complex, rarely flooded, 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. The Pits component of the map unit Schuline-Pits complex, 5 to 30 percent slopes, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

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

Soil Descriptions

10B2—Lagonda silt loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, somewhat poorly drained soil is on ridgetops and in heads of drainageways in the uplands. Erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 15 to more than 2,000 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
- 0 to 5 inches, very dark grayish brown, friable silt loam

Subsurface layer:
- 5 to 9 inches, very dark grayish brown, friable silty clay loam

Subsoil:
- 9 to 38 inches, multicolored, firm silty clay and silty clay loam
- 38 to 60 inches, grayish brown, mottled, firm silty clay loam

In some areas the lower part of the subsoil contains less sand or contains more sand. In other areas the dark upper layers are thicker. In places the soil is lighter in color and contains less clay in the lower part of the subsurface layer.

Important soil properties—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.5 to 3.0 feet
Shrink-swell potential: High

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is moderately susceptible to accelerated water erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown legumes, such as red clover and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that are tolerant of wetness grow best. Erosion control during seedbed preparation is the main concern. Timely tillage and the quick establishment of ground cover are necessary.

This soil is suitable for building site development. The shrink-swell potential and wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons can function properly if the slope can be modified by grading and leveling.

Low strength, frost action, shrinking and swelling, and wetness are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action, shrinking and swelling, and wetness.

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

11C2—Lagonda silty clay loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, somewhat poorly drained soil is on slightly concave side slopes and in heads of drainageways in the uplands. Erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 15 to more than 900 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, friable silty clay loam

Subsoil:
9 to 27 inches, dark grayish brown, mottled, firm silty clay
27 to 45 inches, grayish brown, mottled, very firm silty clay
45 to 60 inches, light brownish gray and yellowish brown, very firm silty clay

In some areas the lower part of the subsoil contains less sand or contains more sand. In other areas the dark upper layers are thicker. In places the soil is lighter in color and contains less clay in the subsurface layer.

Included with this soil in mapping are small areas of the well drained Newcomer soils. These soils are moderately deep to sandstone. They are lower on the landscape than the Lagonda soil. They make up less than 5 percent of the unit.

Important properties of the Lagonda soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.5 to 3.0 feet
Shrink-swell potential: High

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is highly susceptible to accelerated water erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown legumes, such as red clover and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that are tolerant of wetness grow best. Erosion control during seedbed preparation is the main concern. Timely tillage and the quick establishment of ground cover are necessary.

This soil is suitable for building site development. The shrink-swell potential, wetness, and the slope are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. The soil is unsuitable as a site for septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons can function properly if the slope can be modified by grading and leveling.

Low strength, frost action, shrinking and swelling, and wetness are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action, shrinking and swelling, and wetness.

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

12B2—Bevier silty clay loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, somewhat poorly drained soil is on ridgetops in the uplands. Individual areas are long and narrow and range from about 20 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 8 inches, very dark grayish brown, friable silty clay loam

Subsoil:

8 to 13 inches, dark grayish brown, firm silty clay
13 to 18 inches, multicolored, firm silty clay
18 to 24 inches, grayish brown, firm silty clay loam
24 to 60 inches, light brownish gray, mottled, firm silty clay loam

In some areas, the upper part of the subsoil contains more sand or the lower part of the subsoil contains less sand. In some places the dark upper layer is thinner or thicker.

Included with this soil in mapping are small areas of the well drained Newcomer soils and the moderately well drained Gosport and Winnegan soils. These included soils are lower on the landscape than the Bevier soil. Newcomer and Gosport soils are moderately deep to bedrock. Winnegan soils have more sand in the surface layer and in the upper part of the subsoil than the Bevier soil. Included soils make up about 10 to 15 percent of the unit.

Important properties of the Bevier soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 2 to 4 feet
Shrink-swell potential: High

Most areas are used for cultivated crops, pasture, hay, or woodland. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is moderately susceptible to accelerated water erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown legumes, such as red clover and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that are tolerant of wetness grow best. Erosion control during seedbed preparation is the main concern. Timely tillage and the quick establishment of ground cover are necessary.

A small area is used as woodland. This soil is suited to trees. Seedling mortality is the main management concern. Planting container-grown nursery stock improves the seedling survival rate.

This soil is suitable for building site development. The shrink-swell potential and wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the restricted permeability and the wetness. Sewage lagoons can function properly if the slope can be modified by grading and leveling.

Low strength, frost action, and shrinking and swelling are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action and by shrinking and swelling.

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

15B—Grundy silt loam, 2 to 5 percent slopes. This very deep, gently sloping, somewhat poorly drained soil is on ridgetops in the uplands. Individual areas are irregular in shape and range from about 10 to more than 3,500 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 3 inches, very dark grayish brown, friable silt loam

Subsurface layer:

3 to 8 inches, very dark grayish brown, friable silt loam

8 to 15 inches, very dark grayish brown, friable silty clay loam

Subsoil:

15 to 26 inches, dark grayish brown, mottled, firm silty clay

26 to 60 inches, grayish brown, mottled, firm silty clay and silty clay loam

In a few areas the lower part of the subsoil contains more sand. In some places the slope is less than 2 percent. In other places the dark surface layer is thinner. In some areas the subsurface layer is lighter colored and contains less clay.

Included with this soil in mapping are small areas of Armstrong soils. These soils contain more sand in the surface layer and subsoil than the Grundy soil and have a thinner dark surface layer. They are in the lower positions on the landscape. They make up about 5 to 10 percent of the unit.

Important properties of the Grundy soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.5 to 3.0 feet
Shrink-swell potential: High

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is moderately susceptible to accelerated water erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses (fig. 8). If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown legumes, such as red clover and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that are tolerant of wetness grow best. Erosion control during seedbed preparation is the main concern. Timely tillage and the quick establishment of ground cover are necessary.

This soil is suitable for building site development. The shrink-swell potential and wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the wetness and the

Figure 8.—Stripcropping of soybeans and alfalfa and planting on the contour help to control erosion in this area of Grundy silt loam, 2 to 5 percent slopes.

restricted permeability. Seepage and the slope are limitations on sites for sewage lagoons. The lagoons can function properly if the slope can be modified by grading and leveling. Sealing the lagoon with slowly permeable material helps to prevent seepage.

Low strength, frost action, shrinking and swelling, and wetness are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action, shrinking and swelling, and wetness.

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

16—Crestmeade silt loam. This very deep, nearly level, poorly drained soil is on broad ridgetops in the uplands. Individual areas are irregular in shape and range from about 15 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 8 inches, very dark grayish brown, friable silt loam

Subsurface layer:
8 to 14 inches, grayish brown, mottled, friable silt loam

Subsoil:
14 to 26 inches, very dark grayish brown and very dark gray, mottled, very firm clay
26 to 74 inches, grayish brown, mottled, firm silty clay and silty clay loam

In some areas the subsurface layer has been incorporated into the surface layer by tillage. In other areas the slope is more than 2 percent. In places the subsurface layer contains more clay.

Important soil properties—

Permeability: Slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 0.5 foot to 1.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A small acreage is used for pasture and hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, wetness is a hazard. A shallow surface drainage system can remove excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to most commonly grown 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 and switchgrass. Species that are tolerant of wetness grow best. Timely seedbed preparation is needed to ensure good ground cover.

This soil is suitable for building site development. The shrink-swell potential and wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the wetness and the restricted permeability. Sewage lagoons can function adequately if they are properly installed.

Low strength, frost action, shrinking and swelling, and wetness are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action, shrinking and swelling, and wetness.

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

19C2—Menfro silt loam, 3 to 9 percent slopes, eroded. This very deep, well drained, gently sloping and moderately sloping soil is on narrow ridgetops and side slopes in the uplands bordering the Missouri River flood plain. Erosion has removed some of the original surface layer. Individual areas of this unit generally are long and narrow and range from about 15 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 4 inches, brown, friable silt loam

Subsoil:
4 to 36 inches, dark yellowish brown, friable silty clay loam
36 to 42 inches, dark yellowish brown, friable silt loam

Substratum:
42 to 60 inches, dark yellowish brown, very friable silt loam

Some areas are severely eroded. In places the dark surface layer is thicker.

Important soil properties—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Moderately low
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is highly susceptible to accelerated water erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to most commonly grown legumes, such as alfalfa and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. No serious limitations affect the use of this soil for pasture or hayland. Erosion is a management concern when new seedings are established. Timely seedbed preparation is needed to ensure good ground cover.

Most areas support native hardwoods. This soil is suited to trees. No hazards or limitations affect harvesting or planting.

This soil is suited to building site development. The shrink-swell potential and the slope are limitations on sites for buildings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Septic tank systems function well if they are properly installed. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. Seepage and the slope are limitations on sites for sewage lagoons. The lagoons can function properly if the slope can be modified by grading and leveling. Sealing the lagoon with slowly permeable material helps to prevent seepage.

Low strength, frost action, and shrinking and swelling are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action and by shrinking and swelling.

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

19F—Menfro silt loam, 9 to 30 percent slopes. This very deep, well drained, strongly sloping to steep soil is on strongly dissected uplands bordering the Missouri River flood plain. Individual areas are irregular in shape and range from about 25 to more than 3,500 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 2 inches, dark brown, friable silt loam

Subsurface layer:
2 to 7 inches, brown, friable silt loam

Subsoil:
7 to 60 inches, dark yellowish brown, firm silty clay loam

In some places the slope is less than 9 percent or more than 30 percent. Some areas are severely eroded. In places the subsoil has mottles.

Included with this soil in mapping are small areas of Newcomer and Winnegan soils. These soils are lower on the landscape than the Menfro soil. Newcomer soils are moderately deep to soft sandstone. Winnegan soils contain more clay in the subsurface layer and the subsoil than the Menfro soil. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Menfro soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: High
Organic matter content: Moderately low
Shrink-swell potential: Moderate

Most areas are used as woodland. This soil is suited to trees. The erosion hazard and the equipment limitation are the main management concerns. Locating logging roads and skid trails on the contour minimizes the steepness and length of slopes and the concentration of water. In the steepest areas the logs should be yarded uphill to logging roads and skid trails. Disturbed areas should be seeded after the trees are harvested. The use of equipment should be limited to periods when the surface is dry or frozen.

This soil is suited to most commonly grown 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 and switchgrass (fig. 9). Because of the slope and the severe hazard of erosion, however, careful management is needed when pastures are reestablished. A conservation tillage system that leaves large amounts of crop residue on the surface helps to control erosion when pastures are seeded or renovated. Preparing a seedbed in strips that follow the contour of the land also helps to control erosion. Measures that prevent the formation of livestock paths up and down the slope help to keep gullies from forming. Proper stocking rates and pasture rotation improve the pasture. Maintaining fertility and controlling brush are necessary management practices on this soil.

This soil generally is not used for building site development, onsite waste disposal systems, or local roads and streets because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 4R.

Figure 9.—Pasture, woodland, and a pond in an area of Menfro silt loam, 9 to 30 percent slopes.

20A—Shannondale silt loam, 0 to 2 percent slopes. This very deep, nearly level, moderately well drained soil is on low terraces along intermediate streams. Individual areas are irregular in shape and range from about 20 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 9 inches, very dark grayish brown, very friable silt loam

Subsurface layer:

9 to 17 inches, very dark grayish brown, friable silt loam

Subsoil:

17 to 58 inches, very dark grayish brown, firm silty clay loam

58 to 75 inches, dark yellowish brown, mottled, firm silty clay loam

In places the surface layer is thinner. In some areas the subsoil contains more clay. In other areas the subsoil does not have gray mottles.

Included with this soil in mapping are small areas of Triplett and Tina soils. These soils contain more clay in the subsoil than the Shannondale soil. They are in positions slightly below those of the Shannondale soil on low terraces. They make up about 5 to 10 percent of the unit.

Important properties of the Shannondale soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate

Depth to the water table: 1.5 to 3.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, hay, or pasture. This soil is well suited to corn, soybeans, small grain, and grain sorghum. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown legumes, such as red clover and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that are tolerant of wetness grow best.

This soil is suitable for building site development. The shrink-swell potential and the wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the wetness and the restricted permeability. Sewage lagoons can function adequately if they are properly installed.

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

20C2—Shannondale silt loam, 2 to 7 percent slopes, eroded, rarely flooded. This very deep, gently sloping and moderately sloping, moderately well drained soil is on escarpments of low terraces along intermediate streams. Individual areas are irregular in shape and range from about 10 to more than 50 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, dark brown, friable silt loam

Subsoil:
7 to 40 inches, dark yellowish brown, mottled, firm silty clay loam
40 to 65 inches, yellowish brown, mottled, firm silty clay loam

Substratum:
65 to 75 inches, dark yellowish brown, mottled, stratified very fine sandy loam, silt loam, and loam

In places the surface layer is thinner. In some areas the subsoil contains more sand. In other areas the subsoil contains more clay. In some places the gray mottles are at a lower depth in the subsoil.

Included with this soil in mapping are small areas of the poorly drained Gifford soils. These soils contain more clay in the subsoil than the Shannondale soil. They are in positions on low terraces similar to those of the Shannondale soil. They make up about 5 percent of the unit.

Important properties of the Shannondale soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Depth to the water table: 1.5 to 3.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is highly susceptible to accelerated water erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown legumes, such as red clover and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that are tolerant of wetness grow best. Erosion control during seedbed preparation is the main concern. Timely tillage and the quick establishment of ground cover are necessary.

This soil generally is not used for building site development or onsite waste disposal systems because of the wetness. The possibility of flooding as a result of levee failure is also a concern.

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

21C2—Knox silty clay loam, 5 to 9 percent slopes, eroded. This very deep, well drained, moderately sloping soil is on ridgetops and side slopes in the uplands bordering the Missouri River flood plain. Erosion has removed some of the original surface layer. Individual areas generally are long and narrow and range from about 20 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, dark brown, friable silty clay loam

Subsoil:
6 to 55 inches, dark yellowish brown and yellowish brown, firm silty clay loam and silt loam

Substratum:
55 to 70 inches, yellowish brown, mottled, firm silt loam

In places the slope is less than 5 percent. In a few areas the upper part of the subsoil has grayish mottles. In some other areas the surface layer is thinner and lighter colored. In some places the surface layer is thicker.

Included with this soil in mapping are small areas of Newcomer and Winnegan soils. These soils are in positions below the Knox soil on the landscape. Newcomer soils are moderately deep to bedrock and contain more sand than the Knox soil. Winnegan soils contain more clay than the Knox soil. Included soils make up 5 to 10 percent of the unit.

Important properties of the Knox soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, pasture, or hay. A small acreage is used as woodland. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is highly susceptible to accelerated water erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to most commonly grown legumes, such as alfalfa and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. No serious limitations affect the use of this soil for pasture or hayland. Erosion is a management concern when new seedings are established. Timely seedbed preparation is needed to ensure good ground cover.

A few areas support native hardwoods. This soil is suited to trees. No limitations or hazards affect planting or harvesting.

This soil is suited to building site development. The shrink-swell potential and the slope are limitations on sites for buildings. Constructing footings and foundations with adequately reinforced concrete and backfilling with sand and gravel around the foundations help to minimize the structural damage caused by shrinking and swelling. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. Septic tank systems function well if they are properly installed. Seepage and the slope are limitations on sites for sewage lagoons. The lagoons can function properly if the slope can be modified by grading and leveling. Sealing the lagoon with slowly permeable material helps to prevent seepage.

Low strength, frost action, and shrinking and swelling are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action and by shrinking and swelling.

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

22F3—Knox silty clay loam, 9 to 30 percent slopes, severely eroded. This very deep, well drained, strongly sloping to steep soil is on strongly dissected uplands bordering the Missouri River flood plain. Individual areas are irregular in shape and range from about 25 to more than 3,500 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 3 inches, dark yellowish brown, friable silty clay loam

Subsoil:
3 to 34 inches, yellowish brown, friable silty clay loam
34 to 60 inches, dark yellowish brown, mottled, firm silt loam

In some places the slope is less than 9 percent or more than 30 percent. Some areas are less eroded.

Important soil properties—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: High
Organic matter content: Moderately low
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, pasture, or hay. This soil is generally not suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is highly susceptible to accelerated water erosion. In areas where the slope is less than 14 percent, the soil is suited to cultivated crops on a limited basis. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, and winter cover crops help to minimize soil losses. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown 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 and switchgrass. Because of the slope and the severe hazard of erosion, however, careful management is needed when pastures are reestablished. A conservation tillage system that leaves large amounts of crop residue on the surface helps to control erosion when pastures are seeded or renovated. Preparing a seedbed in strips that follow the contour of the land also helps to control erosion. Measures that prevent the formation of livestock paths up and down the slope help to keep gullies from forming. Proper stocking rates and pasture rotation improve the pasture. Maintaining fertility and controlling brush are necessary management practices on this soil.

This soil is suited to trees. The erosion hazard, equipment limitations, and seedling mortality are the main management concerns. Locating logging roads and skid trails on the contour minimizes the steepness and length of slopes and the concentration of water. In the steepest areas the logs should be yarded uphill to logging roads and skid trails. Disturbed areas should be seeded after the trees are harvested. The use of equipment should be limited to periods when the surface is dry or frozen. Planting container-grown stock improves the seedling survival rate.

This soil is generally not used for building site development, onsite waste disposal systems, or local roads and streets because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 4R.

23B2—Higginsville silt loam, 2 to 5 percent slopes, eroded. This very deep, gently sloping, somewhat poorly drained soil is on ridgetops in the uplands. Erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 50 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
- 0 to 6 inches, very dark grayish brown, friable silt loam

Subsoil:
- 6 to 10 inches, dark yellowish brown, firm silty clay loam
- 10 to 30 inches, grayish brown, mottled, firm silty clay loam
- 30 to 60 inches, multicolored, firm silty clay loam

In some areas the surface layer is thicker. In places the subsoil contains more clay.

Included with this soil in mapping are small areas of Armstrong and Gosport soils. These soils are in positions below the Higginsville soil on the landscape. Armstrong soils contain more clay in the subsoil than the Higginsville soil and have a thinner surface layer. The moderately well drained Gosport soils are moderately deep to shale. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Higginsville soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.5 to 3.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is moderately susceptible to accelerated erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown legumes, such as red clover and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that are tolerant of wetness grow best. Erosion control during seedbed preparation is the main concern. Timely tillage and the quick establishment of ground cover are necessary.

This soil is suitable for building site development. The shrink-swell potential and the wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the wetness. Seepage and the slope are limitations on sites for sewage lagoons. Sealing the lagoon with slowly permeable material helps to prevent ground-water contamination and seepage. Sewage lagoons function properly if the slope can be modified by grading and leveling.

Low strength, frost action, shrinking and swelling, and the wetness are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action, shrinking and swelling, and wetness.

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

23C2—Higginsville silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, somewhat poorly drained soil is on concave side slopes in the uplands. Erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 25 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable silt loam

Subsoil:
7 to 30 inches, dark grayish brown, mottled, firm silty clay loam
30 to 41 inches, grayish brown, mottled, friable silt loam

Substratum:
41 to 60 inches, grayish brown, mottled, friable silt loam

In some areas, the surface layer is thicker and the slope is less than 5 percent. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Armstrong and Newcomer soils. Armstrong soils contain more clay in the subsoil than the Higginsville soil and have a thinner surface layer. They are in landscape positions similar to those of the Higginsville soil. The well drained Newcomer soils are moderately deep to soft sandstone. They are below the Higginsville soil on the landscape. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Higginsville soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1.5 to 3.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is highly susceptible to accelerated erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration. Some areas are wet and seepy. Properly located drainage tile reduces wetness in these areas.

This soil is suited to most commonly grown legumes, such as red clover and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that are tolerant of wetness grow best. Erosion control during seedbed preparation is the main concern. Timely tillage and the quick establishment of ground cover are necessary.

This soil is suitable for building site development. The shrink-swell potential, the wetness, and the slope are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. The soil is unsuitable as a site for septic tank absorption fields because of the wetness. Seepage and the slope are limitations on sites for sewage lagoons. Sealing the lagoon with slowly permeable material helps to prevent ground-water contamination and seepage. Sewage lagoons can function properly if the slope can be modified by grading and leveling.

Low strength, frost action, shrinking and swelling, and the wetness are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action, shrinking and swelling, and wetness.

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

25B—Wakenda silt loam, 2 to 5 percent slopes. This very deep, gently sloping, well drained soil is on moderately wide, convex ridgetops in the uplands. Individual areas are long and moderately wide and range from about 10 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
 0 to 5 inches, very dark grayish brown, very friable silt loam

Subsurface layer:
 5 to 14 inches, very dark grayish brown, very friable silt loam

Subsoil:
 14 to 20 inches, dark brown, mottled, friable silty clay loam
 20 to 28 inches, brown, mottled, friable silty clay loam
 28 to 52 inches, dark yellowish brown, mottled, friable silty clay loam
 52 to 60 inches, dark yellowish brown and brown, mottled, friable silt loam

In some areas gray mottles are in the upper part of the subsoil. In other areas the surface layer is thinner. In places the subsoil contains more clay.

Included with this soil in mapping are small areas of Armstrong, Gosport, and Newcomer soils. These soils are in positions on the landscape below those of the Wakenda soil. Armstrong soils contain more clay in the subsoil than the Wakenda soil and have a thinner surface layer. Gosport soils are moderately deep to shale and contain more clay in the subsoil than the Wakenda soil. Newcomer soils are moderately deep to soft sandstone. Included soils make up 5 to 10 percent of the unit.

Important properties of the Wakenda soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: Very high
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 4 to 6 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. A few areas are used for pasture and hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is moderately susceptible to erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to most commonly grown legumes, such as alfalfa and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. No serious limitations affect the use of this soil for pasture or hayland.

This soil is suitable for building site development. The shrink-swell potential and wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the restricted permeability and the wetness. Seepage and the slope are limitations on sites for sewage lagoons. Sealing the lagoon with slowly permeable material helps to prevent ground-water contamination and seepage. Sewage lagoons can function properly if the slope can be modified by grading and leveling.

Low strength, frost action, and shrinking and swelling are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action and by shrinking and swelling.

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

25C2—Wakenda silt loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, well drained soil is on convex side slopes in the uplands. Erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 10 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, very dark grayish brown, friable silt loam

Subsurface layer:
6 to 12 inches, very dark grayish brown, friable silt loam

Subsoil:
12 to 22 inches, brown, firm silty clay loam
22 to 50 inches, multicolored, firm silty clay loam
50 to 60 inches, brown, mottled, friable silty clay loam

In some areas the surface layer is thicker.

Important soil properties—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 4 to 6 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. A few areas are used for pasture and hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is highly susceptible to accelerated erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is well suited to most commonly grown legumes, such as alfalfa and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. No serious limitations affect the use of this soil for pasture or hayland. Erosion is a management concern when new seedings are established. Timely seedbed preparation is needed to ensure good ground cover.

This soil is suitable for building site development. The shrink-swell potential, wetness, and the slope are limitations on sites for buildings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. The soil is unsuitable as a site for septic tank absorption fields because of the restricted permeability and the wetness. Seepage and the slope are limitations on sites for sewage lagoons. Sealing the lagoon with slowly permeable material helps to prevent seepage. Sewage lagoons function properly if the slope can be modified by grading and leveling.

Low strength, frost action, and shrinking and swelling are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action and by shrinking and swelling.

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

26B—Armstrong loam, 2 to 5 percent slopes. This very deep, gently sloping, somewhat poorly drained soil is on narrow secondary ridgetops in the uplands. Individual areas generally are long and narrow and range from about 5 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, friable loam

Subsurface layer:
9 to 18 inches, brown, friable loam

Subsoil:
18 to 22 inches, grayish brown and dark grayish brown, firm clay loam
22 to 35 inches, dark yellowish brown, mottled, firm clay loam

35 to 52 inches, strong brown, mottled, very firm clay
52 to 60 inches, yellowish brown, mottled, very firm clay loam

In some areas, the slope is more than 5 percent and the surface layer is thinner. In places the surface layer contains less sand.

Included with this soil in mapping are small areas of Newcomer and Winnegan soils. These soils are in landscape positions below those of the Armstrong soil. The well drained Newcomer soils are moderately deep to soft sandstone. Winnegan soils are moderately well drained. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Armstrong soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1 to 3 feet
Shrink-swell potential: High

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is moderately susceptible to erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown legumes, such as red clover and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that are tolerant of wetness grow best. Erosion control during seedbed preparation is the main concern. Timely tillage and the quick establishment of ground cover are necessary.

A small area is used as woodland. This soil is suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Planting container-grown nursery stock improves the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil is suitable for building site development. The shrink-swell potential and the wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the wetness and the restricted permeability. Seepage and the slope are limitations on sites for sewage lagoons. Sealing the lagoon with slowly permeable material helps to prevent seepage. Sewage lagoons function properly if the slope can be modified by grading and leveling.

Low strength, shrinking and swelling, and the wetness are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by shrinking and swelling.

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

26C2—Armstrong loam, 5 to 9 percent slopes, eroded. This very deep, moderately sloping, somewhat poorly drained soil is on convex side slopes and on narrow secondary ridgetops in the uplands. Erosion has removed some of the original surface layer. Individual areas are irregular in shape and range from about 10 to more than 1,500 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 7 inches, very dark grayish brown, friable loam

Subsoil:

7 to 14 inches, brown, mottled, firm clay loam
14 to 60 inches, dark yellowish brown and yellowish brown, mottled, firm clay loam

In places the subsoil contains less sand or contains less clay, or it contains more clay than is typical. In some areas the slope is less than 5 percent or more than 9 percent. In other areas the subsoil has fewer mottles or has more mottles.

Included with this soil in mapping are small areas of Gosport, Newcomer, and Winnegan soils. These soils are in landscape positions lower than those of the Armstrong soil. The moderately well drained Gosport soils are moderately deep to shale. The well drained

Newcomer soils are moderately deep to soft sandstone. Winnegan soils are moderately well drained. Included soils make up about 10 to 15 percent of the unit.

Important properties of the Armstrong soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 1 to 3 feet
Shrink-swell potential: High

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is highly susceptible to accelerated erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown legumes, such as red clover and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that are tolerant of wetness grow best. Erosion control during seedbed preparation is the main concern. Timely tillage and the quick establishment of ground cover are necessary.

A small area is used as woodland. This soil is suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Planting container-grown nursery stock improves the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil is suitable for building site development. The shrink-swell potential, the wetness, and the slope are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. The soil is unsuitable as a site for septic tank absorption fields because of the wetness and the restricted permeability. Seepage and the slope are limitations on sites for sewage lagoons. Sealing the lagoon with slowly permeable material helps to prevent seepage. Sewage lagoons function properly if the slope can be modified by grading and leveling.

Low strength, shrinking and swelling, and the wetness are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by shrinking and swelling and by wetness.

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

26D2—Armstrong loam, 9 to 14 percent slopes, eroded. This very deep, strongly sloping, somewhat poorly drained soil is on side slopes in the uplands. Some of the original dark surface soil has been removed by erosion. Individual areas are irregular in shape and range from about 10 to more than 450 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 5 inches, very dark grayish brown, friable loam

Subsoil:
5 to 12 inches, brown, mottled, firm clay loam
12 to 18 inches, multicolored, firm clay
18 to 28 inches, yellowish brown and gray, mottled, firm clay
28 to 60 inches, multicolored, very firm clay loam

In places the slope is less than 9 percent or more than 14 percent. In some areas the subsoil contains less clay or contains more clay. In other areas the subsoil has fewer mottles or has more mottles.

Included with this soil in mapping are small areas of Gosport, Newcomer, and Winnegan soils. These soils are in landscape positions lower than those of the Armstrong soil. The moderately well drained Gosport soils are moderately deep to shale. The well drained Newcomer soils are moderately deep to soft sandstone. Winnegan soils are moderately well drained. Included soils make up about 10 to 15 percent of the unit.

Important properties of the Armstrong soil—

Permeability: Slow
Surface runoff: Rapid
Available water capacity: Moderate
Organic matter content: Moderate

Seasonal high water table: Perched at a depth of 1 to 3 feet
Shrink-swell potential: High

Most areas are used for pasture and hay. This soil is suited to cultivated crops and small grain only if they are grown on a limited basis. If cultivated crops and small grain are grown, the soil is highly susceptible to severe erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown legumes, such as birdsfoot trefoil and crownvetch; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that tolerate wetness grow best. Erosion during seedbed preparation and overgrazing are the main management problems. Timely seedbed preparation is needed to ensure good ground cover. Maintaining fertility and controlling brush are necessary management practices on this soil.

A few areas are used as woodland. This soil is suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Planting container-grown nursery stock improves the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil is suitable for building site development. Shrinking and swelling, the slope, and the wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the wetness, the slope, and the restricted permeability. Seepage and the slope are limitations on sites for sewage lagoons. Sealing the lagoon with slowly permeable material helps to prevent seepage. Sewage lagoons function properly if the slope can be modified by grading and leveling.

Low strength, shrinking and swelling, the wetness, and the slope are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by shrinking and swelling and by wetness. Designing the roads so that they conform to the natural slope of the land minimizes the need for cutting and filling.

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

27D3—Armstrong clay loam, 9 to 14 percent slopes, severely eroded. This very deep, strongly sloping, somewhat poorly drained soil is on convex side slopes in the uplands. Most of the original dark surface soil has been removed by erosion. Individual areas are irregular in shape and range from about 10 to more than 400 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, very dark grayish brown and brown, firm clay loam

Subsoil:
6 to 20 inches, brown, mottled, firm clay loam
20 to 60 inches, strong brown, mottled, firm clay loam

In some less eroded areas, the surface layer is very dark grayish brown loam. In places the slope is less than 9 percent or more than 14 percent. In some areas the subsoil has more mottles. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Gosport, Newcomer, and Winnegan soils. These soils are in landscape positions below those of the Armstrong soil. The moderately well drained Gosport soils are moderately deep to shale. The well drained Newcomer soils are moderately deep to soft sandstone. Winnegan soils are moderately well drained. Included soils make up about 10 to 15 percent of the unit.

Important properties of the Armstrong soil—

Permeability: Slow
Surface runoff: Rapid
Available water capacity: Moderate
Organic matter content: Moderately low
Seasonal high water table: Perched at a depth of 1 to 3 feet
Shrink-swell potential: High

Most areas are used for pasture and hay. This soil is unsuited to cultivated crops because of the slope and the hazard of erosion, but a few areas are farmed along with adjacent less sloping areas. The soil is suited to most commonly grown legumes, such as birdsfoot trefoil and crownvetch; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that tolerate wetness grow best. Erosion during seedbed preparation and overgrazing are the main management concerns. Timely seedbed preparation is needed to ensure good ground cover. Maintaining fertility and controlling brush are necessary management practices on this soil.

A few areas are used as woodland. This soil is suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Planting container-grown nursery stock improves the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil is suitable for building site development. Shrinking and swelling, the slope, and the wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the wetness, the slope, and the restricted permeability. Seepage and the slope are limitations on sites for sewage lagoons. Sealing the lagoon with slowly permeable material helps to prevent seepage. Sewage lagoons function properly if the slope can be modified by grading and leveling.

Low strength, shrinking and swelling, the wetness, and the slope are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by shrinking and swelling and by wetness. Designing the roads so that they conform to the natural slope of the land minimizes the need for cutting and filling.

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

28C—Keswick loam, 5 to 9 percent slopes. This very deep, moderately sloping, moderately well drained soil is on narrow ridgetops and on side slopes in the uplands. Individual areas are long and narrow and range from about 25 to more than 550 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 2 inches, very dark grayish brown, friable loam

Subsurface layer:
2 to 8 inches, brown, friable loam

Subsoil:
8 to 17 inches, strong brown, mottled, firm clay loam
17 to 40 inches, strong brown, mottled, firm clay

Substratum:
40 to 60 inches, multicolored, firm clay loam

In some areas the surface layer is thicker. In other areas the surface layer is clay loam. In places the upper part of the subsoil has more mottles or has fewer mottles. In some areas the surface layer and subsurface layer contain less clay. In other areas the slope is less than 5 percent.

Included with this soil in mapping are small areas of Gosport soils. Gosport soils are moderately deep. They are in landscape positions below those of the Keswick soil. They make up about 5 percent of the unit.

Important properties of the Keswick soil—

Permeability: Slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Low
Seasonal high water table: Perched at a depth of 1 to 3 feet
Shrink-swell potential: High

Most areas are used for pasture, hay, or woodland. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is highly susceptible to erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to most commonly grown legumes, such as red clover and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that are tolerant of wetness grow best. Erosion control during seedbed preparation is the main concern. Timely tillage and the quick establishment of ground cover are necessary.

Many areas support native hardwoods. This soil is suited to trees. The windthrow hazard and seedling mortality are management concerns. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern. Planting container-grown nursery stock improves the seedling survival rate.

This soil is suitable for building site development. Shrinking and swelling, the wetness, and the slope are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. The soil is unsuitable as a site for septic tank absorption fields because of the wetness and the restricted permeability. Seepage and the slope are limitations on sites for sewage lagoons. Sealing the lagoon with slowly permeable material helps to prevent seepage. Sewage lagoons can function properly if the slope can be modified by grading and leveling.

Low strength, frost action, shrinking and swelling, and the wetness are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action, shrinking and swelling, and wetness.

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

31F—Winnegan loam, 9 to 30 percent slopes. This very deep, moderately well drained, strongly sloping to steep soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from about 10 to more than 350 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 2 inches, brown, very friable loam

Subsurface layer:
2 to 7 inches, brown, very friable loam

Subsoil:
7 to 16 inches, yellowish brown, very firm clay
16 to 31 inches, yellowish brown, mottled, very firm clay
31 to 64 inches, yellowish brown and dark yellowish brown, mottled, very firm clay loam

In some areas the surface layer is thicker. In other areas the subsoil has red mottles. In places the upper part of the subsoil has gray mottles. In some severely eroded areas, the surface layer is clay loam.

Included with this soil in mapping are small areas of Gosport and Newcomer soils. Gosport soils are moderately deep to shale and contain more clay in the surface layer than the Winnegan soil. They are below the Winnegan soil on the landscape. Newcomer soils are better drained than the Winnegan soil. Also, they contain more sand. They are in landscape positions similar to those of the Winnegan soil. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Winnegan soil—

Permeability: Slow
Surface runoff: Rapid
Available water capacity: Moderate
Organic matter content: Low
Seasonal high water table: Perched at a depth of 2.0 to 3.5 feet
Shrink-swell potential: High

Most areas are used as woodland. This soil is suited to trees. The soil is unsuited to cultivated crops because of the slope and the hazard of erosion. The hazard of erosion and equipment limitations are concerns affecting woodland management. Locating logging roads and skid trails on the contour minimizes the steepness and length of slopes and the concentration of water. In the steepest areas the logs should be yarded uphill to logging roads and skid trails. Disturbed areas should be seeded after the trees are harvested. The use of equipment should be limited to periods when the surface is dry or frozen. Reshaping small gullies and seeding them to grass can provide a protective cover until trees are established.

This soil is suited to most commonly grown 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 and switchgrass. Because of the slope and the hazard of erosion, however, careful management is needed when pastures are reestablished. A conservation tillage system that leaves large amounts of crop residue on the surface helps to control erosion when pastures are seeded or renovated. Preparing a seedbed in strips that follow the contour of the land also helps to control erosion. Measures that prevent the formation of livestock paths up and down the slope help to keep gullies from forming. Proper stocking rates and pasture rotation improve the pasture. Maintaining fertility and controlling brush are necessary management practices on this soil.

This soil is generally not used for building site development or onsite waste disposal systems because of the slope.

The land capability classification is VIe. The woodland ordination symbol is 3R.

36D2—Gosport silty clay loam, 9 to 14 percent slopes, eroded. This moderately deep, strongly sloping, moderately well drained soil is on convex side slopes along drainageways. Individual areas are irregular in shape and range from about 10 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 3 inches, dark grayish brown, friable silty clay loam

Subsoil:
3 to 24 inches, multicolored, firm silty clay loam and silty clay

Substratum:
24 to 33 inches, light brownish gray and grayish brown, mottled, firm silty clay loam

Bedrock:
33 to 60 inches, soft, weathered shale

In places the depth to bedrock is less than 20 inches or more than 40 inches. In some areas the slope is more than 14 percent. In other areas the surface layer is thinner.

Included with this soil in mapping are small areas of Newcomer soils and areas of rock outcrop. The well drained Newcomer soils formed in material weathered from sandstone. They are in landscape positions similar to those of the Gosport soil. The rock outcrop occurs as narrow bands low on the slope. Included areas make up about 5 to 10 percent of the unit.

Important properties of the Gosport soil—

Permeability: Very slow
Surface runoff: Rapid
Available water capacity: Low
Organic matter content: Moderately low
Depth to soft shale bedrock: 20 to 40 inches
Shrink-swell potential: High

Most areas are used for pasture, hay, or woodland. This soil is unsuited to cultivated crops because of the slope and the hazard of erosion, but a few areas are farmed along with adjacent less sloping areas. The soil is 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 and switchgrass. Shallow-rooted species that tolerate droughtiness should be selected. Erosion control is an important concern when new seedings are being established. Timely tillage and the quick establishment of ground cover are necessary.

This soil is suited to trees, and a few areas support native hardwoods. Seedling mortality and the windthrow hazard are management concerns. Planting container-grown nursery stock improves the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern. Reshaping small gullies and seeding them to grass can provide a protective cover until trees are established.

This soil is suitable for building site development. The depth to bedrock, shrinking and swelling, and the slope are management concerns on sites for dwellings. The bedrock is soft and can be excavated. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. The soil is unsuitable as a site for septic tank absorption fields because of the depth to bedrock and the slope. The depth to bedrock, seepage, and the slope are limitations on sites for sewage lagoons. Building up the berms of sewage lagoons with extra soil material increases the depth to bedrock. Sealing the lagoons with slowly permeable material helps to prevent seepage. Sewage lagoons can function properly if the slope can be modified by grading and leveling.

Low strength, frost action, shrinking and swelling, and the slope are management concerns on sites for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action and by shrinking and swelling. Designing the roads so that they conform to the natural slope of the land minimizes the need for cutting and filling.

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

36F—Gosport silty clay loam, 14 to 30 percent slopes. This moderately deep, moderately steep and steep, moderately well drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from about 10 to more than 700 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 5 inches, dark brown, friable silty clay loam

Subsoil:
5 to 24 inches, yellowish brown and light olive brown, mottled, firm silty clay

Substratum:
24 to 36 inches, multicolored, firm silty clay

Bedrock:
36 to 60 inches, soft, weathered shale

In places the depth to soft bedrock is less than 20 inches or more than 40 inches. In some areas the slope is less than 14 percent or more than 30 percent. In other areas the surface layer is thinner.

Included with this soil in mapping are small areas of Newcomer soils and areas of rock outcrop. The well drained Newcomer soils formed in material weathered from sandstone. They are in landscape positions similar to those of the Gosport soil. The rock outcrop occurs as narrow bands low on the slope. Included areas make up about 5 to 10 percent of the unit.

Important properties of the Gosport soil—

Permeability: Very slow
Surface runoff: Rapid
Available water capacity: Low
Organic matter content: Moderate
Depth to soft shale bedrock: 20 to 40 inches
Shrink-swell potential: High

Most areas are used as woodland or pasture. Because of the slope, this soil generally is unsuited to cultivated crops. The soil is suited to trees. The erosion hazard, equipment limitations, seedling mortality, and the windthrow hazard are management concerns. Locating logging roads and skid trails on the contour minimizes the steepness and length of slopes and the concentration of water. In the steepest areas the logs should be yarded uphill to logging roads and skid trails. Disturbed areas should be seeded after the trees are harvested. The use of equipment should be limited to periods when the surface is dry or frozen. Planting container-grown nursery stock improves the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern. Reshaping small gullies and seeding them to grass can provide a protective cover until trees are established.

This soil is 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 and switchgrass. Shallow-rooted species that tolerate droughtiness should be selected. Erosion control is an important concern when new seedings are being established. Timely tillage and the quick establishment of ground cover are necessary.

This soil is generally not used for building site development or onsite waste disposal systems because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 2R.

37D2—Newcomer loam, 9 to 14 percent slopes, eroded. This moderately deep, strongly sloping, well drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from about 10 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable loam

Subsoil:
7 to 27 inches, dark yellowish brown, firm loam
27 to 34 inches, multicolored, firm loam

Bedrock:
34 to 50 inches, soft, weathered sandstone
50 inches, hard sandstone

In places the depth to sandstone is less than 20 inches or more than 40 inches. In some areas the soil contains less sand. In other areas the surface layer is thicker. In places the slope is less than 9 percent or more than 14 percent. In some severely eroded areas, the surface layer is thinner.

Included with this soil in mapping are small areas of Gosport soils and areas of rock outcrop. The moderately well drained Gosport soils formed in material weathered from shale. They are in landscape positions similar to those of the Newcomer soil. The rock outcrop occurs as narrow bands below the Newcomer soil on the landscape. Included areas make up about 5 to 10 percent of the unit.

Important properties of the Newcomer soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Low
Organic matter content: Moderate
Depth to soft sandstone bedrock: 20 to 40 inches
Shrink-swell potential: Moderate

Most areas are used for pasture, hay, or woodland. This soil is generally not used for cultivated crops because of the slope and the hazard of erosion, but a few areas are farmed along with adjacent less sloping areas. The soil is 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 and switchgrass. Shallow-rooted species that tolerate droughtiness should be selected. Erosion control is an important concern when new seedings are being established. Timely tillage and the quick establishment of ground cover are necessary.

This soil is suited to trees, and a few areas support native hardwoods. No hazards or limitations affect harvesting or planting.

This soil is suitable for building site development. Shrinking and swelling, the depth to bedrock, and the slope are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. The bedrock is soft and can be excavated. Dwellings should be designed so that they conform to the natural slope of the land. Some land shaping may be necessary. The soil is unsuitable as a site for septic tank absorption fields because of the depth to bedrock and the hazard of seepage. The depth to bedrock, seepage, and the slope are limitations on sites for sewage lagoons. Building up the berms of sewage lagoons with extra soil material increases the depth to bedrock. Sealing the lagoon with slowly permeable material helps to prevent seepage. Sewage lagoons can function properly if the slope can be modified by grading and leveling.

Low strength, frost action, shrinking and swelling, and the slope are limitations if this soil is used as a site for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action and by shrinking and swelling. Designing the roads so that they conform to the natural slope of the land minimizes the need for cutting and filling.

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

37F—Newcomer loam, 14 to 30 percent slopes. This moderately deep, moderately steep and steep, well drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from about 10 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches, dark brown, very friable loam

Subsoil:
9 to 29 inches, dark yellowish brown and yellowish brown, friable loam

Substratum:
29 to 35 inches, yellowish brown, very firm sandy loam

Bedrock:
35 to 51 inches, soft, weathered sandstone
51 inches, hard sandstone

In places the depth to sandstone is less than 20 inches or more than 40 inches. In some areas the soil contains less sand. In other areas the surface layer is thicker. In places the slope is less than 14 percent or more than 30 percent. In some severely eroded areas, the surface layer is thinner.

Included with this soil in mapping are small areas of Gosport soils and areas of rock outcrop. The moderately well drained Gosport soils formed in material weathered from shale. They are in landscape positions similar to those of the Newcomer soil. The rock outcrop occurs as narrow bands below the Newcomer soil on the landscape. Included areas make up about 5 to 10 percent of the unit.

Important properties of the Newcomer soil—

Permeability: Moderate
Surface runoff: Rapid
Available water capacity: Low
Organic matter content: Moderate
Depth to soft sandstone bedrock: 20 to 40 inches
Shrink-swell potential: Moderate

Most areas are used for pasture, hay, or woodland. This soil is generally not used for cultivated crops because of the slope and the hazard of erosion, but a few areas are farmed along with adjacent less sloping areas. The soil is 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 and switchgrass. Shallow-rooted species that tolerate droughtiness should be selected. Erosion control is an important concern when new seedings are being established. Timely tillage and the quick establishment of ground cover are necessary.

This soil is suited to trees, and a few areas support native hardwoods. The erosion hazard, equipment limitations, and seedling mortality are management concerns. Locating logging roads and skid trails on the contour minimizes the steepness and length of slopes and the concentration of water. In the steepest areas the logs should be yarded uphill to logging roads and skid trails. Disturbed areas should be seeded after the trees are harvested. The use of equipment should be limited to periods when the surface is dry or frozen. Planting container-grown nursery stock improves the seedling survival rate. Reshaping small gullies and seeding them to grass can provide a protective cover until trees are established.

This soil is generally not used for building site development or onsite waste disposal systems because of the slope.

Low strength, frost action, shrinking and swelling, and the slope are limitations if this soil is used as a site for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action and by shrinking and swelling. Designing the roads so that they conform to the natural slope of the land minimizes the need for cutting and filling.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

40F—Putco clay loam, 9 to 50 percent slopes. This map unit consists of strongly sloping to very steep soil in areas associated with coal mining. It is made up of spoil left prior to present-day mining operations. There are also a few open pits or trenches from which coal was removed. At certain times of the year, some of these pits hold water. Areas of this map unit are irregular in shape and range from about 10 to more than 40 acres in size.

This soil is extremely variable. Most areas of this unit are dominated by clayey soil material, but some areas are loamy. In some places shale, limestone, and sandstone boulders, flagstones, and cobbles are on and below the surface.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 2 inches, multicolored, friable clay loam

Substratum:
2 to 60 inches, multicolored, firm clay loam and silty clay

Included with this soil in mapping are small areas of rock outcrop. These areas are below the Putco soil on the landscape. They make up 5 to 10 percent of the unit.

Important properties of the Putco soil—

Permeability: Slow
Surface runoff: Rapid
Available water capacity: Moderate
Organic matter content: Low
Shrink-swell potential: High

Most areas are used for hay and pasture. Some areas support trees. This soil is unsuited to cultivated crops because of the slope and the hazard of erosion. It is suited to most commonly grown legumes, such as birdsfoot trefoil and crownvetch; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Species that tolerate wetness grow best. Overgrazing and erosion during seedbed preparation are the main management concerns. Timely seedbed preparation is needed to ensure good ground cover. Maintaining fertility and controlling brush are necessary management practices on this soil.

Some areas are reverting to natural vegetation. Cottonwood and willow are the dominant trees. The potential for production of commercial timber is low and generally does not justify the management required.

This map unit provides limited food and cover for wildlife.

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

42F—Schuline-Pits complex, 5 to 30 percent slopes. This unit consists of areas that are actively being strip mined for coal. Because of the current disturbances in areas of this unit, a profile description for the Schuline soil was not available from Chariton County; the description is from an adjoining area in Randolph County. Areas within this unit will be reclaimed as coal production activities proceed. Detailed onsite investigation is needed to determine the suitability of specific areas for any proposed use.

The typical sequence, depth, and composition of the layers of the Schuline soil are as follows—

Surface layer:
0 to 10 inches, mixed dark brown and yellowish brown, very firm silty clay loam

Substratum:
10 to 16 inches, mixed dark yellowish brown and yellowish brown, very firm clay loam
16 to 30 inches, mixed grayish brown and yellowish brown, very firm silty clay loam
30 to 60 inches, mixed dark grayish brown, yellowish brown, and dark brown, very firm silty clay loam

Pits consist of deep excavations from which overburden and residuum have been removed for the extraction of coal. These areas generally do not support plants. They generally range from 50 to 100 feet deep and have vertical sides. Small areas of water are common.

The land capability classification of the Schuline soil is IVe, and that of the Pits is VIIIs. No woodland ordination symbol is assigned.

47—Dockery silt loam, frequently flooded. This very deep, nearly level, somewhat poorly drained soil is on the flood plains. It is flooded for brief periods. Individual areas are long and narrow and range from about 10 to more than 1,000 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 5 inches, very dark grayish brown, very friable silt loam

Substratum:
5 to 60 inches, stratified very dark grayish brown, very dark gray, grayish brown, dark grayish brown, and dark yellowish brown, friable silt loam

In some areas the surface layer is silty clay loam. In other areas the substratum is not stratified and is silty clay loam. In some places the soil is moderately well drained. In other places the surface layer contains more sand. In some areas the soil is poorly drained.

Included with this soil in mapping are small areas of the poorly drained Blackoar, Carlow, Tuskeego, and Zook soils, the very poorly drained Portage soils, and Tice soils. Blackoar and Tice soils are not stratified. They are in positions on the flood plain similar to those of the Dockery soil. Carlow soils contain more clay than the Dockery soil. They are in the slightly lower positions on the flood plain. Zook soils are darker than the Dockery soil. Portage and Zook soils contain more clay than the Dockery soil. They are in areas between the Dockery soil and the uplands. Tuskeego soils have a light colored subsurface layer and contain more clay than the Dockery soil. They are slightly lower on the flood plain than the Dockery soil. Included soils make up about 10 to 15 percent of the unit.

Important properties of the Dockery soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Depth to the water table: 2 to 3 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, pasture, or woodland. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, flooding delays tillage in the spring of some years. Levees help to control the floodwater. A shallow surface drainage system can remove excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to commonly grown legumes, such as alsike clover; to cool-season grasses, such as reed canarygrass and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Flooding is the main concern. Species that are tolerant of wetness grow best on this soil, and grazing management should be designed around possible periods of flooding.

Many areas support native trees. This soil is suited to trees. The equipment limitation is a management concern. The use of equipment should be limited to periods when the surface is dry or frozen.

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

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

50—Blackoar silt loam, occasionally flooded. This very deep, nearly level, poorly drained soil is on flood plains. It is flooded for brief periods. Individual areas are long and narrow and range from about 25 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable silt loam

Subsurface layer:
7 to 11 inches, very dark gray, friable silt loam

Subsoil:
11 to 65 inches, gray, mottled, firm silt loam

In some areas the surface layer is thinner. In other areas the subsoil contains more clay. In some places the soil is somewhat poorly drained. In other places the subsoil is stratified.

Included with this soil in mapping are small areas of Carlow, Speed, and Zook soils. These soils contain more clay than the Blackoar soil. They are in positions on the flood plain similar to those of the Blackoar soil. They make up about 10 to 15 percent of the unit.

Important properties of the Blackoar soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Seasonal high water table: At the surface to 1 foot below the surface
Shrink-swell potential: Low

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, small grain, and grain sorghum. Flooding is a hazard. Shallow surface drains can remove the excess water. Levees also help to control floodwater. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to keep the surface layer friable, and increases the rate of water infiltration.

This soil is suited to wetness-tolerant, shallow-rooted legumes, such as alsike clover, and to cool-season grasses, such as reed canarygrass. It is poorly suited to warm-season grasses. The wetness and the flooding are the main problems. Grazing systems should be designed around possible periods of flooding. Seedbeds are easy to prepare, except during wet periods. A surface drainage system is beneficial for the deeper rooted species.

This soil is suited to trees. Equipment limitations, seedling mortality, and the windthrow hazard are management concerns. The use of equipment should be limited to periods when the surface is dry or frozen. Planting container-grown nursery stock improves the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

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

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

53—Colo silt loam, occasionally flooded. This very deep, nearly level, poorly drained soil is on flood plains. It is flooded for brief periods. Individual areas are long and narrow and range from about 10 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, black, friable silt loam

Subsurface layer:
8 to 16 inches, black, friable silt loam
16 to 26 inches, black, firm silty clay loam

Subsoil:
26 to 42 inches, very dark gray, mottled, firm silty clay loam
42 to 60 inches, grayish brown and light brownish gray, firm silty clay loam

In some areas the dark layers are thinner. In other areas the surface layer is very dark grayish brown. In places the subsoil contains more clay.

Included with this soil in mapping are small areas of Speed soils. These soils have a lighter colored subsurface layer than the Colo soil. They are in positions on the flood plain similar to those of the Colo soil. They make up about 5 percent of the unit.

Important properties of the Colo soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: High
Organic matter content: High
Depth to the water table: 1 to 3 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, small grain, and grain sorghum. Flooding is a hazard. Shallow surface drains can remove the excess water. Levees also help to control floodwater. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to keep the surface layer friable, and increases the rate of water infiltration.

This soil is suited to commonly grown legumes, such as alsike clover; to cool-season grasses, such as reed canarygrass and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. The occasional flooding is the main concern. Species that are tolerant of wetness grow best on this soil, and grazing management should be designed around possible periods of flooding.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding and the wetness.

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

54—Zook silty clay loam, occasionally flooded. This very deep, nearly level, poorly drained soil is on flood plains. It is flooded for brief periods. Individual areas are irregular in shape and range from 20 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 4 inches, black, firm silty clay loam

Subsurface layer:
4 to 20 inches, black and very dark gray, firm silty clay loam
20 to 40 inches, very dark gray, mottled, firm silty clay loam

Subsoil:
40 to 60 inches, dark gray, mottled, firm silty clay loam

Substratum:
60 to 75 inches, gray, mottled, firm silty clay loam

In places the surface layer is very dark grayish brown silt loam. In some areas the subsurface layer and the subsoil contain more clay or contain less clay. In other areas the dark surface layer is thinner.

Included with this soil in mapping are small areas of Dockery, Tice, and Speed soils. The somewhat poorly drained Dockery and Tice soils contain less clay than the Zook soil. They are on natural stream levees. Speed soils have a lighter colored subsurface layer than the Zook soil. They are in positions on the flood plain similar to those of the Zook soil. Also included are areas that are frequently flooded. Included areas make up about 5 to 10 percent of the unit.

Important properties of the Zook soil—

Permeability: Slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: High
Seasonal high water table: At the surface to 3 feet below the surface
Shrink-swell potential: High

This soil is suited to corn, soybeans, small grain, and grain sorghum. Flooding is a hazard. Shallow surface drains can remove the excess water. Levees also help to control floodwater. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to keep the surface layer friable, and increases the rate of water infiltration.

This soil is suited to wetness-tolerant, shallow-rooted legumes, such as birdsfoot trefoil, and to cool-season grasses, such as reed canarygrass and redtop. It is poorly suited to warm-season grasses. Wetness and the flooding are the main problems. Grazing systems should be designed around possible periods of flooding. In depressional areas, maintaining stands of desirable species is difficult. A surface drainage system is beneficial for the deeper rooted species.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding and the wetness.

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

56—Triplett silt loam, rarely flooded. This very deep, nearly level, somewhat poorly drained soil is on low stream terraces. Individual areas are irregular in shape and range from about 30 to more than 700 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, very friable silt loam

Subsurface layer:
7 to 14 inches, grayish brown, mottled, very friable silt loam

Subsoil:
14 to 33 inches, very dark gray, mottled, firm silty clay
33 to 60 inches, dark grayish brown and grayish brown, mottled, firm silty clay loam

In some areas the subsurface layer has been incorporated into the surface layer by tillage.

Included with this soil in mapping are small areas of Shannondale and Tina soils. The moderately well drained Shannondale soils contain less clay in the subsoil than the Triplett soil. They are slightly higher than the Triplett soil on the low stream terrace. Tina soils have a darker subsurface layer than the Triplett soil. They are in landscape positions similar to those of the Triplett soil. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Triplett soil—

Permeability: Slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 0.5 foot to 1.5 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. A small acreage is used for pasture and hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, wetness is a hazard. A shallow surface drainage system can remove excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to most commonly grown 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 and switchgrass. Species that are tolerant of wetness grow best. Timely seedbed preparation is needed to ensure good ground cover.

This soil is suitable for building site development. Because of the possibility of levee failure, the local flooding history should be considered when sites are selected. The shrink-swell potential and the wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the wetness and the restricted permeability. Because of the possibility of levee failure, the local flooding history should be considered when sites are selected for sewage lagoons. The lagoons can function adequately if they are properly installed.

Low strength, frost action, shrinking and swelling, the wetness, and the flooding are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action, shrinking and swelling, and wetness. In areas where flooding occurs, building up the streets and roads with suitable base material above the level of possible flooding helps to prevent damage.

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

60—Portage silty clay, occasionally flooded. This very deep, nearly level, very poorly drained soil is in broad areas on the flood plain. It is flooded for brief periods. It commonly is ponded after heavy rains. Individual areas are irregular in shape and range from about 50 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 4 inches, very dark gray, firm silty clay

Subsurface layer:
4 to 9 inches, very dark gray, very firm silty clay

Subsoil:
9 to 15 inches, very dark gray, very firm clay
15 to 60 inches, very dark gray and dark gray, mottled, very firm clay

In some areas the soil contains less clay.

Included with this soil in mapping are small areas of Dockery, Tice, and Tuskeego soils. Dockery and Tice soils are better drained than the Portage soil. Also, they are closer to the old stream channels. Tuskeego soils have a light colored subsurface layer and contain less clay in the subsoil than the Portage soil. They are in positions on the flood plain similar to those of the Portage soil. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Portage soil—

Permeability: Very slow
Surface runoff: Very slow
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: 0.5 foot above to 1.0 foot below the surface
Shrink-swell potential: Very high

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, flooding delays tillage in the spring of some years. Levees help to control the floodwater. A shallow surface drainage system can remove excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to wetness-tolerant, shallow-rooted legumes, such as birdsfoot trefoil, and to cool-season grasses, such as reed canarygrass and redtop. It is poorly suited to warm-season grasses. Wetness and the flooding are the main problems. Grazing systems should be designed around possible periods of flooding. In depressional areas, maintaining stands of desirable species is difficult. A surface drainage system is beneficial for the deeper rooted species.

This soil is suited to trees. Equipment limitations, seedling mortality, and the windthrow hazard are management concerns. The use of equipment should be limited to periods when the surface is dry or frozen. Planting container-grown nursery stock improves the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

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

The land capability classification is IIIw. The woodland ordination symbol is 6W.

61—Carlow silty clay, occasionally flooded. This very deep, nearly level, poorly drained soil is on flood plains. It is flooded for brief periods. Individual areas are irregular in shape and range from about 15 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 3 inches, very dark grayish brown, firm silty clay

Subsurface layer:
3 to 13 inches, very dark grayish brown, very firm silty clay

Subsoil:
13 to 30 inches, dark grayish brown, mottled, very firm clay
30 to 60 inches, gray, mottled, very firm silty clay

In some areas the dark surface layer is thinner or thicker. In other areas the soil contains less clay throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery and Tice soils. These soils contain less clay in the subsoil than the Carlow soil. They are in narrow areas between stream channels and areas of the Carlow soil. Also included are a few areas of Carlow soils that are subject to ponding and some areas of soils that are frequently flooded. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Carlow soil—

Permeability: Very slow
Surface runoff: Very slow
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: At the surface to 1 foot below the surface
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, flooding delays tillage in the spring of some years. Levees help to control the floodwater. A shallow surface drainage system can remove excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to wetness-tolerant, shallow-rooted legumes, such as birdsfoot trefoil, and to cool-season grasses, such as reed canarygrass and redtop. It is poorly suited to warm-season grasses. Wetness and the flooding are the main problems. Grazing systems should be designed around possible periods of flooding. In depressional areas, maintaining stands of desirable species is difficult. A surface drainage system is beneficial for the deeper rooted species.

This soil is suited to trees. Equipment limitations, the windthrow hazard, and seedling mortality are management concerns. The use of equipment should be limited to periods when the surface is dry or frozen. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern. Planting container-grown nursery stock improves the seedling survival rate.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding and the wetness.

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

62—Carlow silty clay, rarely flooded. This very deep, nearly level, poorly drained soil is on flood plains. Levees have been installed, but the soil is still subject to rare flooding caused by overflow from local tributaries or resulting from levee failure. Individual areas are irregular in shape and range from about 15 to more than 250 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, black, firm silty clay

Subsurface layer:
7 to 12 inches, very dark gray, very firm silty clay

Subsoil:
12 to 34 inches, dark gray, mottled, very firm silty clay
34 to 44 inches, gray, mottled, very firm silty clay
44 to 60 inches, dark gray, mottled, very firm silty clay

In some areas the dark surface layer is thinner or thicker. In other areas the soil contains less clay throughout.

Included with this soil in mapping are small areas of the somewhat poorly drained Dockery and Tice soils. These soils contain less clay in the subsoil than the Carlow soil. They are in narrow areas between stream channels and areas of the Carlow soil. Also included are a few areas of Carlow soils that are subject to ponding. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Carlow soil—

Permeability: Very slow
Surface runoff: Very slow
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: At the surface to 1 foot below the surface
Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, flooding delays tillage in the spring of some years. Levees help to control the floodwater. A shallow surface drainage system can remove excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to wetness-tolerant, shallow-rooted legumes, such as birdsfoot trefoil, and to cool-season grasses, such as reed canarygrass and redtop. It is poorly suited to warm-season grasses. Wetness and the flooding are the main problems. Grazing systems should be designed around possible periods of flooding. In depressional areas, maintaining stands of desirable species is difficult. A surface drainage system is beneficial for the deeper rooted species.

This soil is suited to trees. Equipment limitations, the windthrow hazard, and seedling mortality are management concerns. The use of equipment should be limited to periods when the surface is dry or frozen. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern. Planting container-grown nursery stock improves the seedling survival rate.

This soil is generally unsuited to building site development and onsite waste disposal systems because of the wetness. Also, levee failure and flooding are possible.

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

64—Tina silt loam, rarely flooded. This very deep, nearly level, somewhat poorly drained soil is on low stream terraces. Individual areas are irregular in shape and range from about 40 to more than 400 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, black, friable silt loam

Subsurface layer:
6 to 12 inches, black, friable silt loam

Subsoil:
12 to 26 inches, very dark gray, firm silty clay loam
26 to 34 inches, dark grayish brown, mottled, firm silty clay
34 to 52 inches, grayish brown, mottled, firm silty clay loam and clay loam

Substratum:
52 to 75 inches, multicolored, friable loam

In some areas the surface layer and the subsoil contain more clay or contain less clay. In other areas the soil is poorly drained. In some places the subsurface layer is lighter in color. In other places the lower part of the subsoil contains more sand.

Important soil properties—

Permeability: Slow
Surface runoff: Moderately slow
Available water capacity: High
Organic matter content: Moderate
Depth to the water table: 1.5 to 3.0 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn (fig. 10), soybeans, small grain, and grain sorghum. Flooding is a hazard. Shallow surface drains can remove the excess water. Levees also help to control floodwater. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to keep the surface layer friable, and increases the rate of water infiltration.

This soil is suited to commonly grown legumes, such as alsike clover; to cool-season grasses, such as reed canarygrass and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. The flooding is the main concern. Species that are tolerant of wetness grow best on this soil, and grazing management should be designed around possible periods of flooding.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development. Because of the possibility of levee failure, the local flooding history should be considered when sites are selected. The shrink-swell potential and the wetness are limitations on sites for dwellings. Constructing footings, foundations, and basement walls with adequately reinforced concrete and backfilling with sand and gravel around the foundations or basement walls help to minimize the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the damage caused by excessive

Figure 10.—Corn on a low stream terrace in an area of Tina silt loam, rarely flooded.

wetness. The soil is unsuitable as a site for septic tank absorption fields because of the wetness and the restricted permeability. Because of the possibility of levee failure, the local flooding history should be considered when sites are selected for sewage lagoons. The lagoons can function adequately if they are properly installed.

Low strength, frost action, shrinking and swelling, the wetness, and the flooding resulting from levee failure are limitations if this soil is used for local roads and streets. Strengthening the base material with crushed rock or other suitable material helps to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, establishing adequate side ditches, and installing culverts improve drainage and thus help to prevent the damage caused by frost action, shrinking and swelling, and wetness. In areas where flooding occurs, building up the streets and roads with suitable base material above the level of possible flooding helps to prevent damage.

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

66C2—Gifford silty clay loam, 2 to 9 percent slopes, eroded, rarely flooded. This very deep, gently sloping and moderately sloping, poorly drained soil is on the escarpment of low stream terraces. Individual areas are long and narrow and range from about 15 to more than 100 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 3 inches, very dark grayish brown, mottled, friable silty clay loam

Subsoil:
3 to 30 inches, grayish brown, mottled, firm silty clay
30 to 48 inches, light brownish gray, mottled, firm silty clay loam

Substratum:
48 to 60 inches, gray, mottled, very firm silty clay loam

In some areas the surface layer is thicker. In other areas the slope is less than 2 percent. In some places the soil contains less clay throughout. In other places the soil contains less sand throughout. Some areas are severely eroded.

Included with this soil in mapping are small areas of Shannondale and Tina soils. Shannondale soils contain less clay than the Gifford soil. They are in positions on the terrace similar to and higher than those of the Gifford soil. Tina soils have a thicker dark surface layer than the Gifford soil. They are in positions on the terrace higher than those of the Gifford soil. Included soils make up 10 to 15 percent of the unit.

Important properties of the Gifford soil—

Permeability: Very slow
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: Perched at a depth of 0.5 foot to 2.0 feet
Shrink-swell potential: High

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, the soil is moderately susceptible to erosion. Conservation practices that include contour farming, minimum tillage and no-till farming, stripcropping, crop rotations, terrace systems, and winter cover crops help to minimize soil losses. If exposed by terracing, the clayey subsoil cannot be easily tilled, is low in fertility, and has a low available water capacity. In some areas the exposed subsoil can be covered with topsoil stockpiled from areas under construction. Returning crop residue to the soil or regularly adding other organic material improves fertility, minimizes crusting, and increases the rate of water infiltration.

This soil is suited to wetness-tolerant, shallow-rooted legumes, such as birdsfoot trefoil, and to cool-season grasses, such as reed canarygrass and redtop. It is poorly suited to warm-season grasses. Wetness and the flooding are the main problems. Grazing systems should be designed around possible periods of flooding. In depressional areas, maintaining stands of desirable species is difficult. A surface drainage system is beneficial for the deeper rooted species.

This soil is generally unsuited to building site development and onsite waste disposal systems because of the wetness. Also, levee failure and flooding are possible.

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

68—Tuskeego silty clay loam, occasionally flooded. This very deep, nearly level, poorly drained soil is on flood plains. Individual areas are irregular in shape and range from about 15 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark gray, very firm silty clay loam

Subsurface layer:
8 to 12 inches, dark gray, firm silty clay loam
12 to 24 inches, gray, mottled, firm silty clay loam

Subsoil:
24 to 46 inches, dark grayish brown, mottled, firm silty clay
46 to 60 inches, gray, firm silty clay loam

In some areas the dark surface layer is thinner or thicker. In other areas the soil contains less clay throughout. In some places the surface layer and subsurface layer contain more clay.

Included with this soil in mapping are small areas of Carlow and Tice soils. Carlow soils have a thicker dark surface layer than the Tuskeego soil. They are in landscape positions similar to those of the Tuskeego soil. The somewhat poorly drained Tice soils contain less clay throughout than the Tuskeego soil. Also, they are closer to the stream channel. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Tuskeego soil—

Permeability: Very slow
Surface runoff: Very slow
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: At the surface to 1 foot below the surface

Shrink-swell potential: High

Most areas are used for cultivated crops. A few areas are used for pasture and hay. This soil is suited to corn, soybeans, small grain, and grain sorghum. If cultivated crops are grown, flooding delays tillage in the spring of some years. Levees help to control the floodwater. A shallow surface drainage system can remove excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is suited to wetness-tolerant, shallow-rooted legumes, such as birdsfoot trefoil, and to cool-season grasses, such as reed canarygrass and redtop. Wetness and the flooding are the main problems. Grazing systems should be designed around possible periods of flooding. In depressional areas, maintaining stands of desirable species is difficult. A surface drainage system is beneficial for the deeper rooted species.

This soil is suited to trees. Equipment limitations, the windthrow hazard, and seedling mortality are management concerns. The use of equipment should be limited to periods when the surface is dry or frozen. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern. Planting container-grown nursery stock improves the seedling survival rate.

This soil is unsuited to building site development and onsite waste disposal systems because of the flooding and the wetness.

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

70—Speed silt loam, occasionally flooded. This very deep, nearly level, somewhat poorly drained soil is on flood plains, fans, and foot slopes. It is flooded for brief periods. Individual areas are long and narrow and range from about 10 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, very dark gray, friable silt loam

Subsurface layer:
6 to 15 inches, very dark gray, friable silt loam
15 to 20 inches, grayish brown, very friable silt loam
20 to 27 inches, grayish brown, friable silty clay loam

Subsoil:
27 to 38 inches, very dark grayish brown, firm silty clay loam
38 to 60 inches, dark grayish brown and grayish brown, mottled, firm silty clay loam

In some areas the surface layer is very dark grayish brown, stratified overwash. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Carlow, Dockery, and Tice soils. These soils do not have a grayish brown subsurface layer. Carlow soils are in positions on the flood plain similar to those of the Speed soil. Dockery and Tice soils are between stream channels and areas of the Speed soil. Also included are areas that are frequently flooded. Included areas make up about 5 to 10 percent of the unit.

Important properties of the Speed soil—

Permeability: Moderately slow
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Depth to the water table: 1.5 to 3.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. A few areas are used for hay and pasture (fig. 11). This soil is suited to corn, soybeans, small grain, and grain sorghum. Flooding is a hazard. Shallow surface drains can remove the excess water. Levees also help to control floodwater. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to keep the surface layer friable, and increases the rate of water infiltration.

This soil is moderately suited to wetness-tolerant, shallow-rooted legumes, such as alsike clover, and to cool-season grasses, such as reed canarygrass. Wetness and the flooding are the main problems. Grazing systems should be designed around possible periods of flooding. Seedbeds can be easily prepared, except during wet periods. A surface drainage system is beneficial for the deeper rooted species.

This soil is generally unsuited to building site development and onsite waste disposal systems because of the flooding and the wetness.

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

72—Tice silt loam, frequently flooded. This very deep, nearly level, somewhat poorly drained soil is on flood plains. It is flooded for brief periods. Individual areas are long and narrow and range from about 10 to more than 1,200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 5 inches, very dark grayish brown, friable silt loam

Figure 11.—Hayland in an area of Speed silt loam, occasionally flooded. Soybeans and woodland are in the background.

Subsurface layer:
5 to 12 inches, very dark grayish brown, friable silty clay loam

Subsoil:
12 to 35 inches, multicolored, friable silt loam

Substratum:
35 to 60 inches, multicolored, friable silt loam

In some places the surface layer is thinner. In other places the surface layer and subsurface layer contain more clay or contain less clay. In some areas the soil is moderately well drained. A few areas have overwash.

Included with this soil in mapping are small areas of the poorly drained Carlow, Tuskeego, and Speed soils. Carlow and Tuskeego soils contain more clay than the Tice soil. They are in slightly lower positions on the flood plain than the Tice soil. Speed soils have a light colored subsurface layer. They are generally in areas adjacent to the uplands. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Tice soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Depth to the water table: 1.5 to 3.0 feet

Shrink-swell potential: Moderate

Most areas are used for cultivated crops or for pasture. This soil is suited to corn, soybeans, small grain, and grain sorghum. Flooding is a hazard. Shallow surface drains can remove the excess water. Levees also help to control floodwater. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to keep the surface layer friable, and increases the rate of water infiltration.

This soil is suited to commonly grown legumes, such as alsike clover; to cool-season grasses, such as reed canarygrass and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Flooding is the main concern. Species that are tolerant of wetness grow best on this soil, and grazing management should be designed around possible periods of flooding.

A few areas support native trees. This soil is suited to trees. No hazards or limitations affect harvesting or planting.

This soil is generally not used for building site development or onsite waste disposal systems because of the flooding and the wetness.

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

73—Tice silty clay loam, rarely flooded. This very deep, nearly level, somewhat poorly drained soil is on the flood plains. Levees have been installed, but the soil is still subject to rare flooding caused by overflow from local tributaries or resulting from levee failure. Individual areas are long and narrow and range from about 10 to more than 1,200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 6 inches, very dark grayish brown, friable silty clay loam

Subsurface layer:
6 to 11 inches, very dark grayish brown, firm silty clay loam

Subsoil:
11 to 23 inches, mottled, grayish brown and brown, friable silty clay loam
23 to 43 inches, mottled, grayish brown and brown, friable silt loam

Substratum:
43 to 60 inches, gray and pale brown, friable silt loam

In some places the surface layer is thinner. In other places the surface layer and subsurface layer contain less clay. In some areas the soil is moderately well drained. A few areas have overwash.

Included with this soil in mapping are small areas of the poorly drained Carlow soils. These soils contain more clay than the Tice soil. They are in slightly lower positions on the flood plain than those of the Tice soil. They make up about 5 percent of the unit.

Important properties of the Tice soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Depth to the water table: 1.5 to 3.0 feet
Shrink-swell potential: Moderate

Most areas are used for cultivated crops or for pasture. This soil is suited to corn, soybeans, small grain, and grain sorghum. Flooding is a hazard. Shallow surface drains can remove the excess water. Levees also help to control floodwater. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to keep the surface layer friable, and increases the rate of water infiltration.

This soil is suited to commonly grown legumes, such as alsike clover; to cool-season grasses, such as reed canarygrass and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Flooding is the main concern. Species that are tolerant of wetness grow best on this soil, and grazing management should be designed around possible periods of flooding.

A few areas support native trees. This soil is suited to trees. No hazards or limitations affect harvesting or planting.

This soil is generally unsuited to building site development and onsite waste disposal systems because of the wetness. Also, levee failure and flooding are possible.

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

78—Levasy silty clay, rarely flooded. This very deep, nearly level, poorly drained soil is on the flood plains along the Missouri River. Levees have been installed, but the soil is still subject to rare flooding caused by overflow from local tributaries or resulting from levee failure. Areas are irregular in shape and range from about 30 to more than 150 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark gray, very firm silty clay

Subsurface layer:
8 to 20 inches, very dark gray, very firm silty clay

Subsoil:
20 to 29 inches, dark gray, very firm silty clay

Substratum:
29 to 60 inches, stratified grayish brown and dark grayish brown, friable silt loam

In some areas the loamy substratum is deeper than 38 inches. In places the clayey part does not have free carbonates.

Included with this soil in mapping are small areas of the somewhat poorly drained Parkville and Waldron soils. Parkville soils have a loamy substratum at a depth of less than 20 inches. They are slightly higher on the flood plain than the Levasy soil. Waldron soils are stratified throughout. They are in positions on the flood plain similar to those of the Levasy soil. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Levasy soil—

Permeability: Slow in the upper part; moderate in the lower part
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Seasonal high water table: 1.0 foot above to 1.5 feet below the surface
Shrink-swell potential: High in the upper part; low in the lower part

Most areas are used for cultivated crops. This soil is suited to soybeans, grain sorghum, corn, and winter wheat. Wetness is the main limitation. Careful timing of tillage is needed because the surface layer is firm and becomes cloddy if tilled when wet. Land grading, shallow surface drains, and open ditches help to remove the excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is suited to trees. Equipment limitations, seedling mortality, and the windthrow hazard are management concerns. The use of equipment should be limited to periods when the surface is dry or frozen. Selecting planting stock that is larger than is typical improves the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is slight.

This soil is generally not used for building site development or onsite waste disposal systems because of the wetness. Also, levee failure and flooding are possible.

The land capability classification is IIIw. The woodland ordination symbol is 7W.

81—Haynie very fine sandy loam, rarely flooded. This very deep, nearly level, moderately well drained soil is in the slightly higher areas on the flood plains along the Missouri River. Levees have been installed, but the soil is still subject to rare flooding caused by overflow from local tributaries or resulting from levee failure. Individual areas generally are long and narrow and range from about 25 to more than 500 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 9 inches, very dark grayish brown, very friable very fine sandy loam

Substratum:
9 to 60 inches, stratified very dark grayish brown, dark grayish brown, grayish brown, and brown, very friable very fine sandy loam and silt loam

In some areas the surface layer is silt loam or silty clay loam. In other areas the substratum contains more sand. In places the substratum contains less sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Parkville and Waldron soils. Parkville soils contain more clay in the upper part than the Haynie soil. They are lower on the flood plain than the Haynie soil. Waldron soils are clayey in the upper part. They are in small drainageways and depressions. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Haynie soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderately low
Shrink-swell potential: Low

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and small grain. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth and increases the rate of water infiltration.

This soil is well suited to most commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as timothy and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Grazing management should be designed around possible periods of flooding.

This soil is suited to trees. No major hazards or limitations affect harvesting.

This soil is generally not used for building site development or onsite waste disposal systems because of the possibility of levee failure and flooding.

The land capability classification is I. The woodland ordination symbol is 11A.

82—Sarpy loamy fine sand, rarely flooded. This very deep, nearly level, excessively drained soil is in the slightly higher areas on the flood plains along the Missouri River. Levees have been installed, but the soil is still subject to rare flooding resulting from levee failure. Individual areas are long and narrow and range from about 10 to more than 40 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 7 inches, dark brown, very friable loamy fine sand

Substratum:
7 to 60 inches, grayish brown and brown, stratified, loose fine sand

In some areas the substratum has finer textured strata.

Included with this soil in mapping are small areas of Grable and Haynie soils. These soils are not as sandy as the Sarpy soil. They are slightly lower on the flood plain than the Sarpy soil. They make up about 5 to 10 percent of the unit.

Important properties of the Sarpy soil—

Permeability: Rapid
Surface runoff: Slow
Available water capacity: Low
Organic matter content: Low
Shrink-swell potential: Low

Most areas are used for small grain or for watermelons. This soil is poorly suited to cultivated crops because insufficient soil moisture is common during summer months. The surface layer is loose and can be easily tilled throughout a wide range in moisture content. If cultivated crops are grown, irrigation is needed. The soil is subject to wind erosion, which results mainly in damage to young crops. Cover crops, wind stripcropping, and field windbreaks help to control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to control wind erosion.

This soil is suited to most commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as orchardgrass and tall fescue; and to warm-season grasses, such as big bluestem and indiangrass. Droughtiness is the main management concern.

This soil is suited to trees. Seedling mortality is the main hazard. Selecting planting stock that is larger than is typical improves the seedling survival rate.

This soil is generally not used for building site development or onsite waste disposal systems because of the possibility of levee failure and flooding.

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

83—Landes fine sandy loam, rarely flooded. This very deep, nearly level, well drained soil is in the slightly higher areas on the flood plains along the Missouri River. Levees have been installed, but the soil is still subject to rare flooding caused by overflow from local tributaries or resulting from levee failure. Individual areas are irregular in shape and range from about 50 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 12 inches, very dark grayish brown, very friable fine sandy loam

Subsoil:
12 to 24 inches, yellowish brown, very friable loamy very fine sand
24 to 34 inches, brown, very friable loamy fine sand

Substratum:
34 to 60 inches, brown, stratified, loose fine sand, very fine sandy loam, and loamy fine sand

In some areas the surface layer contains more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Parkville soils. These soils are lower on the flood plain than the Landes soil. They make up about 5 to 10 percent of the unit.

Important properties of the Landes soil—

Permeability: Moderately rapid
Surface runoff: Slow
Available water capacity: Moderate
Organic matter content: Moderately low
Shrink-swell potential: Low

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. Returning crop residue to the soil and regularly adding other organic material increase the available water capacity, improve fertility, and help to prevent surface crusting.

This soil is well suited to most 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.

This soil is suited to trees. No hazards or limitations affect harvesting or planting.

This soil is generally not used for building site development or onsite waste disposal systems because of the possibility of levee failure and flooding.

The land capability classification is IIs. The woodland ordination symbol is 7A.

84—Haynie-Waldron complex, rarely flooded. These very deep, nearly level, moderately well drained and somewhat poorly drained soils are on the flood plains along the Missouri River. Levees have been installed, but the soils are still subject to rare flooding caused by overflow from local tributaries or resulting from levee failure. Individual areas generally are long and narrow and range from about 100 to more than 800 acres in size. They are about 60 percent Haynie soil and 30 percent Waldron soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

The typical sequence, depth, and composition of the layers of the Haynie soil are as follows—

Surface layer:

0 to 9 inches, very dark grayish brown, friable very fine sandy loam

Substratum:

9 to 60 inches, stratified dark grayish brown and brown, very friable very fine sandy loam

The typical sequence, depth, and composition of the layers of the Waldron soil are as follows—

Surface layer:

0 to 6 inches, very dark gray, firm silty clay loam

Substratum:

6 to 52 inches, stratified very dark gray and dark grayish brown, very firm silty clay loam and silty clay

52 to 60 inches, stratified very dark gray and grayish brown, friable silt loam to very fine sandy loam

Included with these soils in mapping are small areas of the poorly drained Booker and excessively drained Sarpy soils. Booker soils are slightly lower on the flood plain than the major soils. They are less stratified than the Waldron soil. Sarpy soils contain more sand than the major soils. Also, they are slightly higher on the flood plain. Included soils make up about 10 percent of the unit.

Important properties of the Haynie soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderately low
Shrink-swell potential: Low

Important properties of the Waldron soil—

Permeability: Slow in the upper part; moderate in the lower part
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Depth to the water table: 1 to 3 feet
Shrink-swell potential: High in the upper part; low in the lower part

Most areas are used for cultivated crops. These soils are suited to corn, soybeans, grain sorghum, and small grain (fig. 12). The surface layer of the Haynie soil is friable and can be easily tilled throughout a wide range in moisture content. The surface layer of the Waldron soil is firm when dry and sticky when wet. It becomes cloddy if tilled when wet. As a result, careful timing of tillage is needed. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth and increases the rate of water infiltration.

The Waldron soil is suited and the Haynie soil is well suited to most commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as timothy and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Grazing management should be designed around possible periods of flooding.

These soils are suited to trees. No major hazards or limitations affect harvesting on the Haynie soil. Equipment limitations and seedling mortality are the main management concerns in areas of the Waldron soil. The use of equipment should be limited to periods when the surface is dry or frozen. Selecting planting stock that is larger than is typical improves the seedling survival rate.

These soils are generally not used for building site development or onsite waste disposal systems because of the wetness and the possibility of levee failure and flooding.

The land capability classification of the Haynie soil is I, and that of the Waldron soil is IIw. The woodland ordination symbol for the Haynie soil is 11A, and that for the Waldron soil is 11C.

85—Waldron silty clay, loamy substratum, rarely flooded. This very deep, nearly level, somewhat poorly drained soil is on the flood plains along the Missouri River. Levees have been installed, but the soil is still subject to rare flooding caused by overflow from local tributaries or resulting from levee failure. Individual

Figure 12.—Wheat in an area of Haynie-Waldron complex, rarely flooded. Menfro silt loam, 9 to 30 percent slopes, is in the background.

areas are irregular in shape and range from about 10 to more than 300 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:

0 to 4 inches, very dark grayish brown, firm silty clay

Substratum:

4 to 48 inches, stratified very dark grayish brown, very dark gray, and grayish brown, mottled, firm silty clay and silty clay loam; thin strata of very fine sandy loam and very fine sand

48 to 60 inches, brown, yellowish brown, and light brownish gray, friable very fine sandy loam to silt loam

In some areas the soil has less clay throughout. In places the surface layer is silty clay loam. Some areas are poorly drained. In some places the lower part of the soil contains more clay.

Included with this soil in mapping are small areas of Haynie and Parkville soils. Haynie soils contain more sand throughout than the Waldron soil. They are in the slightly higher areas. Parkville soils contain more sand in the lower part than the Waldron soil. They are in slightly higher areas than the Waldron soil. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Waldron soil—

Permeability: Slow in the upper part; moderate in the lower part
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Depth to the water table: 1 to 3 feet
Shrink-swell potential: High in the upper part; low in the lower part

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. The surface layer is firm when dry and sticky when wet. It becomes cloddy if tilled when wet. As a result, careful timing of tillage is needed. Wetness is the main limitation. It can be reduced, however, by open ditches, shallow surface drains, and land grading. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is suited to trees. Equipment limitations and seedling mortality are the main management concerns. The use of equipment should be limited to periods when the surface is dry or frozen. Selecting planting stock that is larger than is typical improves the seedling survival rate.

This soil is generally not used for building site development or onsite waste disposal systems because of the wetness. Also, levee failure and flooding are possible.

The land capability classification is IIw. The woodland ordination symbol is 11C.

86—Parkville silty clay loam, rarely flooded. This very deep, nearly level, somewhat poorly drained soil is on the flood plains along the Missouri River. Levees have been installed, but the soil is still subject to rare flooding caused by overflow from local tributaries or resulting from levee failure. Areas are irregular in shape and range from about 40 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 4 inches, very dark gray, firm silty clay loam

Subsurface layer:
4 to 20 inches, very dark gray, firm silty clay

Substratum:
20 to 60 inches, stratified dark grayish brown and grayish brown, friable very fine sandy loam, loamy very fine sand, and silt loam

In some areas the clayey upper part of the soil is more than 20 inches thick. In other areas the surface layer is silty clay. In places the upper part of the soil contains less clay.

Included with this soil in mapping are small areas of Haynie and Waldron soils. The moderately well drained Haynie soils contain less clay in the upper part than the Parkville soil. They are slightly lower on the flood plain than the Parkville soil. Waldron soils are stratified throughout and contain more clay in the lower part than the Parkville soil. They are in landscape positions similar to those of the Parkville soil. Included soils make up less than 10 percent of the unit.

Important properties of the Parkville soil—

Permeability: Very slow in the upper part; moderate in the lower part
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Depth to the water table: 1 to 2 feet
Shrink-swell potential: High in the upper part; low in the lower part

Most areas are used for cultivated crops. This soil is suited to soybeans, grain sorghum, corn, and winter wheat. Careful timing of tillage is needed because the surface layer is firm and becomes cloddy if tilled when wet. Wetness is the main limitation. Land grading, shallow surface drains, and open ditches help to remove the excess water. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is suited to trees. Equipment limitations and seedling mortality are management concerns. The use of equipment should be limited to periods when the surface is dry or frozen. Selecting planting stock that is larger than is typical improves the seedling survival rate.

This soil is generally not used for building site development or onsite waste disposal systems because of the wetness. Also, levee failure and flooding are possible.

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

87—Modale silt loam, rarely flooded. This very deep, nearly level, somewhat poorly drained soil is on the flood plains along the Missouri River. Levees have been installed, but the soil is still subject to rare flooding resulting from levee failure. Individual areas are irregular in shape and range from about 50 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark grayish brown, very friable silt loam

Substratum:
8 to 22 inches, stratified dark grayish brown and grayish brown, very friable silt loam
22 to 60 inches, very dark grayish brown and dark grayish brown, mottled, very firm silty clay

In some places the upper loamy layers contain more sand than is typical. In other places the clayey substratum is more than 30 inches deep.

Included with this soil in mapping are small areas of Haynie and Waldron soils. Haynie soils have less clay in the lower part than the Modale soil. They are in the slightly higher positions on the landscape. Waldron soils are clayey in the upper part. They are slightly lower on the landscape than the Modale soil. Included soils make up about 5 to 10 percent of the map unit.

Important properties of the Modale soil—

Permeability: Moderate in the upper part; very slow in the lower part
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderately low
Depth to the water table: 1.5 to 3.0 feet
Shrink-swell potential: Low in the upper part; high in the lower part

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and winter wheat. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content. The soil is subject to wind erosion, which results mainly in damage to young crops. Cover crops, stripcropping, and field windbreaks help to control wind erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and reduces the hazard of wind erosion.

This soil is generally not used for building site development or onsite waste disposal systems because of the wetness. Also, levee failure and flooding are possible.

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

88—Cotter silt loam, rarely flooded. This very deep, nearly level, well drained soil is on high flood plains along the Missouri River. Levees have been installed, but the soil is still subject to rare flooding resulting from levee failure. Individual areas are irregular in shape and range from about 75 to more than 250 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 11 inches, black, very friable silt loam

Subsurface layer:
11 to 16 inches, black, friable silt loam

Subsoil:
16 to 25 inches, black, firm silty clay loam
25 to 36 inches, dark brown, firm silty clay loam
36 to 46 inches, dark yellowish brown, firm silty clay loam

Substratum:
46 to 60 inches, yellowish brown, friable silt loam

In some areas the slope is more than 2 percent. In other areas the subsoil is mottled. In places the subsoil contains more sand.

Included with this soil in mapping are small areas of Norborne and Tina soils. Norborne soils contain more sand than the Cotter soil. They are slightly higher on the flood plain than the Cotter soil. Tina soils contain more clay than the Cotter soil. They are in the slightly lower positions on the flood plain. Included soils make up about 5 to 10 percent of the unit.

Important properties of the Cotter soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderate
Shrink-swell potential: Moderate

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and small grain. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after hard rains. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to most commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as bromegrass and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. No serious limitations affect the use of this soil for pasture or hayland.

This soil is suited to trees. No major hazards or limitations affect harvesting.

This soil is suited to building site development and onsite waste disposal systems. Because of the possibility of levee failure, the history of flooding in a given area should be considered when sites for buildings and sanitary facilities are selected.

The land capability classification is I. The woodland ordination symbol is 9A.

89—Norborne loam, rarely flooded. This very deep, nearly level, well drained soil is in the slightly higher areas on the flood plain along the Missouri River. Levees have been installed, but the soil is still subject to rare flooding resulting from levee failure. Individual areas are long and moderately wide and range from about 50 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark brown, friable loam

Subsoil:
8 to 40 inches, very dark brown, very dark grayish brown, and brown, friable loam

Substratum:
40 to 65 inches, yellowish brown, mottled, friable loam

In some areas the dark surface layer is thinner. In other areas the slope is more than 2 percent. In some places the surface layer contains less sand. In other places the surface layer contains less clay.

Included with this soil in mapping are small areas of Cotter soils and the somewhat poorly drained Tina soils. These included soils contain more clay than the Norborne soil. They are in positions on the flood plain similar to those of the Norborne soil. They make up 5 to 10 percent of the unit.

Important properties of the Norborne soil—

Permeability: Moderate
Surface runoff: Medium
Available water capacity: High
Organic matter content: Moderate
Shrink-swell potential: Low

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, small grain, and grain sorghum. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to most commonly grown legumes, such as alfalfa and lespedeza; to cool-season grasses, such as tall fescue and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. No serious limitations affect the use of this soil for pasture or hayland.

This soil is suited to trees. No major hazards or limitations affect planting and harvesting.

This soil is suited to building site development and onsite waste disposal systems. Because of the possibility of levee failure, the history of flooding in a given area should be considered when sites for buildings and sanitary facilities are selected.

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

93—Booker silty clay, rarely flooded. This very deep, nearly level, very poorly drained soil is on the flood plains along the Missouri River. Levees have been installed, but the soil is still subject to rare flooding caused by overflow from local tributaries or resulting from levee failure. It is also subject to ponding after heavy rains. Individual areas are irregular in shape and range from about 5 to several hundred acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark gray, very firm silty clay

Subsurface layer:
8 to 13 inches, very dark gray, very firm silty clay

Subsoil:
13 to 48 inches, dark gray, mottled, very firm silty clay
48 to 60 inches, multicolored, very firm silty clay

In some areas the dark surface layer is less than 10 inches thick. In other areas the surface soil is clay. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Parkville soils. These soils have less clay in the subsoil than the Booker soil. They are in slightly higher landscape positions than those of the Booker soil. They make up about 5 percent of the unit.

Important properties of the Booker soil—

Permeability: Very slow
Surface runoff: Very slow
Available water capacity: Moderate
Organic matter content: Moderate
Seasonal high water table: 0.5 foot above to 1.0 foot below the surface
Shrink-swell potential: Very high

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. The surface layer is firm when dry and sticky when wet. It becomes cloddy if tilled when wet. As a result, careful timing of tillage is needed. Wetness is the main limitation. It can be reduced by open ditches, shallow surface drains, and land grading. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is suited to trees. Equipment limitations, seedling mortality, and the windthrow hazard are the main management concerns. The use of equipment should be limited to periods when the surface is dry or frozen. Selecting planting stock that is larger than is typical improves the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is not a concern.

This soil is generally not used for building site development or onsite waste disposal systems because of the wetness. Also, levee failure and flooding are possible.

The land capability classification is IIIw. The woodland ordination symbol is 6W.

94—Grable silt loam, rarely flooded. This very deep, nearly level, well drained soil is in the slightly higher areas on the flood plain along the Missouri River. Levees have been installed, but the soil is still subject to rare flooding caused by overflow from local tributaries or resulting from levee failure. Individual areas are irregular in shape and range from about 50 to more than 200 acres in size.

The typical sequence, depth, and composition of the layers of this soil are as follows—

Surface layer:
0 to 8 inches, very dark grayish brown, very friable silt loam

Substratum:
8 to 60 inches, stratified grayish brown and dark grayish brown, friable to loose very fine sandy loam and fine sand

In some areas the surface layer is lighter colored and is loamy fine sand or coarser sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Parkville and excessively drained Sarpy soils. Parkville soils contain more clay in the upper part than the Grable soil. They are in the higher positions on the landscape. Sarpy soils have more sand throughout than the Grable soil. They are in positions on the flood plain similar to those of the Grable soil. Included soils make up about 10 percent of the unit.

Important properties of the Grable soil—

Permeability: Moderate in the upper part; rapid in the lower part
Surface runoff: Slow
Available water capacity: Moderate
Organic matter content: Moderate
Shrink-swell potential: Low

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. Returning crop residue to the soil and regularly adding other organic material increase the available water capacity, improve fertility, and help to prevent surface crusting.

This soil is well suited to most 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.

This soil is generally not used for building site development or onsite waste disposal systems because of the possibility of levee failure and flooding.

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

99—Haynie-Waldron complex, frequently flooded. These very deep, nearly level, moderately well drained and somewhat poorly drained soils are on the flood plain along the Missouri River. They are on the river side of levees or in areas where levees have not been installed. Individual areas generally are long and narrow and range from about 200 to more than 800 acres in size. They are about 60 percent Haynie soil and 30 percent Waldron soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

The typical sequence, depth, and composition of the layers of the Haynie soil are as follows—

Surface layer:
0 to 7 inches, very dark grayish brown, friable very fine sandy loam

Substratum:
7 to 60 inches, stratified dark grayish brown, yellowish brown, and brown, very friable silt loam and very fine sandy loam

The typical sequence, depth, and composition of the layers of the Waldron soil are as follows—

Surface layer:
0 to 14 inches, very dark grayish brown, firm silty clay loam

Substratum:
14 to 16 inches, brown, firm silty clay loam
16 to 50 inches, stratified very dark grayish brown, dark grayish brown, and grayish brown, firm silty

clay and silty clay loam
50 to 60 inches, stratified dark grayish brown and grayish brown, friable very fine sandy loam to silt loam

Included with these soils in mapping are small areas of borrow pits and the excessively drained Sarpy soils. Sarpy soils contain more sand than the major soils. They are slightly higher on the flood plain than the major soils. Borrow pits that were used in the construction of levees are scattered throughout the unit. Included areas make up about 10 percent of the unit.

Important properties of the Haynie soil—

Permeability: Moderate
Surface runoff: Slow
Available water capacity: Very high
Organic matter content: Moderately low
Shrink-swell potential: Low

Important properties of the Waldron soil—

Permeability: Slow in the upper part; moderate in the lower part
Surface runoff: Slow
Available water capacity: High
Organic matter content: Moderate
Depth to the water table: 1 to 3 feet
Shrink-swell potential: High in the upper part; low in the lower part

The surface layer of the Haynie soil is friable and can be easily tilled throughout a wide range in moisture content. The surface layer of the Waldron soil is firm when dry and sticky when wet. It becomes cloddy if tilled when wet. As a result, careful timing of tillage is needed.

Most areas are used for cultivated crops. These soils are suited to corn, soybeans, grain sorghum, and small grain. Flooding is the main hazard. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth and increases the rate of water infiltration.

The Waldron soil is suited and the Haynie soil is well suited to most commonly grown legumes, such as alfalfa and red clover; to cool-season grasses, such as timothy and orchardgrass; and to warm-season grasses, such as big bluestem and switchgrass. Grazing management should be designed around possible periods of flooding.

These soils are suited to trees. No major hazards or limitations affect harvesting on the Haynie soil. Equipment limitations and seedling mortality are the main management concerns in areas of the Waldron soil. The use of equipment should be limited to periods when the surface is dry or frozen. Selecting planting stock that is larger than is typical improves the seedling survival rate.

These soils are generally unsuited to building site development and onsite waste disposal systems because of the flooding.

The land capability classification of the Haynie and Waldron soils is IIIw. The woodland ordination symbol for the Haynie soil is 11A, and that for the Waldron soil is 11C.

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 or 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 Natural Resources Conservation Service.

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 as 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 to prevent 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 behavioral 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 recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

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

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

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

Crops and Pasture

Robert J. Crowder, district conservationist, Natural Resources 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 Natural Resources 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 the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Crops are harvested from about 270,000 acres in Chariton County. This acreage includes about 16,000 acres of wheat, 60,000 acres of corn, 144,000 acres of soybeans, 14,000 acres of grain sorghum, and 36,000 acres of hay (Missouri Crop and Livestock Reporting Service, 1988).

Erosion is the major hazard on about 40 percent of the cropland and pasture in Chariton County. It is a particular concern in areas where the slope is more than 2 percent. The two major types of erosion in the survey area are sheet and gully erosion. Sheet erosion is more damaging than gully erosion. The loss of the surface layer results in lower fertility levels and poorer tilth, reduces the available water capacity, lowers productivity, reduces the rate of water infiltration, and increases the energy requirements for tillage. The eroding sediment enters lakes, ponds, and streams and fills roadside ditches and drainage systems. Erosion control is needed to reduce stream pollution and improve the quality of water for domestic, municipal, and recreational uses.

Conservation tillage, crop rotations, winter cover crops, a permanent plant cover, contour farming, contour stripcropping, grassed waterways, terraces, diversions, and grade-stabilization structures help to control erosion on upland soils. Crop rotations that include grasses help to minimize the amount of time that the soil is exposed to erosion. A permanent plant cover, such as grasses and legumes grown for hay or pasture, helps to minimize soil losses.

A system of conservation tillage limits the extent to which the surface is disturbed and leaves crop residue on or near the surface. Crop residue increases the rate of water infiltration, improves tilth, and reduces the susceptibility to erosion by protecting the soil from the impact of raindrops. The greater the percentage of ground covered by crop residue, the more effective the erosion control. Conservation tillage uses methods of chiseling, discing, and planting that leave a protective cover on the soil. It is most effective on soils that have smooth, uniform slopes. Terraces and diversions intercept water as it travels downslope and thus help to control erosion. They are most effective on deep, well drained or moderately well drained soils that have uniform slopes. Grassed waterways, tile terrace outlets, and grade-stabilization structures help to control gully erosion by disposing of excess water at a nonerosive velocity.

Wind erosion is a minor problem in Chariton County. It occurs mainly on bottom-land soils that are tilled in the fall or are not protected by a cover of plants or crop residue in winter or early spring. It can be controlled by maintaining a permanent plant cover and by delaying tillage until just prior to planting.

Soil fertility is a basic management concern affecting the productivity of all soils. Some soils, such as Cotter, Haynie, Grundy, and Wakenda soils, have a high level of natural fertility. On these soils, additions of moderate amounts of nitrogen, phosphate, potash, and calcium are needed. Additions of trace elements may also be needed. In other soils, such as Armstrong, Higginsville, and Carlow soils, natural fertility is medium or low. Higher amounts of fertilizer and lime are needed on these soils. Soil tests are needed to determine the kinds and amounts of lime and fertilizer that should be applied.

Soil tilth is an important factor affecting seedbed preparation, the germination of seeds, and the infiltration of water into the soil. The content of organic matter has an important effect on tilth. Soils that have a higher organic matter content can be tilled more easily than those in which the content is lower. Soils in areas where severe erosion has removed most of the topsoil and soils in areas where frequent tillage has broken down the soil structure are subject to surface crusting. The crust hardens when dry and reduces the rate of water infiltration and increases the runoff rate. Returning crop residue to the soil helps to maintain the content of organic matter.

Some form of conservation tillage is needed to maintain present levels of tilth and organic matter content and to maintain good soil structure. In Chariton County, using no-till farming and maintaining a permanent cover of sod are the most effective methods of conservation tillage. Tilth and soil structure can be improved over a period of time, but an estimated 10 years of regular additions of organic matter may be needed before a measurable improvement takes place.

Soil drainage is a major management concern on about 20,000 acres in Chariton County. It is a concern mainly on alluvial soils along flood plains. Carlow, Portage, Booker, and Zook soils are examples of poorly drained soils in these areas. Because of restricted permeability, the extra water damages crops in most years unless a surface drainage system is installed.

Many different kinds of crops and grasses are suited to the soils and climatic conditions of the survey area. Soybeans are the main crop. Corn and grain sorghum are also important row crops. Wheat is the dominant small grain. Oats, rye, barley, and tobacco (fig. 13) are suited to the area but are not widely grown.

The important grasses and legumes grown for hay and pasture are fescue, orchardgrass, bromegrass, timothy, red clover, and alfalfa. Deep-rooted legumes, such as alfalfa, are best suited to deep, well drained or moderately well drained soils, such as Knox, Menfro, and Wakenda soils, and to some of the bottom-land soils that are adequately drained. The major management concern on most of the pasture is overgrazing. Grazing should be controlled so that plants survive and achieve maximum production. Keeping grasses at a desirable height reduces the runoff rate and the hazard of erosion.

Native warm-season grasses can grow well in the survey area, but currently they are not widely grown. Big bluestem, indiangrass, and switchgrass are examples of plants that could be included in grazing systems. These species produce forage during the hot, dry periods in July and August when many cool-season grasses are dormant.

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 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,

Figure 13.—Tobacco in an area of Knox silty clay loam, 5 to 9 percent slopes, eroded.

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 Natural Resources 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 or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA, 1961). Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main 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); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Douglas C. Wallace, forester, Natural Resources Conservation Service, helped prepare this section.

According to estimates by the Missouri Department of Conservation, approximately 9 percent of Chariton County, or about 46,282 acres, was forested in 1986. Upland woodland tracts in the county are primarily small, irregular, private holdings of 10 to 50 acres in size and are essentially unmanaged (Geissman and others, 1986). On the flood plains, wooded tracts occur only as long, narrow bands bordering streams and rivers.

Soil properties that affect the growth of trees include reaction (pH), fertility, drainage, texture, structure, and soil depth. The soil also serves as a reservoir for moisture, provides an anchor for roots, and supplies essential plant nutrients. Soils in which these properties are not extreme and that have an effective rooting depth of more than 40 inches provide the best medium for timber production.

Site characteristics that affect tree growth include aspect, slope, and topographic position. These site characteristics influence the amount of available sunlight, air drainage, soil temperature, soil moisture, and relative humidity. Generally, north and east aspects and the lower slope positions, which are cooler and have better moisture conditions, are the best upland sites for tree growth. The most productive bottom-land soils are generally deep, moderately well drained, and only occasionally flooded.

Management activities can influence woodland productivity and should be aimed at eliminating factors that cause tree stress. Generally, such management includes thinning overstocked young stands; harvesting old, mature trees; and preventing destructive fire and grazing by livestock. Fire and grazing have very negative impacts on forest growth and quality. Although forest fires are no longer a major problem in the county, about 50 percent of the woodland is still subject to grazing. Grazing destroys the leaf layer on the surface, compacts the soil, and kills or damages tree seedlings. Woodland sites that have not been grazed or burned have the highest potential for optimum timber production.

Armstrong, Winnegan, and Menfro soils support the largest acreages of upland timber. Typical species are white oak, northern red oak, black oak, black walnut, and sugar maple. Post oak, black oak, and shagbark hickory occur on the less productive Armstrong soils in the steeply dissected areas of glacial till. Undisturbed areas of timber on Menfro soils are very productive.

Along the major watercourses, Waldron, Booker, Carlow, Portage, Tuskeego, Tice, and Dockery soils support bottom-land hardwoods adapted to wet or flooded soil conditions. Many of these sites have been cleared for crop production. The remaining wooded areas typically support silver maple, hackberry, American elm, swamp white oak, sycamore, cottonwood, pecan, and pin oak. Bur oak, shellbark hickory, and walnut are common on bottom land along the smaller streams and on the higher terraces of the major streams. A high potential for excellent timber growth exists on these sites.

Specialty tree plantings, such as Christmas trees, nut trees, and fuelwood trees, can be very successful if adapted species are used. Christmas tree plantings can be established on any soil that is not poorly drained or very poorly drained. Species of trees suited to the soils in Chariton County include Scotch pine, Austrian pine, white pine, and Douglas-fir. Nut trees, such as eastern black walnut and native pecan (fig. 14), are best suited to deep, loamy, moderately well drained or well drained soils, such as Menfro and Knox soils in the uplands and Haynie and Landes soils on bottom land. Pecan trees grow best in areas of poorly drained bottom-land soils that are subject to occasional flooding. Other soils are also suited to pecans but may be less productive than the soils in these areas. Tree plantations for fuelwood utilizing fast-growing species are feasible in Chariton County. The species most adaptable for this purpose are green ash, black locust, sycamore, and silver maple.

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 *N*, snowpack. 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 N.

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, and fire lanes and in 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 and season of use are 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.

Figure 14.—A pecan grove in an area of Booker silty clay, rarely flooded, south of Brunswick. Brunswick is the "Pecan Capital of Missouri."

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 generally is the most common species on the soil and is the one that determines the ordination class.

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

Windbreaks and Environmental Plantings

Douglas C. Wallace, forester, Natural Resources Conservation Service, helped prepare this section.

Living plants play an important role in supporting our life and improving its condition. When properly used and maintained, plants provide positive solutions to problems in our contemporary environment. In Chariton County, windbreaks and environmental plantings can be utilized throughout the landscape for a variety of engineering, climatological, and esthetic purposes.

Windbreaks can be grown successfully in most areas of Chariton County. Some important considerations affecting the management of farmstead and field windbreaks are design and layout, species selection, site preparation, seedling handling, weed management, supplemental watering, and protection from diseases, insects, and livestock.

Farmstead windbreaks make the farmstead more comfortable, reduce energy costs, increase yields from gardens and fruit trees, enhance wildlife populations, buffer noises, and increase property values (Scholten, 1988).

Feedlot windbreaks can be used to protect livestock from wind and snow. Windbreaks significantly minimize calf losses, make feeding easier, and enable livestock to maintain better weight with less feed.

Farmstead and feedlot windbreaks are generally three or more rows deep and include at least two rows of coniferous trees. The windbreaks should be established on the windward side of the area to be protected and should be at right angles to the prevailing winds. Well designed farmstead and feedlot windbreaks are needed in Chariton County, especially in the open areas of former prairie soils, such as Lagonda, Grundy, Bevier, and Armstrong soils.

Field windbreaks or shelterbelts protect field crops and areas of bare soil from the effects of strong winds. Field windbreaks minimize soil losses, increase crop yields, help to prevent the spread of weeds, and enhance wildlife populations (Brandle and others, 1988). Careful planning is needed. Field boundaries, irrigation systems, power lines, and roads should be considered when the location of field windbreaks is determined. Windbreaks should be oriented at right angles to the prevailing winds. A typical field windbreak system consists of a series of single rows of trees or shrubs. Field windbreaks are adaptable to many locations in Chariton County but are most beneficial in areas of the Carlow-Tice-Dockery and Lagonda-Grundy-Armstrong associations, which are described under the heading "General Soil Map Units."

Environmental plantings can be used for beautification, as visual screens, and for control of acoustical and climatological problems around buildings and other living spaces. Plants whose height, shape, color, and texture are compatible with the surrounding area, structures, and desired use should be selected (Robinette, 1972). Trees and shrubs can be easily established in most parts of Chariton County if proper site preparation methods are applied and weeds and other competing vegetation are controlled.

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

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public 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 recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational 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 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.

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

John Mack Ellis, biologist, Missouri Department of Conservation, helped prepare this section.

Chariton County is the southernmost county of the 11 counties in north-central Missouri that make up the Northern Riverbreaks Zoogeographic Region (Nagel, 1970). Its most prominent features are the quantity and diversity of wetland habitats. Rivers and streams include the lower reaches of the Grand and Chariton Rivers, the Missouri River, and the lower reaches of Mussel Fork, Yellow, and Locust Creeks. These southward-flowing streams and associated side channels, bottom-land lakes, oxbows, marshes, and timbered riparian areas were once considered among the most important waterfowl flyways in the central United States (Nagel, 1970). The construction of levees and dredging, channelization, and agricultural expansion have reduced the wetland wildlife resources to about 10 percent of their presettlement size.

Presettlement surveys by the United States General Land Office indicated that 50 percent of Chariton County was covered by prairie. Much of the upland prairie consisted of luxuriant growths of bluestem and other native grasses (Schroeder, 1982). The flood plains along the Missouri, Grand, and Chariton Rivers supported approximately 53,000 acres of wet bottom-land prairie. The present site of Swan Lake National Wildlife Refuge was predominantly a wet prairie before the area was settled. The wet prairies consisted mainly of dense stands of cordgrass (ripgut), reed canarygrass, and rice cutgrass. Early historical accounts reported good populations of deer, turkey, buffalo, bears, wolves, white pelicans, golden plover, sandhill cranes, elk, grouse, prairie chickens, and rattlesnakes. The Lagonda-Grundy-Armstrong and Tina-Triplett-Shannondale associations, which are described under the heading "General Soil Map Units," make up the 242,500 acres of upland and wet bottom-land prairie. Except for a few remnant tracts, virtually all of the native prairie has been converted to cropland, pasture, or hayland.

More than 294 species of fish and wildlife seasonally or permanently inhabit Chariton County, and 115 additional species are listed as "likely to occur" (Missouri Department of Conservation, 1981). Typical nongame species include tufted titmouse, cedar waxwing, barred owl, red-tailed hawk, great blue heron, belted kingfisher, eastern meadowlark, American goldfinch, northern cardinal, red-winged blackbird, prairie kingsnake, and common snapping turtle. The most common game species include white-tailed deer, eastern wild turkey, bobwhite quail, fox squirrel, gray squirrel, eastern cottontail rabbit, raccoon, wood duck, mallard, northern pintail, and Canada goose.

At least 24 species recognized by the state or by the Federal government as rare or endangered have been reported in Chariton County (Missouri Department of Conservation, 1981). Included are the bald eagle, the Indiana bat, the interior least tern, the massasauga rattlesnake, the eastern spotted skunk, and the winged mapleleaf mussel. A few northern harriers (marsh hawks) and badgers still inhabit the county, despite the almost complete loss of their native prairie habitat.

The abundant furbearer populations in Chariton County include all of the species that are typical of northern Missouri. Raccoon, opossum, muskrat, coyote, mink, beaver, gray fox, and striped skunk are common. Most of the species are limited to the remaining areas of suitable habitat.

Since 1937, when the Missouri Department of Conservation was established, many wildlife species have been restored to their original ranges. Other restoration efforts are currently underway. Chariton County has benefited from many of these successful restoration efforts. In 1990, 2,282 deer and 623 turkeys were harvested. The midwinter eagle survey in January of 1991 counted 1,815 bald eagles in Missouri, many of which migrated through Chariton County. More than 100 eagles regularly concentrate near Swan Lake National Wildlife Refuge each winter. The first otters to be reintroduced into Missouri were released at this refuge in 1982. The diversity and the high quality of the wetland habitat remaining there provide ideal conditions for otters. Since that time, hundreds of otters have been released in suitable habitats throughout the Grand River system. In 1991, 113 otter sightings from 64 different waterways in 42 counties were reported (Kulowiec and Hamilton, 1991).

The Chinese ring-necked pheasant is likely to be the next species to be successfully established in Chariton County. More than 275 pheasants were released near Glasgow and Salisbury in January 1991. These releases were part of a plan to expand the pheasant range in northern Missouri using wild birds. Pheasant nesting cover can be improved by establishing grasses, such as orchardgrass, brome, or native warm-season grasses.

The remaining wetland bottom-land habitat is in areas of the Carlow-Tice-Dockery and Haynie-Waldron-Booker associations. The Carlow-Tice-Dockery association is adjacent to the Grand and Chariton Rivers and the small creek bottoms along Mussel Fork and Locust Creeks. The highest quality and most diverse types of wetlands are near the Swan Lake Wildlife Refuge and Dalton Cutoff Lake (fig. 15). More than 160 species of migratory birds and waterfowl rest and feed in these wetlands during their spring and fall migration. Four active great blue heron rookeries are also known to exist in areas of these associations (Missouri Department of Conservation, 1991). Great blue herons require tall trees, which generally occur in areas of bottom land, for successful nesting. The county is also noted for great concentrations of Canada geese. The number of these geese in the county has increased regularly, and more than 100,000 winter in the area each year (Vaught and Kirsh, 1966).

The Armstrong association and the Lagonda-Grundy-Armstrong association provide most of the habitat for openland wildlife. Small tracts of woodland, hedgerows, fencerows, and other woody or brushy areas provide the edge effect essential for the 86 species of openland wildlife that inhabit the county. These "hard cover" areas supply an important type of habitat that is rapidly disappearing in many of the intensively cultivated sections of the county. Typical openland species include bobwhite quail, cottontail rabbit, eastern meadowlark, goldfinch, dickcissel, cardinal, and mourning dove.

The bobwhite quail is one of the most sought-after game species. Numbers of this species fluctuate greatly from year to year because of extreme winter weather and a lack of woody cover and quality nesting areas. Practices that improve the habitat for bobwhite quail include planting native warm-season grasses; establishing field borders, windbreaks, and waterways; applying a system of conservation tillage; and using a system of crop rotation.

The Armstrong association, the Menfro-Higginsville-Wakenda association, and the Carlow-Tice-Dockery association include most of the forest land and other wooded areas in the county. Common woodland wildlife species include white-tailed deer, turkey, raccoon, wood duck, redheaded woodpecker, white-breasted nuthatch, short-tailed shrew, gray squirrel, fox squirrel, barred owl, bluejay, and woodcock. The county supports good populations of deer, turkey, and squirrels. Gray squirrels are common in wooded areas on bottom land. Fox

Figure 15.—Dalton Cutoff Lake is a diverse wetland area. Pictured is an area of Booker silty clay, rarely flooded.

squirrels are mainly in the uplands, in farm woodlots, and in wooded draws.

Most of the wildlife habitat in the county is controlled by private landowners. Obtaining access for deer hunting may become easier in the future as landowners become more aware of the advantages of using hunting as a means of deer management. The Missouri Department of Conservation manages two public wildlife areas in the county. Yellow Creek National History area consists of 618 acres of wetlands and bottom-land forest and provides opportunities for observation and hunting of waterfowl and woodland wildlife. Also, the department leases 2,500 acres of land from the Swan Lake National Wildlife Refuge for public waterfowl hunting (fig. 16).

More than 63 species of game and nongame fish inhabit the rivers and lakes of Chariton County (Missouri Department of Conservation, 1981). Rivers and streams offer the major fishing opportunities. Anglers catch good numbers of flathead catfish, channel catfish, carp, drum, and bullheads and some sunfish. The major fishing streams are the Missouri, Grand, and Chariton Rivers and the Middle and East Forks of the Little Chariton River. Mussel Fork, Yellow, and Locust Creeks also provide seasonal fishing opportunities. Chariton County has about 125 miles of permanent flowing streams (Missouri Crop and Livestock Reporting Service, 1984).

Fish populations and fishing opportunities in the streams of north-central Missouri have decreased dramatically as a result of channelization, especially on the Chariton River. The length of the channel of the Chariton River from U.S. Highway 136 to the confluence with the Missouri River has been shortened from 205 to 92 miles (Congdon, 1971). In addition, many of the associated channel areas, such as marshes, oxbows, and wetland lakes, have disappeared.

The majority of the impoundment fishing in the county is provided by three public lakes and one private lake. The public lakes are Marceline City Lake (176 acres), Sterling Price Community Lake (25 acres), and Pine Ridge Lake (25 acres). Lake Nehai Tonkea (300 acres) is a private development lake restricted to membership fishing only. These lakes are fished for largemouth bass, channel catfish, crappie, and bluegill. Approximately 1,000 private farm ponds and small lakes provide additional fishing opportunities (Missouri Crop and Livestock Reporting Service, 1984).

The Food Security Act of 1985 gave landowners an opportunity to enhance wildlife habitat through various cost-share and incentive programs, such as the Conservation Reserve Program (CRP), the Agricultural Conservation Program (ACP), and the Forestry Stewardship Incentive Program. Other programs are offered by state agencies and by soil and water conservation districts.

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

Figure 16.—An important area for wildlife habitat and public waterfowl hunting near Sumner, Missouri, in the Swan Lake National Wildlife Refuge. The soils are in an area of the Tina-Triplett-Shannondale association.

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 flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and soybeans.

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, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

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

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

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

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

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

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

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

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

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

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for 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 should 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 kinds 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 recreational 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 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, shrinking and swelling, 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, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

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

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

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

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

Table 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. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

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

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should 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, highly organic layers, soil reaction, and content of salts and sodium affect trench 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 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 wind erosion.

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 the 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 to 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 have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They 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 low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

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

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high 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, organic matter, or salts or sodium. 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 the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. 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, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control 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 wind erosion 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 wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

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

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

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

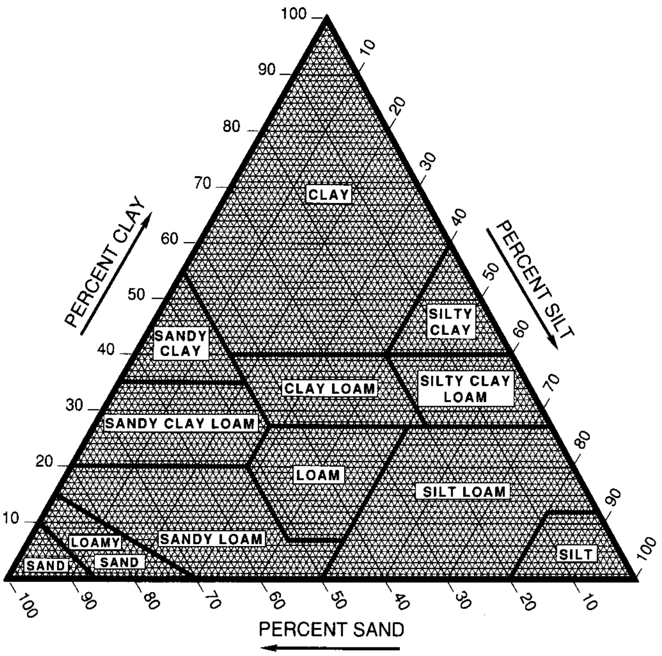

Figure 17.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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 the heading "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. 17). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

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 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

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

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

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

Physical and Chemical Properties

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

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

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, 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 and septic tank absorption fields.

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 classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

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

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

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

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.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. 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 (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

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 little or no horizon development.

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 estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

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

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

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

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

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

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1975). 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 Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that has a udic moisture regime).

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

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 equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, montmorillonitic, mesic Aquertic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the 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" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). 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."

Armstrong Series

The Armstrong series consists of very deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in a thin layer of pedisediment and in the underlying paleosol derived from glacial till. Slopes range from 2 to 14 percent.

Typical pedon of Armstrong loam, 5 to 9 percent slopes, eroded, 2,200 feet south and 150 feet east of the northwest corner of sec. 15, T. 56 N., R. 17 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; common fine roots; some brown (10YR 4/3) mixings; neutral; abrupt smooth boundary.

2Bt1—7 to 14 inches; brown (10YR 4/3) clay loam; common fine prominent reddish brown (5YR 4/4) and strong brown (7.5YR 4/6) and few fine faint grayish brown (10YR 5/2) mottles; moderate very fine subangular blocky structure; firm; common fine roots; few faint clay films on faces of peds; few black iron stains; few silt coatings; 2 percent gravel; very strongly acid; clear smooth boundary.

2Bt2—14 to 21 inches; dark yellowish brown (10YR 4/6) clay loam; common fine prominent yellowish red (5YR 4/6) and grayish brown (10YR 5/2) mottles; moderate very fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; few black iron stains; 1 percent gravel; moderately acid; gradual smooth boundary.

2Bt3—21 to 33 inches; dark yellowish brown (10YR 4/6) clay loam; common medium prominent yellowish red (5YR 4/6) and common fine prominent grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) mottles; weak fine prismatic structure parting to moderate very fine subangular blocky; firm; few fine roots; common distinct clay films on faces of peds; few black iron stains; 2 percent gravel; slightly acid; gradual smooth boundary.

2Bt4—33 to 48 inches; yellowish brown (10YR 5/6) clay loam; many fine prominent grayish brown (10YR 5/2) and few fine prominent yellowish red (5YR 4/6) mottles; moderate very fine subangular blocky structure; firm; common distinct clay films on faces of peds; common black iron stains; 3 percent gravel; slightly alkaline; gradual smooth boundary.

2Bk—48 to 60 inches; yellowish brown (10YR 5/6) clay loam; many medium prominent grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; firm; few faint clay films on vertical faces of peds; many black iron stains; 2 percent gravel; slight effervescence; moderately alkaline.

The Ap or A horizon has chroma of 1 or 2. It commonly is loam, but the range includes clay loam. The E horizon, if it occurs, has value of 4 or 5 and chroma of 2 or 3. The 2Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 3 to 6. Mottles with chroma of 2 are in the upper part of this horizon. The upper part of the argillic horizon has hue of 5YR or redder, either in the matrix or as mottles. The 2Bk horizon has colors and textures similar to those of the 2Bt horizon.

Bevier Series

The Bevier series consists of very deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in a thin layer of loess over weathered pedisediment. Slopes range from 2 to 5 percent.

Typical pedon of Bevier silty clay loam, 2 to 5 percent slopes, eroded, 300 feet west and 175 feet south of the northeast corner of sec. 19, T. 56 N., R. 18 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; few fine roots; moderately acid; abrupt smooth boundary.

Bt1—8 to 13 inches; dark grayish brown (10YR 4/2) silty clay; few fine distinct yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; few black iron stains; common organic coatings on faces of peds; strongly acid; clear smooth boundary.

Bt2—13 to 18 inches; multicolored dark grayish brown (10YR 4/2), brown (10YR 4/3), and dark yellowish brown (10YR 4/6) silty clay; weak fine prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; common distinct clay films on faces of peds; few black iron stains; strongly acid; clear smooth boundary.

Btg1—18 to 24 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common distinct clay films on faces of peds; few black iron and manganese concretions; strongly acid; clear smooth boundary.

2Btg2—24 to 39 inches; light brownish gray (10YR 6/2) silty clay loam; common coarse distinct yellowish brown (10YR 5/4) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common distinct clay films on faces of peds; common silt coatings; few black iron and manganese concretions; 14 percent sand; slightly acid; gradual smooth boundary.

2Btg3—39 to 53 inches; light brownish gray (10YR 6/2) silty clay loam; many coarse distinct yellowish brown (10YR 5/4) mottles; moderate very fine prismatic structure parting to moderate fine subangular blocky; firm; common distinct clay films on faces of peds; common silt coatings; few black iron and manganese concretions; 14 percent sand; moderately acid; gradual smooth boundary.

2Btg4—53 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; common medium prominent yellowish brown (10YR 5/6) and few fine distinct yellowish brown (10YR 5/4) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; common distinct clay films on faces of peds; common silt coatings; few black iron and manganese concretions; 13 percent sand; moderately acid.

The depth to maximum sand content ranges from 20 to 40 inches. The Ap horizon has chroma of 1 or 2. The Bt horizon has value of 4 to 6. Mottles have hue of 5YR to 2.5Y, value of 4 to 6, and chroma of 1 to 8. The 2Bt horizon has colors similar to those of the Bt horizon. It is silt loam, silty clay loam, or clay loam. The content of sand in the 2Bt horizon ranges from 10 to 15 percent.

Blackoar Series

The Blackoar series consists of very deep, poorly drained, moderately permeable soils on flood plains along intermediate streams. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Blackoar silt loam, occasionally flooded, 1,400 feet west and 250 feet north of the southeast corner of sec. 36, T. 54 N., R. 17 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate thin platy structure parting to moderate fine granular; friable; neutral; abrupt smooth boundary.

A—7 to 11 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bg1—11 to 23 inches; gray (10YR 6/1) silt loam; common fine prominent yellowish brown (10YR 5/6) and many fine faint grayish brown (10YR 5/2) mottles; weak fine prismatic structure parting to weak fine subangular blocky; firm; moderately acid; clear smooth boundary.

Bg2—23 to 34 inches; gray (10YR 6/1) silt loam; few fine prominent yellowish brown (10YR 5/6) and common fine distinct brown (10YR 4/3) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; moderately acid; clear smooth boundary.

Bg3—34 to 48 inches; gray (10YR 6/1) silt loam; common fine faint dark grayish brown (10YR 4/2) and common fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine prismatic structure parting to weak fine subangular blocky; firm; moderately acid; clear smooth boundary.

BCg—48 to 65 inches; gray (10YR 6/1) silt loam; common fine distinct dark grayish brown (10YR 4/2) and many fine prominent dark yellowish brown (10YR 4/6) mottles; weak fine prismatic structure; firm; moderately acid.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bg and BCg horizons have hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 or less and have mottles with higher chroma. They are silt loam or silty clay loam.

Booker Series

The Booker series consists of very deep, very poorly drained, very slowly permeable soils on the flood plain along the Missouri River. These soils formed in clayey alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Booker silty clay, rarely flooded, 450 feet west and 1,210 feet south of the northeast corner of sec. 7, T. 52 N., R. 18 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; moderate very fine granular structure; very firm; few very fine roots; neutral; abrupt smooth boundary.

A—8 to 13 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; moderate very fine angular blocky structure; very firm; few very fine roots; neutral; clear smooth boundary.

Bg1—13 to 23 inches; dark gray (5Y 4/1) silty clay; common fine prominent dark yellowish brown (10YR 4/4) mottles; moderate fine angular blocky structure; very firm; few very fine roots; common shiny pressure faces; neutral; gradual smooth boundary.

Bg2—23 to 33 inches; dark gray (5Y 4/1) silty clay; common fine prominent dark yellowish brown (10YR 4/6) mottles; strong very fine angular blocky structure; very firm; few very fine roots; many shiny pressure faces; neutral; gradual smooth boundary.

Bg3—33 to 48 inches; dark gray (5Y 4/1) silty clay; common fine prominent yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/6) mottles; strong very fine angular blocky structure; very firm; few very fine roots; common shiny pressure faces; neutral; gradual smooth boundary.

BCg—48 to 60 inches; multicolored olive gray (5Y 5/2), dark gray (5Y 4/1), and yellowish brown (10YR 5/6) silty clay; weak medium angular blocky structure; very firm; few shiny pressure faces; neutral.

The mollic epipedon ranges from 10 to 24 inches in thickness. The A horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 2 or 3 and chroma of 0 to

2. The Bg horizon has hue of 10YR, 2.5Y, or 5Y or is neutral in hue. It has value of 3 to 5 and chroma of 0 to 2. It typically is silty clay, but the range includes silty clay loam in the lower part. The BCg horizon or the Cg horizon, if it occurs, has hue of 2.5Y or 5Y or is neutral in hue. It has value of 4 or 5 and chroma of 0 to 2. It is silty clay or clay.

Carlow Series

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

Typical pedon of Carlow silty clay, occasionally flooded, 2,550 feet south and 900 feet east of the northwest corner of sec. 16, T. 54 N., R. 18 W.

Ap—0 to 3 inches; very dark grayish brown (10YR 3/2) silty clay, dark grayish brown (10YR 4/2) dry; weak fine granular structure; firm; few fine roots; neutral; abrupt smooth boundary.

A—3 to 13 inches; very dark grayish brown (10YR 3/2) silty clay, dark grayish brown (10YR 4/2) dry; moderate medium angular blocky structure; very firm; few fine roots; slightly acid; clear smooth boundary.

Bg1—13 to 30 inches; dark grayish brown (10YR 4/2) clay; common fine faint brown (10YR 4/3) and common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; very firm; few fine roots; common black iron stains; few slickensides; strongly acid; clear smooth boundary.

Bg2—30 to 60 inches; gray (10YR 5/1) silty clay; many medium distinct brown (10YR 5/3) and common fine distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; very firm; few fine roots; few black iron stains; few slickensides; strongly acid.

The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. Mottles have hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 3 to 6. The Cg horizon, if it occurs, has colors and textures similar to those of the Bg horizon.

Colo Series

The Colo series consists of very deep, poorly drained, moderately permeable soils on the flood plains along intermediate streams. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Colo silt loam, occasionally flooded, 2,300 feet west and 800 feet north of the southeast corner of sec. 17, T. 56 N., R. 18 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; common fine roots; neutral; gradual smooth boundary.

A1—8 to 16 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; moderately acid; gradual smooth boundary.

A2—16 to 26 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; firm; common fine roots; few fine iron stains; moderately acid; gradual smooth boundary.

Bg1—26 to 42 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; common medium distinct dark yellowish brown (10YR 4/4) and common medium faint dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; firm; common fine roots; few iron stains; few iron and manganese concretions; moderately acid; gradual smooth boundary.

Bg2—42 to 56 inches; grayish brown (10YR 5/2) silty clay loam; weak medium subangular blocky structure; firm; common fine roots; few iron and manganese concretions; common iron stains; common organic coatings on faces of peds; moderately acid; gradual smooth boundary.

BCg—56 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; weak medium subangular blocky structure; firm; common fine roots; few iron and manganese concretions; common iron stains; common organic coatings on faces of peds; moderately acid.

The mollic epipedon is 36 or more inches thick. The 10- to 40-inch control section averages 27 to 35 percent clay. Individual horizons may contain 36 to 40 percent clay.

The A horizon has value of 2 or 3. The Bg horizon also has value of 2 or 3. The BCg and C horizons have hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 2 or less. Strong brown and yellowish brown mottles are below a depth of 24 inches in some pedons.

Cotter Series

The Cotter series consists of very deep, well drained, moderately permeable soils on high flood plains along the Missouri River. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Cotter silt loam, rarely flooded, 450 feet north and 150 feet east of the southwest corner of sec. 25, T. 52 N., R. 19 W.

Ap—0 to 5 inches; black (10YR 2/1) silt loam; moderate fine granular structure; very friable; few very fine roots; neutral; abrupt smooth boundary.

A1—5 to 11 inches; black (10YR 2/1) silt loam; weak fine granular structure; friable; few very fine roots; moderately acid; clear smooth boundary.

A2—11 to 16 inches; black (10YR 2/1) silt loam; moderate fine subangular blocky structure; friable; moderately acid; clear smooth boundary.

Bt1—16 to 25 inches; black (10YR 2/1) silty clay loam; moderate fine subangular blocky structure; firm; common faint clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt2—25 to 36 inches; dark brown (10YR 3/3) silty clay loam; moderate medium subangular blocky structure parting to moderate fine subangular blocky; firm; common distinct clay films on faces of peds; few black organic stains on faces of peds; moderately acid; clear smooth boundary.

BC—36 to 46 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium faint brown (10YR 4/3) mottles; weak fine subangular blocky structure; firm; few distinct clay films; few black organic stains on faces of peds; moderately acid; clear smooth boundary.

C—46 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct dark yellowish brown (10YR 4/6) mottles; massive; friable; few black organic stains in root channels and voids; slightly acid.

The thickness of the mollic epipedon ranges from 24 to 36 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. The part of the B horizon below the mollic epipedon has value of 4 or 5 and chroma of 3 or 4. The C horizon, if it occurs, is silt loam or very fine sandy loam and may be stratified with textures that contain more clay. It has value of 4 to 6 and chroma of 2 to 4.

Crestmeade Series

The Crestmeade series consists of very deep, poorly drained, slowly permeable soils on uplands. These soils formed in loess. Slopes range from 0 to 2 percent.

Typical pedon of Crestmeade silt loam, 500 feet west and 50 feet south of the northeast corner of sec. 1, T. 56 N., R. 21 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; friable; many very fine and fine roots; few black iron stains; moderately acid; abrupt smooth boundary.

E—8 to 14 inches; grayish brown (10YR 5/2) silt loam; common fine faint dark grayish brown (10YR 4/2) and few fine faint very dark grayish brown (10YR 3/2) mottles; weak very fine subangular blocky structure; friable; few very fine roots; few black iron stains; moderately acid; abrupt smooth boundary.

Bt1—14 to 20 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; common fine faint dark brown (10YR 4/3) mottles; moderate very fine subangular blocky structure; very firm; few very fine roots; common distinct clay films on faces of peds; few black iron and manganese concretions and stains; common organic coatings on faces of peds; strongly acid; clear smooth boundary.

Bt2—20 to 26 inches; very dark gray (10YR 3/1) clay, dark grayish brown (10YR 4/2) dry; common fine distinct dark brown (10YR 4/3) mottles; moderate very fine subangular blocky structure; very firm; few very fine roots; common distinct clay films on faces of peds; few black iron and manganese concretions and stains; common organic coatings on faces of peds; moderately acid; clear smooth boundary.

Btg1—26 to 34 inches; grayish brown (2.5Y 5/2) silty clay; common fine distinct olive brown (2.5Y 4/4) and common fine faint dark grayish brown (2.5Y 4/2) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; common distinct clay films on faces of peds; few black iron and manganese concretions and stains; moderately acid; gradual smooth boundary.

Btg2—34 to 53 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct light olive brown (2.5Y 5/4) and few fine faint dark grayish brown (2.5Y 4/2) mottles; weak fine prismatic structure parting to moderate very fine subangular blocky; firm; few very fine roots; common distinct clay films on faces of peds; few black iron and manganese concretions and stains; slightly acid; gradual smooth boundary.

BCg—53 to 74 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct olive brown (2.5Y 4/4) and few fine distinct light olive brown (2.5Y 5/4) mottles; weak fine prismatic structure parting to weak coarse angular blocky; firm; few faint clay films on vertical faces of peds; few black iron and manganese concretions and stains; neutral.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 1 or 2. The upper part of the Bt horizon has value of 2 or 3 and chroma of 1 or 2. It is clay or silty clay. The lower part of the Bt horizon and the BC horizon have hue of

10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. They are silty clay or silty clay loam. Mottles in the B horizons have hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 2 to 8.

Dockery Series

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

Typical pedon of Dockery silt loam, frequently flooded, 2,400 feet west and 2,500 feet south of the northeast corner of sec. 26, T. 54 N., R. 18 W.

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

Ap2—2 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many very fine roots; common thin strata of dark grayish brown (10YR 4/2); neutral; abrupt smooth boundary.

C1—5 to 19 inches; thin layers of very dark grayish brown (10YR 3/2), grayish brown (10YR 5/2), and dark yellowish brown (10YR 3/6) silt loam; massive; friable; few very fine roots; few black iron stains; slightly alkaline; clear smooth boundary.

C2—19 to 38 inches; thin layers of very dark grayish brown (10YR 3/2), grayish brown (10YR 5/2), and dark yellowish brown (10YR 4/4) silt loam; massive; friable; few very fine roots; few black iron stains; neutral; clear smooth boundary.

C3—38 to 60 inches; thin layers of very dark grayish brown (10YR 3/2), grayish brown (10YR 5/2), very dark gray (10YR 3/1), and dark grayish brown (10YR 4/2) silt loam; massive; friable; few very fine roots; common black iron stains; moderately acid.

The Ap horizon has chroma of 2 or 3. The C horizon typically has value of 3 to 5 and chroma of 1 to 3. It has mottles with higher value and chroma.

Gifford Series

The Gifford series consists of very deep, poorly drained, very slowly permeable soils on the side slopes of benches. These soils formed in loess and alluvial sediments. Slopes range from 2 to 9 percent.

Typical pedon of Gifford silty clay loam, 2 to 9 percent slopes, eroded, rarely flooded, about 2,150 feet east and 2,100 feet north of the southwest corner of sec. 35, T. 55 N., R. 17 W.

Ap—0 to 3 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; few fine faint grayish brown (10YR 5/2) and few fine prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure parting to moderate fine granular; friable; moderately acid; abrupt smooth boundary.

Btg1—3 to 10 inches; grayish brown (10YR 5/2) silty clay; many fine prominent yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; many faint clay films on faces of peds; common black iron and manganese concretions and stains; common organic stains on faces of peds; strongly acid; clear smooth boundary.

Btg2—10 to 30 inches; grayish brown (10YR 5/2) silty clay; many medium prominent yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to weak fine subangular blocky; firm; many distinct clay films on faces of peds; common black iron and manganese concretions and stains; slightly acid; gradual smooth boundary.

2BCg—30 to 48 inches; light brownish gray (10YR 6/2) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to weak fine subangular blocky; firm; common distinct clay films on vertical faces of peds; few black iron and manganese stains; neutral; clear smooth boundary.

2Cg—48 to 60 inches; gray (10YR 6/1) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; massive; very firm; neutral.

The A or Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Btg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It has few to many mottles that have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The 2BC and C horizons have hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 or 2. They have mottles. They are silty clay or silty clay loam and have a sand content of more than 10 percent.

Gosport Series

The Gosport series consists of moderately deep, moderately well drained, very slowly permeable soils on upland side slopes. These soils formed in shale residuum. Slopes range from 9 to 30 percent.

Typical pedon of Gosport silty clay loam, 14 to 30 percent slopes, 100 feet south and 450 feet west of the northeast corner of sec. 2, T. 56 N., R. 18 W.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) silty clay loam, light brownish gray (10YR 6/2) dry; weak very fine subangular blocky structure; friable;

many fine and very fine roots; moderately acid; abrupt smooth boundary.

Bw1—5 to 14 inches; yellowish brown (10YR 5/4) silty clay; few fine prominent light brownish gray (2.5Y 6/2), few fine prominent yellowish red (5YR 5/8), and common fine distinct yellowish brown (10YR 5/6) mottles; weak very fine subangular blocky structure; firm; few very fine roots; few shale fragments; strongly acid; clear smooth boundary.

Bw2—14 to 24 inches; light olive brown (2.5Y 5/4) silty clay; common fine distinct light brownish gray (2.5Y 6/2) and many fine prominent yellowish brown (10YR 5/8) mottles; moderate very fine subangular blocky structure; firm; few fine roots; few black iron stains; few shale fragments; very strongly acid; clear smooth boundary.

C—24 to 36 inches; multicolored light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), and light brownish gray (2.5Y 6/2) silty clay; massive; firm; few fine roots; few black iron stains; common lenses of soft, weathered shale; strongly acid; clear smooth boundary.

Cr—36 to 60 inches; shale bedrock.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. The E horizon, if it occurs, has value of 4 or 5 and chroma of 2 or 3. The Bw horizon has value of 5 or 6 and chroma of 2 to 4. It has high-chroma mottles. The C and Cr horizons have hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 0 to 8.

Grable Series

The Grable series consists of very deep, well drained soils on high flood plains along the Missouri River. These soils formed in calcareous alluvium. Permeability is moderate in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Grable silt loam, rarely flooded, 3,300 feet south and 750 feet west of the northeast corner of sec. 32, T. 53 N., R. 19 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; few very fine roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

C1—8 to 26 inches; thin layers of grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) very fine sandy loam; appears massive but has weak fine bedding planes; friable; few very fine roots; few iron stains on horizontal faces in the lower part; slight effervescence; moderately alkaline; abrupt smooth boundary.

2C2—26 to 60 inches; grayish brown (10YR 5/2) fine sand; appears single grain but has weak fine bedding planes; loose; slight effervescence; slightly alkaline.

The Ap horizon has chroma of 1 or 2. The C horizon has value of 4 or 5. It is very fine sandy loam or silt loam. The 2C horizon has value of 4 or 5. It is fine sand or loamy sand.

Grundy Series

The Grundy series consists of very deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in loess. Slopes range from 2 to 5 percent.

Typical pedon of Grundy silt loam, 2 to 5 percent slopes, 200 feet west and 200 feet south of the northeast corner of sec. 2, T. 56 N., R. 21 W.

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

Ap2—3 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure parting to moderate very fine granular; friable; many fine roots; slightly acid; clear smooth boundary.

AB—8 to 15 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure parting to moderate very fine granular; friable; many very fine roots; few faint iron stains; slightly acid; clear smooth boundary.

Bt—15 to 26 inches; dark grayish brown (10YR 4/2) silty clay; common fine faint dark brown (10YR 4/3) mottles; moderate very fine subangular blocky structure; firm; common fine roots; common distinct clay films on faces of peds; many medium iron and manganese stains and concretions; many distinct organic stains on faces of peds; moderately acid; gradual smooth boundary.

Btg1—26 to 39 inches; grayish brown (2.5Y 5/2) silty clay; many fine distinct olive brown (2.5Y 4/4) and common fine prominent yellowish brown (10YR 5/4) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common distinct clay films on faces of peds; many medium iron and manganese stains and concretions; few distinct organic stains on faces of peds and in root channels; slightly acid; gradual smooth boundary.

Btg2—39 to 48 inches; grayish brown (2.5Y 5/2) silty clay; common fine distinct light olive brown (2.5Y 5/4) and few fine faint light brownish gray (2.5Y 6/2) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; common faint clay films on faces of peds; many medium iron and manganese stains and concretions; few distinct organic stains on faces of peds and in root channels; slightly acid; gradual smooth boundary.

BCg—48 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine distinct light olive brown (2.5Y 5/4) and common fine distinct light yellowish brown (2.5Y 6/4) mottles; weak very fine prismatic structure parting to weak medium subangular blocky; firm; few distinct clay films on vertical faces of peds; many medium iron and manganese stains and concretions; neutral.

The mollic epipedon ranges from 11 to 18 inches in thickness. The A horizon has value of 2 or 3 and chroma of 1 or 2. The AB horizon, if it occurs, has colors similar to those of the A horizon. The upper part of the Bt horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 to 3. The lower part has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. The BCg horizon has hue of 10YR to 5Y. It commonly has mottles with chroma of 2 to 6.

Haynie Series

The Haynie series consists of very deep, moderately well drained, moderately permeable soils on the flood plains along the Missouri River. These soils formed in calcareous, silty or loamy alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Haynie very fine sandy loam, rarely flooded, 1,400 feet west and 1,000 feet north of the southeast corner of sec. 2, T. 51 N., R. 18 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to moderate fine granular; very friable; few very fine roots; slight effervescence; slightly alkaline; abrupt smooth boundary.

C1—9 to 27 inches; thin layers of very dark grayish brown (10YR 3/2) and brown (10YR 5/3) very fine sandy loam; massive; very friable; few very fine roots; slight effervescence; moderately alkaline; clear smooth boundary.

C2—27 to 48 inches; thin layers of grayish brown (10YR 5/2) and brown (10YR 5/3) silt loam; massive; very friable; few very fine roots; slight effervescence; common iron stains; moderately alkaline; clear smooth boundary.

C3—48 to 60 inches; thin layers of brown (10YR 5/3) and dark grayish brown (10YR 4/2) very fine sandy loam; massive; very friable; few very fine roots; common iron stains; slight effervescence; moderately alkaline.

The thickness of the Ap horizon is 6 to 10 inches. The control section contains free carbonates throughout. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. Some pedons have mottles with hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 8.

Higginsville Series

The Higginsville series consists of very deep, somewhat poorly drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 2 to 9 percent.

The Higginsville soils in this county have a thinner dark surface layer than is defined as the range for the series. This difference, however, does not significantly affect the use and management of the soils.

Typical pedon of Higginsville silt loam, 5 to 9 percent slopes, eroded, 2,750 feet east and 1,150 feet north of the southwest corner of sec. 30, T. 53 N., R. 17 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common very fine roots; neutral; abrupt smooth boundary.

Bt1—7 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine faint dark brown (10YR 4/3) and common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine subangular blocky structure; firm; few fine roots; few faint clay films; many organic stains on faces of peds; slightly acid; clear smooth boundary.

Bt2—12 to 30 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine prominent dark yellowish brown (10YR 4/6), common fine distinct grayish brown (10YR 5/2), and common fine distinct olive brown (2.5Y 4/4) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common distinct clay films on faces of peds; few black iron and manganese stains; common fine iron and manganese concretions; common organic stains on vertical faces of peds; slightly acid; gradual smooth boundary.

BC—30 to 41 inches; grayish brown (2.5Y 5/2) silt loam; many medium prominent light olive brown (2.5Y 5/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; friable; few faint clay films on vertical faces of peds; few black iron and manganese stains; slightly acid; gradual smooth boundary.

C—41 to 60 inches; grayish brown (2.5Y 5/2) silt loam; common fine distinct light olive brown (2.5Y 5/4) mottles; massive; friable; slightly acid.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has value of 4 or 5 and chroma of 2 to 4. It is commonly mottled. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2.

Keswick Series

The Keswick series consists of very deep, moderately well drained, slowly permeable soils on uplands. These soils formed in a thin layer of pedisediment and in the underlying paleosol derived from glacial till. Slopes range from 5 to 9 percent.

Typical pedon of Keswick loam, 5 to 9 percent slopes, 2,150 feet west and 2,000 feet south of the northeast corner of sec. 11, T. 55 N., R. 18 W.

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

E—2 to 8 inches; brown (10YR 5/3) loam; moderate thin platy structure parting to weak fine granular; friable; few fine roots; very strongly acid; clear smooth boundary.

2Bt1—8 to 17 inches; strong brown (7.5YR 5/6) clay loam; common fine prominent red (2.5YR 4/6) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common distinct clay films on faces of peds; 2 percent gravel; strongly acid; clear smooth boundary.

2Bt2—17 to 26 inches; strong brown (7.5YR 5/6) clay; common fine prominent red (2.5YR 4/6) and few fine prominent grayish brown (10YR 5/2) mottles; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; common prominent clay films on faces of peds; 2 percent gravel; strongly acid; clear smooth boundary.

2Bt3—26 to 40 inches; strong brown (7.5YR 5/6) clay; common medium prominent red (2.5YR 4/8) and light brownish gray (10YR 6/2) mottles; weak fine prismatic structure parting to weak fine subangular blocky; firm; few fine roots; common prominent clay films on faces of peds; 3 percent gravel; strongly acid; clear smooth boundary.

2C—40 to 60 inches; multicolored strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and light brownish gray (10YR 6/2) clay loam; massive; firm; few fine roots; 3 percent gravel; moderately acid.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 4 or 5 and chroma of 2 or 3. The upper part of the 2Bt horizon has hue of 5YR or 7.5YR and chroma of 3 to 6. If the matrix has hue of 7.5YR, this part of the 2Bt horizon has mottles with hue of 5YR or 2.5YR. The lower part of the 2Bt horizon and the BC horizon have hue of 7.5YR or 5Y, value of 4 or 5, and chroma of 2 to 6.

Knox Series

The Knox series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 5 to 30 percent.

Typical pedon of Knox silty clay loam, 5 to 9 percent slopes, eroded, about 1,500 feet west and 400 feet north of the southeast corner of sec. 4, T. 53 N., R. 19 W.

Ap—0 to 6 inches; dark brown (10YR 3/3) silty clay loam, dark grayish brown (10YR 4/2) dry; weak thin platy structure parting to moderate fine subangular blocky; friable; few very fine roots; neutral; abrupt smooth boundary.

Bt1—6 to 16 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; common faint clay films on faces of peds; many black iron and manganese stains; neutral; gradual smooth boundary.

Bt2—16 to 32 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; many distinct clay films on faces of peds; common black iron and manganese stains; moderately acid; gradual smooth boundary.

BC—32 to 55 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; firm; few very fine roots; common fine silt coatings on vertical faces of peds; moderately acid; gradual smooth boundary.

C—55 to 70 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct light brownish gray (10YR 6/2) mottles; massive; firm; few clay flows in vertical cleavage planes and in root channels; few black manganese stains; few red iron stains; many fine silt coatings on vertical faces of peds; slightly acid.

The Ap horizon has value and chroma of 2 or 3. The Bt and BC horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. They contain 25 to 35 percent clay. The C horizon has value of 4 or 5 and chroma of 3 to 6. It is silt loam or silty clay loam.

Knox silty clay loam, 9 to 30 percent slopes, severely eroded, has a thinner dark surface layer than is defined as the range for the series. This difference, however, does not significantly affect the use and management of the soil.

Lagonda Series

The Lagonda series consists of very deep, somewhat poorly drained, slowly permeable soils on uplands. These soils formed in a thin layer of loess and pedisediment. Slopes range from 2 to 9 percent.

The Lagonda soils in this county have a thinner dark surface layer than is defined as the range for the series. This difference, however, does not significantly affect the use and management of the soils.

Typical pedon of Lagonda silt loam, 2 to 5 percent slopes, eroded, 2,000 feet north and 500 feet west of the southeast corner of sec. 12, T. 55 N., R. 20 W.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

AB—5 to 9 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure; friable; common fine roots; few black iron stains; few black iron and manganese concretions; neutral; clear smooth boundary.

Bt1—9 to 15 inches; multicolored dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4), and yellowish brown (10YR 5/6) silty clay; moderate very fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; few black iron stains; few black iron and manganese concretions; many organic stains on faces of peds; neutral; clear smooth boundary.

Bt2—15 to 26 inches; multicolored dark yellowish brown (10YR 4/4), dark grayish brown (10YR 4/2), and yellowish brown (10YR 5/6) silty clay; weak very fine prismatic structure parting to moderate very fine subangular blocky; firm; few fine roots; common distinct clay films on faces of peds; few black iron stains; few black iron and manganese concretions; slightly acid; clear smooth boundary.

2Bt3—26 to 38 inches; grayish brown (10YR 5/2) silty clay loam; yellowish brown (10YR 5/6) mottles; weak very fine prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common distinct clay films on faces of peds; few black iron stains; few black iron and manganese concretions; 12 percent sand; neutral; clear smooth boundary.

2Bt4—38 to 60 inches; grayish brown (10YR 5/2) silty clay loam; many medium prominent brownish yellow (10YR 6/6) and many fine prominent yellowish brown (10YR 5/6) mottles; weak fine prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; common distinct clay films on faces of peds; common black iron and manganese concretions; 14 percent sand; neutral.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is silt loam, but the range includes silty clay loam. The Bt horizon has value of 3 to 5 and chroma of 2 to 4. It is silty clay loam or silty clay. The 2Bt horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam, silty clay, or clay. The content of sand in this horizon is more than 5 percent.

Landes Series

The Landes series consists of very deep, well drained, moderately rapidly permeable soils on high flood plains along the Missouri River. These soils formed in sandy alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Landes fine sandy loam, rarely flooded, 1,250 feet east and 625 feet north of the southwest corner of sec. 6, T. 52 N., R. 18 W.

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; few very fine roots; slightly acid; abrupt smooth boundary.

Bw1—12 to 24 inches; yellowish brown (10YR 5/4) loamy fine sand; weak fine subangular blocky structure; very friable; few very fine roots; few distinct organic coatings; neutral; gradual smooth boundary.

Bw2—24 to 34 inches; brown (10YR 5/3) loamy fine sand; weak medium subangular blocky structure; very friable; few very fine roots; slightly alkaline; gradual smooth boundary.

C—34 to 60 inches; stratified, brown (10YR 5/3) fine sand, very fine sandy loam, and loamy fine sand; massive; loose; few very fine roots; slight effervescence; slightly alkaline.

The Ap horizon has chroma of 2 or 3. The Bw and C horizons have value of 4 or 5 and chroma of 2 to 4.

Levasy Series

The Levasy series consists of very deep, poorly drained soils on the flood plain along the Missouri

River. These soils formed in 20 to 38 inches of clayey alluvium over loamy alluvium. Permeability is slow in the upper part of the profile and moderate in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Levasy silty clay, rarely flooded, 4,800 feet west and 2,680 feet south of the northeast corner of sec. 3, T. 52 N., R. 19 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure; very firm; common very fine roots; slightly alkaline; abrupt smooth boundary.

A—8 to 20 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; few fine prominent dark yellowish brown (10YR 4/6) mottles; moderate very fine angular blocky structure; very firm; few very fine roots; common shiny pressure faces; slight effervescence; slightly alkaline; clear smooth boundary.

Bg—20 to 29 inches; dark gray (10YR 4/1) silty clay; common fine prominent dark yellowish brown (10YR 4/6) mottles; moderate very fine angular blocky structure; very firm; few very fine roots; few shiny pressure faces; slight effervescence; slightly alkaline; abrupt smooth boundary.

2Cg—29 to 60 inches; thin layers of grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) silt loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; appears massive but has weak bedding planes; friable; common iron stains in root channels; slight effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 10 to 24 inches. The clayey A and Bg horizons are underlain at a depth of 20 to 38 inches by loamy deposits. Free carbonates are below a depth of 10 inches.

The Ap horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. The A horizon has hue of 10YR to 5Y, value of 2 or 3, and chroma of 1 or 2. The Bg horizon has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. The 2C horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2. It is very fine sandy loam or silt loam.

Menfro Series

The Menfro series consists of very deep, well drained, moderately permeable soils on uplands adjacent to the flood plains along the Missouri River. These soils formed in loess. Slopes range from 3 to 30 percent.

Typical pedon of Menfro silt loam, 3 to 9 percent slopes, eroded, 2,500 feet south and 100 feet west of the northeast corner of sec. 34, T. 53 N., R. 18 W.

Ap—0 to 4 inches; brown (10YR 4/3) silt loam; weak very thin platy structure parting to weak very fine granular; friable; few fine roots; strongly acid; abrupt smooth boundary.

Bt1—4 to 18 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate very fine subangular blocky structure; friable; few fine roots; common distinct clay films on faces of peds; few silt coatings; strongly acid; clear smooth boundary.

Bt2—18 to 36 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak very fine prismatic structure parting to weak fine subangular blocky; friable; few fine roots; common faint clay films; strongly acid; clear smooth boundary.

BC—36 to 42 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few fine roots; few faint clay films; moderately acid; clear smooth boundary.

C—42 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; massive; very friable; few silt coatings; moderately acid.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR and chroma of 3 or 4. The content of clay in the upper 20 inches of this horizon ranges from 29 to 35 percent. The BC and C horizons generally have colors similar to those of the Bt horizon, but in some pedons they have mottles with chroma of 2.

Modale Series

The Modale series consists of very deep, somewhat poorly drained soils on the flood plain along the Missouri River. These soils formed in silty alluvium over clayey alluvium. Permeability is moderate in the silty upper part and very slow in the clayey lower part. Slopes range from 0 to 2 percent.

Typical pedon of Modale silt loam, rarely flooded, 780 feet south and 275 feet east of the northwest corner of sec. 28, T. 53 N., R. 19 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; few very fine roots; slight effervescence; moderately alkaline; abrupt smooth boundary.

C1—8 to 22 inches; thin layers of dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam; massive; weak bedding planes; very friable; few very fine roots; few fine yellowish brown (10YR 5/6) stains; few thin strata of silty clay loam; slight effervescence; moderately alkaline; abrupt smooth boundary.

2C2—22 to 29 inches; very dark grayish brown (2.5Y 3/2) silty clay; few fine prominent dark yellowish brown (10YR 4/6) mottles; massive; very firm; slight effervescence; moderately alkaline; clear smooth boundary.

2C3—29 to 44 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine prominent strong brown (7.5YR 4/6) mottles; massive; very firm; few thin strata of silt loam; slight effervescence; moderately alkaline; abrupt smooth boundary.

2C4—44 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine prominent dark yellowish brown (10YR 4/6) mottles; massive; very firm; few thin strata of silt loam; slight effervescence; moderately alkaline.

The silty upper part ranges from 18 to 30 inches in thickness. The lower part is silty clay or clay. The C horizon has value of 4 or 5 and chroma of 2 or 3. The 2C horizon has hue of 5Y or 2.5Y and value of 3 to 5. It is silty clay or clay.

Newcomer Series

The Newcomer series consists of moderately deep, well drained, moderately permeable soils on upland side slopes. These soils formed in sandstone residuum and interbedded shale. Slopes range from 9 to 30 percent.

Typical pedon of Newcomer loam, 9 to 14 percent slopes, eroded, 650 feet west and 850 feet north of the southeast corner of sec. 17, T. 54 N., R. 19 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak thin platy structure parting to weak fine granular; friable; common fine roots; slightly alkaline; abrupt smooth boundary.

Bt1—7 to 13 inches; dark yellowish brown (10YR 4/6) loam; weak fine subangular blocky structure; firm; common fine roots; common distinct clay films on faces of peds; neutral; clear smooth boundary.

Bt2—13 to 27 inches; dark yellowish brown (10YR 4/6) loam; moderate fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; common black iron and manganese stains; moderately acid; clear smooth boundary.

BC—27 to 34 inches; multicolored yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and grayish brown (10YR 5/2) loam; massive; firm; common distinct clay flows in vertical cleavage planes; many black iron and manganese stains; common silt coatings; moderately acid; clear smooth boundary.

Cr—34 to 50 inches; weathered sandstone bedrock.

R—50 inches; sandstone bedrock.

The thickness of the solum and the depth to sandstone range from 20 to 40 inches. The Ap horizon has value and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam or clay loam and averages from 18 to 35 percent clay. The BC horizon has hue of 5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6.

Norborne Series

The Norborne series consists of very deep, well drained, moderately permeable soils on high flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Norborne loam, rarely flooded, about 2,500 feet east and 1,600 feet south of the northwest corner of sec. 7, T. 53 N., R. 19 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; weak thin platy structure parting to moderate fine granular; friable; few very fine and fine roots; moderately acid; abrupt smooth boundary.

Bt1—8 to 20 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; few very fine roots; common faint clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—20 to 28 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine prismatic structure parting to moderate fine subangular blocky; friable; few very fine roots; many faint clay films on faces of peds; moderately acid; clear smooth boundary.

Bt3—28 to 40 inches; brown (10YR 4/3) loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; few very fine roots; many faint clay films on faces of peds; slightly acid; clear smooth boundary.

C1—40 to 57 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (10YR 5/2) mottles; massive; friable; few very fine roots; few silt coatings; slightly acid; clear smooth boundary.

C2—57 to 65 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (10YR 5/2) mottles; massive; friable; few very fine roots; many silt coatings; slightly acid.

The mollic epipedon is 24 to 36 inches in thickness and extends into the B horizon. The Ap and A horizons have value of 2 or 3 and chroma of 1 to 3. The upper part of the Bt horizon has chroma of 2 or 3. The lower part has value of 4 or 5 and chroma of 3 or 4. The content of clay in the Bt horizon averages between 12 and 18 percent. This horizon has more than 15 percent and less than 40 percent sand that is coarser than very fine sand. It is very fine sandy loam, loam, or silt loam. The C horizon has value of 4 or 5 and chroma of 2 to 4. It is very fine sandy loam, loam, silt loam, fine sandy loam, or loamy very fine sand.

Parkville Series

The Parkville series consists of very deep, somewhat poorly drained soils on the flood plains along the Missouri River. These soils formed in calcareous, clayey alluvium 12 to 20 inches deep over calcareous, loamy alluvium. Permeability is very slow in the upper part of the profile and moderate in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Parkville silty clay loam, rarely flooded, 2,375 feet south and 150 feet east of the northwest corner of sec. 7, T. 51 N., R. 17 W.

Ap—0 to 4 inches; very dark gray (10YR 3/1) silty clay loam; weak fine subangular blocky structure; firm; neutral; abrupt smooth boundary.

A—4 to 20 inches; very dark gray (10YR 3/1) silty clay; weak fine prismatic structure parting to weak fine subangular blocky; firm; slight effervescence; slightly alkaline; abrupt smooth boundary.

2Cg—20 to 60 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) very fine sandy loam, loamy very fine sand, and silt loam; many fine distinct dark yellowish brown (10YR 4/4) mottles; massive; friable; strong effervescence; moderately alkaline.

The mollic epipedon ranges from 10 to 20 inches in thickness. The A horizon has value of 2 or 3. The B horizon, if it occurs, has hue of 10YR or 2.5Y. It is silty clay loam or silty clay. The 2C horizon has hue of 10YR or 2.5Y. It is silt loam, very fine sandy loam, or loamy very fine sand and has strata of coarser or finer textured material.

Portage Series

The Portage series consists of very deep, very poorly drained, very slowly permeable soils on broad flood plains along intermediate streams. These soils formed in clayey alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Portage silty clay, occasionally flooded, 1,550 feet west and 250 feet south of the northeast corner of sec. 3, T. 56 N., R. 21 W.

Ap—0 to 4 inches; very dark gray (10YR 3/1) silty clay, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; firm; few fine roots; moderately acid; abrupt smooth boundary.

A—4 to 9 inches; very dark gray (10YR 3/1) silty clay, dark grayish brown (10YR 4/2) dry; weak very fine angular blocky structure; very firm; few very fine roots; few iron stains; moderately acid; clear smooth boundary.

Bg1—9 to 15 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure; very firm; few very fine roots; few black iron stains; strongly acid; gradual smooth boundary.

Bg2—15 to 28 inches; very dark gray (10YR 3/1) clay, grayish brown (10YR 5/2) dry; common fine distinct dark brown (10YR 4/3) mottles; weak fine prismatic structure parting to moderate very fine subangular blocky; very firm; few very fine roots; common black iron stains; common pressure faces on faces of peds; very strongly acid; gradual smooth boundary.

Bg3—28 to 44 inches; very dark gray (10YR 3/1) clay, grayish brown (10YR 5/2) dry; common fine faint dark gray (10YR 4/1) and common fine distinct dark brown (10YR 4/3) mottles; moderate fine prismatic structure parting to moderate very fine angular blocky; very firm; few very fine roots; many fine black iron and manganese concretions and stains; common pressure faces on faces of peds; strongly acid; gradual smooth boundary.

Bg4—44 to 60 inches; dark gray (10YR 4/1) clay; many fine prominent olive brown (2.5Y 4/4) mottles; weak medium prismatic structure parting to moderate fine angular blocky; very firm; many black iron stains; common organic coatings on faces of peds; common pressure faces on faces of peds; very strongly acid.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bg horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or less. It has faint to prominent mottles. The average clay content in the control section is more than 60 percent.

Putco Series

The Putco series consists of very deep, well drained, slowly permeable soils in surface-mined areas. These soils formed in materials that have been excavated during surface mining. Slopes range from 9 to 50 percent.

Typical pedon of Putco clay loam, 9 to 50 percent slopes, 1,600 feet south and 1,100 feet west of the northeast corner of sec. 4, T. 56 N., R. 18 W.

A—0 to 2 inches; multicolored yellowish brown (10YR 5/4), dark grayish brown (2.5Y 4/2), and light olive brown (2.5Y 5/4) clay loam; weak fine granular structure; friable; common fine roots; 14 percent coarse fragments; moderately alkaline; clear wavy boundary.

C1—2 to 12 inches; multicolored yellowish brown (10YR 5/6), light yellowish brown (2.5Y 6/4), and grayish brown (2.5Y 5/2) clay loam; weak fine subangular blocky structure; firm; few fine roots; 10 percent coarse fragments; moderately alkaline; slight effervescence; clear wavy boundary.

C2—12 to 21 inches; multicolored olive brown (2.5Y 4/4), light brownish gray (2.5Y 6/2), light gray (2.5Y 6/0), and black (2.5Y 2/0) silty clay; moderate fine angular blocky structure; firm; few fine roots; 14 percent coarse fragments; moderately alkaline; slight effervescence; clear wavy boundary.

C3—21 to 60 inches; multicolored olive yellow (2.5Y 6/6), grayish brown (2.5Y 5/2), and dark gray (2.5Y 4/0) silty clay; massive; firm; few fine roots; 25 percent soft shale fragments; 5 percent stones; moderately alkaline; slight effervescence.

The depth to bedrock is 60 to more than 80 inches. The content of soft fragments ranges from 0 to 15 percent in the A horizon and from 0 to 60 percent in the C horizon. The content of hard fragments of shale or limestone ranges from 0 to 15 percent throughout the profile.

The A horizon typically has hue of 10YR to 5Y, value of 2 to 5 (4 to 7 dry), and chroma of 2 to 4. In some pedons it has chroma of 1 to 6. Dark coatings are on the faces of peds in some pedons. The C horizon has hue of 7.5YR to 2.5Y or is neutral in hue. In most pedons it has value of 4 to 6 and chroma of 0 to 6. In some pedons it has value of 2 or 3 and has some peds or soil fragments that are grayer or browner. Mottles with chroma of 2 or less are relict and are not indicative of soil drainage. They occur at random depths, spacing, and orientation in the soil. The C horizon is silty clay or clay loam. Thin strata or small pockets of coarser or finer textured material are in some pedons.

Sarpy Series

The Sarpy series consists of very deep, excessively drained, rapidly permeable soils on the flood plain along the Missouri River. These soils formed in sandy alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Sarpy loamy fine sand, rarely flooded, 800 feet east and 200 feet north of the southwest corner of sec. 2, T. 52 N., R. 19 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many very fine roots; slight effervescence; neutral; abrupt smooth boundary.

C1—7 to 38 inches; grayish brown (10YR 5/2) fine sand; single grain; loose; few very fine roots; few thin strata of loamy fine sand; slight effervescence; slightly alkaline; abrupt smooth boundary.

C2—38 to 60 inches; brown (10YR 5/3) fine sand; single grain; loose; few thin strata of loamy fine sand; slight effervescence; moderately alkaline.

The A horizon has value of 3 to 5 and chroma of 1 to 3. The C horizon has value of 4 to 6 and chroma of 2 to 4.

Schuline Series

The Schuline series consists of very deep, well drained, slowly permeable soils in upland areas that have been reclaimed and smoothed after coal was extracted. These soils formed in nonacid material. Slopes range from 5 to 30 percent.

The Schuline soils in this county are not calcareous and are more acid in the upper part than is defined as the range for the series. These differences, however, do not significantly affect the use and management of the soils.

Typical pedon of Schuline silty clay loam, 3 to 9 percent slopes, in Randolph County; 1,450 feet west and 1,100 feet south of the northeast corner of sec. 10, T. 54 N., R. 16 W.

Ap—0 to 10 inches; mixed dark brown (10YR 4/3) and yellowish brown (10YR 5/6) silty clay loam, brown (10YR 5/3) and yellowish brown (10YR 5/4) dry; moderate thin platy structure; very firm; many fine and few medium roots; slightly alkaline; abrupt wavy boundary.

C1—10 to 16 inches; mixed dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/6) clay loam; moderate thin platy structure; very firm; few medium roots; few prominent thin discontinuous horizontal strata of grayish brown (10YR 5/2) material; moderately acid; abrupt wavy boundary.

C2—16 to 30 inches; mixed grayish brown (10YR 5/2) and yellowish brown (10YR 5/4 and 5/6) silty clay loam; massive; very firm; common medium roots; few prominent thin discontinuous horizontal strata of light gray (10YR 7/2) material; about 8 percent shale fragments; slight effervescence; moderately alkaline; abrupt wavy boundary.

C3—30 to 52 inches; mixed dark grayish brown (10YR 4/2), yellowish brown (10YR 5/6), and dark brown (7.5YR 4/4) silty clay loam; massive; very firm; common fine roots; about 10 percent shale fragments; slight effervescence; moderately alkaline; clear wavy boundary.

C4—52 to 60 inches; mixed dark grayish brown (10YR

4/2) and yellowish brown (10YR 5/6) silty clay loam; massive; very firm; about 12 percent shale fragments; slight effervescence; moderately alkaline.

The depth to bedrock is more than 5 feet. The A horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 6. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 6. The content of coarse fragments in this horizon ranges from 5 to 15 percent.

Shannondale Series

The Shannondale series consists of very deep, moderately well drained, moderately permeable soils on low stream terraces along intermediate streams. These soils formed in loess. Slopes range from 0 to 7 percent.

Typical pedon of Shannondale silt loam, 0 to 2 percent slopes, 2,550 feet west and 50 feet north of the southeast corner of sec. 35, T. 54 N., R. 18 W.

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

A—9 to 17 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; friable; few very fine roots; common silt coatings; neutral; clear smooth boundary.

Bt1—17 to 35 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine prominent light gray (10YR 7/2) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; many faint clay films on faces of peds; common organic stains on faces of peds; slightly acid; clear smooth boundary.

Bt2—35 to 58 inches; yellowish brown (10YR 5/4) silty clay loam; common fine prominent light gray (10YR 7/2) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; many distinct clay films on faces of peds; few organic stains on faces of peds; strongly acid; clear smooth boundary.

2C—58 to 75 inches; dark brown (7.5YR 4/4) loam; common fine prominent light gray (10YR 7/2) mottles; massive; weak fine bedding planes; very friable; few clay flows in voids and root channels; few dark grayish brown organic stains; strongly acid.

The Ap horizon has value of 2 or 3 and chroma of 1 to 3. The Bt horizon has value and chroma of 2 to 4. This horizon has mottles with value of 4 to 7 and chroma of 1 to 8. The 2C horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 to 6. It is mottled.

Shannondale silt loam, 2 to 7 percent slopes, eroded, rarely flooded, has a thinner dark surface layer than is defined as the range for the series. This difference, however, does not significantly affect the use and management of the soil.

Speed Series

The Speed series consists of very deep, poorly drained, moderately permeable soils on flood plains, foot slopes, and fans. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Speed silt loam, occasionally flooded, 1,500 feet west and 225 feet south of the northeast corner of sec. 25, T. 55 N., R. 20 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common fine roots; moderately acid; abrupt smooth boundary.

A—6 to 15 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; few fine roots; moderately acid; abrupt smooth boundary.

E1—15 to 20 inches; grayish brown (10YR 5/2) silt loam; weak thin platy structure parting to weak fine subangular blocky; very friable; common organic stains on faces of peds; few iron stains; strongly acid; clear smooth boundary.

E2—20 to 27 inches; grayish brown (10YR 5/2) silt loam; weak thin platy structure parting to weak fine subangular blocky; very friable; few iron stains; strongly acid; clear smooth boundary.

Bt—27 to 38 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; few fine faint brown (10YR 4/3) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; common distinct clay films on faces of peds; common silt coatings; few fine iron and manganese oxide accumulations; strongly acid; clear smooth boundary.

Btg1—38 to 56 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint brown (10YR 4/3) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; common distinct clay films on faces of peds; neutral; clear smooth boundary.

Btg2—56 to 60 inches; grayish brown (10YR 5/2) silty clay loam; few fine faint brown (10YR 4/3) mottles; weak fine prismatic structure parting to moderate medium subangular blocky; firm; common distinct clay films on faces of peds: neutral.

The A horizons have value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 4 or 5 and chroma of 1 or 2. In some pedons it has mottles with hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 6. The upper part of the Bt horizon has value of 3 or 4 and chroma of 1 or 2. The lower part has value of 3 to 5 and chroma of 1 or 2.

Tice Series

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

Typical pedon of Tice silty clay loam, rarely flooded, 1,600 feet west and 150 feet south of the northeast corner of sec. 4, T. 54 N., R. 21 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; few very fine roots; neutral; abrupt smooth boundary.

A—6 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; firm; slightly acid; abrupt smooth boundary.

Bw1—11 to 23 inches; mottled grayish brown (10YR 5/2) and brown (10YR 4/3) silty clay loam; weak fine prismatic structure parting to moderate fine subangular blocky; friable; slightly acid; clear smooth boundary.

Bw2—23 to 43 inches; mottled grayish brown (10YR 5/2) and brown (10YR 5/3) silt loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; slightly acid; clear smooth boundary.

Cg—43 to 60 inches; mottled gray (10YR 6/1) and pale brown (10YR 6/3) silt loam; massive; friable; slightly acid.

The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. They are silt loam or silty clay loam. The Bw horizon has value of 4 or 5 and chroma of 1 to 4. It has mottles with hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6. It averages 20 to 35 percent clay. The Cg horizon or the C horizon, if it occurs, has value of 4 to 6 and chroma of 1 to 3.

Tina Series

The Tina series consists of very deep, somewhat poorly drained, moderately slowly permeable soils on low stream terraces along the Missouri River and intermediate streams. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Tina silt loam, rarely flooded, about 1,800 feet south and 2,000 feet east of the northwest corner of sec. 12, T. 53 N., R. 20 W.

Ap—0 to 6 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; many very fine roots; neutral; abrupt smooth boundary.

A—6 to 12 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; common very fine roots; neutral; clear smooth boundary.

Bt—12 to 26 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; common very fine roots; common faint clay films on faces of peds; slightly acid; clear smooth boundary.

Btg1—26 to 34 inches; dark grayish brown (10YR 4/2) silty clay; many fine prominent yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to weak medium subangular blocky; firm; few very fine roots; many faint clay films on faces of peds; common black iron stains; common organic stains on faces of peds; moderately acid; clear smooth boundary.

Btg2—34 to 41 inches; grayish brown (10YR 5/2) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; common faint clay films on faces of peds; common black iron stains; common organic stains on faces of peds; moderately acid; clear smooth boundary.

2BCg—41 to 52 inches; grayish brown (10YR 5/2) clay loam; many medium prominent dark yellowish brown (10YR 4/6) mottles; moderate fine prismatic structure; firm; few very fine roots; few faint clay films on faces of peds; common organic stains on faces of peds; slightly acid; clear smooth boundary.

2Cg—52 to 75 inches; multicolored dark yellowish brown (10YR 4/4 and 4/6) and grayish brown (10YR 5/2) loam; massive; friable; few organic stains in root channels; neutral.

The thickness of the mollic epipedon ranges from 15 to 30 inches. The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. The Bt horizon has colors similar to those of the A horizon. The Btg horizon has value of 4 to 7 and chroma of 2 or less. It is mottled. The 2BCg and 2Cg horizons have hue of 10YR to 5Y, value of 4 to 7, and chroma of 1 to 6.

Triplett Series

The Triplett series consists of very deep, somewhat poorly drained, slowly permeable soils on high flood plains. These soils formed in loess and in the underlying alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Triplett silt loam, rarely flooded, 225 feet south and 100 feet east of the northwest corner of sec. 1, T. 54 N., R. 17 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; common fine roots; neutral; abrupt smooth boundary.

E—7 to 14 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/1) dry; weak thin platy structure parting to weak fine granular; common fine faint dark grayish brown (10YR 4/2) and brown (10YR 4/3) mottles; very friable; common fine roots; few fine iron stains; strongly acid; abrupt smooth boundary.

Bt—14 to 33 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; common fine faint very dark grayish brown (10YR 3/2) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; common fine roots; common faint clay films on faces of peds; common fine black iron and manganese concretions and stains; strongly acid; gradual smooth boundary.

Btg1—33 to 53 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine prominent light olive brown (2.5Y 5/6) and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few fine roots; common distinct clay films on faces of peds; common fine iron and manganese concretions and stains; common black organic stains on faces of peds; strongly acid; clear smooth boundary.

2Btg2—53 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; firm; few faint clay films on faces of peds; many medium black iron and manganese concretions and stains; 10 percent sand; moderately acid.

The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 1 or 2. The upper part of the Bt horizon has hue of 2.5Y or 10YR, value of 2 or 3, and chroma of 1 or 2. The lower part has hue of 10YR to 5Y, value of 4 or 5, and chroma of 1 or 2. Mottles in the lower part have hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 4 to 8. The particle-size control section averages 42 to 52 percent clay. Depth to the 2C horizon ranges from 40 to more than 60 inches.

Tuskeego Series

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

Typical pedon of Tuskeego silty clay loam, occasionally flooded, 1,800 feet west and 2,600 feet north of the southeast corner of sec. 22, T. 53 N., R. 17 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium angular blocky structure parting to moderate fine angular blocky; very firm; few very fine roots; common fine iron stains; moderately acid; abrupt smooth boundary.

E—8 to 12 inches; dark gray (10YR 4/1) silty clay loam, gray (10YR 5/1) dry; weak fine subangular blocky structure; firm; few very fine roots; common organic stains on faces of peds; many fine iron stains; strongly acid; clear smooth boundary.

Eg—12 to 24 inches; gray (10YR 5/1) silty clay loam; common medium distinct brown (10YR 4/3) mottles; weak medium platy structure parting to weak fine subangular blocky; firm; few very fine roots; many fine iron stains; strongly acid; gradual smooth boundary.

Btg1—24 to 46 inches; dark grayish brown (10YR 4/2) silty clay; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; common silt coatings; many fine and medium iron stains; many faint clay films on faces of peds; strongly acid; clear smooth boundary.

Btg2—46 to 60 inches; gray (10YR 5/1) silty clay loam; weak fine prismatic structure parting to weak fine subangular blocky; firm; few silt coatings; common fine iron stains; common distinct clay films on faces of peds; strongly acid.

The A horizon has chroma of 1 or 2. The E horizon typically is dark gray (10YR 4/1) or gray (10YR 5/1), but it has value of 4 to 6 and chroma of 1 or 2. The Btg horizon has hue of 10YR or 2.5Y and value of 3 to 5.

Wakenda Series

The Wakenda series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 2 to 9 percent.

Typical pedon of Wakenda silt loam, 2 to 5 percent slopes, 1,300 feet south and 500 feet east of the northwest corner of sec. 30, T. 53 N., R. 17 W.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; very friable; few fine roots; neutral; abrupt smooth boundary.

A—5 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure parting to moderate very fine granular; very friable; few fine roots; neutral; clear smooth boundary.

Bt1—14 to 20 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 4/3) dry; few fine faint brown (10YR 4/3) mottles; moderate very fine subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; neutral; clear smooth boundary.

Bt2—20 to 28 inches; brown (10YR 4/3) silty clay loam; few fine faint dark yellowish brown (10YR 4/4) mottles; weak very fine prismatic structure parting to moderate very fine subangular blocky; friable; few fine roots; common distinct clay films on faces of peds; few silt coatings; moderately acid; gradual smooth boundary.

Bt3—28 to 40 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine faint brown (10YR 4/3) and few fine distinct grayish brown (10YR 5/2) mottles; moderate very fine prismatic structure parting to moderate fine subangular blocky; friable; few fine roots; common distinct clay films on faces of peds; few black iron stains; common silt coatings; moderately acid; gradual smooth boundary.

Bt4—40 to 52 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium faint brown (10YR 4/3) and common fine distinct grayish brown (10YR 5/2) mottles; weak very fine prismatic structure parting to weak fine subangular blocky; friable; very few fine roots; few faint clay films on vertical faces of peds; few black iron stains; moderately acid; gradual smooth boundary.

BC—52 to 60 inches; dark yellowish brown (10YR 4/4) and brown (10YR 4/3) silt loam; common medium faint grayish brown (10YR 5/2) and common fine distinct dark yellowish brown (10YR 4/6) mottles; weak fine prismatic structure; friable; few faint clay films on vertical faces of peds; few black iron and manganese stains; moderately acid.

The thickness of the mollic epipedon ranges from 10 to 24 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. The upper part of the Bt horizon has value of 3 or 4 and chroma of 2 or 3. The lower part has value of 4 or 5 and chroma of 3 or 4. This horizon has mottles with chroma of 2 to 6. The C horizon, if it occurs, has value of 4 or 5 and chroma of 2 to 4 but has mottles with higher value and chroma. It commonly is silt loam, but in some pedons it is silty clay loam.

Waldron Series

The Waldron series consists of very deep, somewhat poorly drained soils on the flood plains along the Missouri River. These soils formed in calcareous, stratified deposits of clayey and loamy alluvium. Permeability is slow in the upper part of the profile and moderate in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Waldron silty clay, loamy substratum, rarely flooded, 325 feet east and 200 feet south of the northwest corner of sec. 7, T. 51 N., R. 17 W.

Ap—0 to 4 inches; very dark grayish brown (10YR 3/2) silty clay, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; firm; slightly alkaline; abrupt smooth boundary.

C1—4 to 14 inches; stratified very dark grayish brown (10YR 3/2) silty clay and silty clay loam; few thin strata of brown (10YR 4/3) very fine sandy loam; moderate fine subangular blocky structure; firm; slight effervescence; slightly alkaline; clear smooth boundary.

C2—14 to 40 inches; stratified very dark gray (10YR 3/1) silty clay and silty clay loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; few strata of brown (10YR 4/3) very fine sand; weak medium angular blocky structure parting to moderate fine angular blocky; firm; slight effervescence; slightly alkaline; clear smooth boundary.

C3—40 to 48 inches; stratified grayish brown (10YR 5/2) silty clay and silty clay loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure; firm; strong effervescence; slightly alkaline; clear smooth boundary.

C4—48 to 60 inches; stratified light brownish gray (10YR 6/2), yellowish brown (10YR 5/4), and brown (10YR 5/3) very fine sandy loam to silt loam; massive; friable; strong effervescence; moderately alkaline.

Free carbonates are within 10 inches of the surface. The content of clay in the 10- to 40-inch control section ranges from 35 to 50 percent. Thin lenses of coarser textures are in the control section.

The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. The C horizon has hue of 10YR or 2.5Y, value of 2 to 5, and chroma of 1 to 4.

Winnegan Series

The Winnegan series consists of very deep, moderately well drained, slowly permeable soils on uplands. These soils formed in glacial till. Slopes range from 9 to 30 percent.

Typical pedon of Winnegan loam, 9 to 30 percent slopes, 1,800 feet south and 1,100 feet east of the northwest corner of sec. 13, T. 54 N., R. 18 W.

A—0 to 2 inches; brown (10YR 5/3) loam, very pale brown (10YR 7/3) dry; weak thin platy structure parting to weak fine subangular blocky; very friable; common fine and few very fine roots; strongly acid; abrupt smooth boundary.

E—2 to 7 inches; brown (10YR 5/3) loam; weak fine subangular blocky structure; very friable; common fine and few medium and coarse roots; very strongly acid; clear smooth boundary.

Bt1—7 to 16 inches; yellowish brown (10YR 5/6) clay; weak fine prismatic structure parting to moderate medium subangular blocky; very firm; common fine and medium and few coarse roots; common faint clay films on faces of peds; 5 percent gravel; very strongly acid; clear smooth boundary.

Bt2—16 to 22 inches; yellowish brown (10YR 5/6) clay; few fine distinct light yellowish brown (10YR 6/4) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; very firm; few fine and medium roots; many faint clay films on faces of peds; 5 percent gravel; strongly acid; clear wavy boundary.

Bt3—22 to 31 inches; yellowish brown (10YR 5/6) clay; few fine prominent gray (10YR 6/1) mottles; moderate fine subangular blocky structure; very firm; few fine roots; many distinct clay films on faces of peds; 5 percent gravel; strongly acid; clear wavy boundary.

Bk—31 to 39 inches; yellowish brown (10YR 5/6) clay loam; few medium prominent light gray (10YR 7/1) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; very firm; few fine and medium roots; many distinct clay films on vertical faces of peds; common fine soft calcium carbonates; 5 percent gravel; violent effervescence; slightly alkaline; clear smooth boundary.

BCk—39 to 64 inches; dark yellowish brown (10YR 4/4) clay loam; common coarse prominent light gray (10YR 7/1) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; very firm; few fine roots; few faint clay films on vertical faces of peds; many fine to coarse soft calcium carbonates; common fine black iron and manganese stains on faces of peds and in root channels; 5 percent gravel; violent effervescence; moderately alkaline.

The A horizon has value of 2 to 5 and chroma of 2 or 3. The E horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The lower part of this horizon has mottles with chroma of 2 or less. The Bt horizon is clay loam or clay. The Bk and BCk horizons have value of 4 to 6 and chroma of 2 to 6.

Zook Series

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

Typical pedon of Zook silty clay loam, occasionally flooded, 1,650 feet north and 350 feet west of the southeast corner of sec. 22, T. 56 N., R. 18 W.

Ap—0 to 4 inches; black (10YR 2/1) silty clay loam; moderate fine subangular blocky structure; firm; common fine and many very fine roots; moderately acid; abrupt smooth boundary.

A1—4 to 8 inches; black (10YR 2/1) silty clay loam; moderate fine subangular blocky structure; firm; few fine and common very fine roots; moderately acid; clear smooth boundary.

A2—8 to 20 inches; very dark gray (10YR 3/1) silty clay loam; weak fine prismatic structure parting to moderate fine angular blocky; common very fine roots; firm; slightly acid; gradual smooth boundary.

A3—20 to 30 inches; very dark gray (10YR 3/1) silty clay loam; few fine prominent dark yellowish brown (10YR 4/6) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; common very fine roots; neutral; clear smooth boundary.

A4—30 to 40 inches; very dark gray (10YR 3/1) silty clay loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; weak fine prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; neutral; clear smooth boundary.

Bg—40 to 60 inches; dark gray (10YR 4/1) silty clay loam; many fine prominent dark yellowish brown (10YR 4/6) and few fine prominent yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; firm; few organic stains in root channels; neutral; clear smooth boundary.

Cg—60 to 75 inches; gray (10YR 5/1) silty clay loam;

many medium distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; neutral.

The content of clay in the particle-size control section is about 35 to 45 percent. The mollic epipedon is more than 36 inches thick.

The Bg horizon and the Cg horizon, if it occurs, have hue of 10YR or 2.5Y and value of 2 to 5. Mottles with higher value and chroma are commonly below a depth of 36 inches.

Formation of the Soils

Soil is the product of soil-forming processes acting on accumulated or deposited geologic materials. The characteristics of the soil are determined by the type of parent material; the plant and animal life on and in the soil; the climate under which the soil-forming factors were active; topography, or lay of the land; and the length of time these forces have been active.

The parent material affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Plant and animal life are the active factors of soil formation. The climate determines the amount of water available for leaching and the amount of heat for physical and chemical changes. Together, climate and plant and animal life act on the parent material and slowly change it to a natural body that has genetically related horizons. Relief often modifies these other factors. Finally, time is required for changes in the parent material to result in the formation of a soil. Generally, a long time is required for the development of distinct soil horizons.

These factors of soil formation are all so closely interrelated in their effects on the soil that few generalizations can be made about the effect of any one factor unless conditions are specified for the other four. Soil formation is complex, and many processes of soil development are still unknown.

Parent Material

Parent material is the unconsolidated mass from which soil is formed. The formation or the deposition of this material is the first step in the development of a soil profile. The characteristics of the material determine the chemical and mineralogical composition of the soil. In Chariton County, four kinds of parent material, alone or in combinations of two or more, have contributed to the formation of the soils. These four kinds of parent material are residuum, or material weathered from bedrock; glacial material; loess, or wind-deposited material; and alluvium, or water-deposited material.

Gosport and Newcomer soils formed in residuum derived from shale or sandstone.

Glacial parent material, composed of clay, silt, sand, gravel, and a few boulders, was transported by glaciation. Much of the glacial material was moved long distances, but some is of local origin. Armstrong and Keswick soils formed in a thin layer of pedisediment and in the underlying paleosol derived from glacial till. Winnegan soils formed in glacial till.

Loess, a silty material transported by the wind, is an extensive parent material in Chariton County. The principal source is believed to have been the flood plains along the Missouri River after the retreat of the last glacier. The thickest deposits of loess are on the hills bordering this flood plain. The well drained Knox and Menfro soils, the moderately well drained Wakenda soils, and the somewhat poorly drained Higginsville soils formed in these deposits. Farther from the source, the deposits were thinner and contained more clay. Finer loess parent material and gentle slopes resulted in soils in which drainage is more restricted. Grundy soils are examples. Lagonda soils formed in a thin layer of loess and pedisediment.

Alluvium is material that was transported by water and deposited on nearly level flood plains. Because of the various origins and differing velocities of flowing water, this material varies greatly in texture and mineralogical composition. The source of the parent material on the flood plains along small tributary streams is limited to local uplands. The silty Dockery soils formed in material that was deposited near the stream channel, where the current is strongest. The finer textured Carlow and Zook soils formed away from the stream channels, where the finer clay particles settled from the backwaters. The vast drainage area of the Missouri River provides parent material for soils in its flood plain, and thus the range of soil textures on the flood plain along this river is relatively wide. The soils reflect the varying speeds of the flowing water. The parent material in which the coarser textured Haynie, Landes, and Norborne soils formed was deposited while the water had sufficient flow and velocity to carry sand-sized particles. The parent material in which the more clayey Parkville and Waldron soils formed was deposited in slackwater areas.

Plant and Animal Life

Plants and animals living on or in the soil are active in the soil-forming process. Plants furnish organic matter to the soil and bring up plant nutrients from underlying layers to the surface layer. As plants die and decay, they contribute organic matter to the soil. Bacteria and fungi decompose the plant remains and help to incorporate the organic matter into the soil.

The kind of native vegetation is one factor that has greatly influenced soil formation. The basic kinds of native vegetation were prairie grasses and forest vegetation. Additions of organic matter to soils that formed under prairie grasses are largely a result of the yearly decomposition of plant materials. Plant tops decompose at the surface, and the roots decompose at various depths in the soil. As a result, soils that formed under prairie grasses have a thick, dark surface layer. Grundy and Wakenda soils are examples of soils that formed under prairie vegetation.

Additions of organic matter to soils that formed under forest vegetation are mostly the result of leaves and twigs that decompose on the surface. These soils have a thin, dark surface layer. Gosport, Menfro, and Winnegan soils are examples.

Insects, worms, humans, and other animals affect soil formation. Bacteria and fungi cause rotting of organic materials, fix nitrogen, and improve tilth. Burrowing animals and insects loosen and mix various soil horizons.

In a relatively short time, human activities have greatly affected the processes of soil formation. The major alterations have resulted from changes in vegetation, drainage of wet areas, and accelerated erosion. Row crops have replaced native grasses and many forested areas. Nearly all of the flood plains and much of the upland areas are now farmed. These changes have increased food production but have had an adverse effect in terms of sustained productivity. Accelerated erosion continues to reduce the potential of many upland soils, and the loss of cropland to urban development is virtually irreversible.

Climate

Climate has been and still is an important factor in soil formation. Geologic erosion, plant and animal life, and, in more recent times, accelerated erosion all have varied with the climate. The subhumid midcontinental climate of the county has changed little in the past 8,000 years. The climate that was present when the first settlers arrived in the area favored the growth of mixed prairie and forest vegetation. The prairie areas were a result of a more arid climatic cycle.

The glacial periods that so greatly affected the soil-forming processes were a result of climatic changes. Thousands of years of cold temperatures resulted in glaciers that moved into the area. Several soil-forming periods have occurred since the last ice sheet left northern Missouri. Geologic evidence indicates that the climate was colder and wetter than the present climate during some soil-forming periods and was warmer during others. The warmer weather and high winds resulted in severe geologic erosion, and much of the area was covered by loess.

High temperatures and adequate rainfall encourage rapid chemical and physical changes. This type of climate is conducive to the breakdown of minerals and the relocation of clay within the soil. The clay is moved downward into the soil profile, and this downward movement results in the formation of the subsoil. Nearly all of the upland soils in the county show evidence of this eluviation.

Topography

Topography, or relief, affects soil formation through its influence on drainage, runoff, the rate of water infiltration, and geologic erosion. Topography is characterized by length, shape, aspect, and degree of slope. It is important in determining the pattern and distribution of soils.

The amount of water entering the soil depends on steepness of slope, permeability, and the intensity of rainfall. Because runoff is rapid in steep areas, very little water passes through the soil and soil formation is slow. Geologic erosion almost keeps pace with the soil-forming processes. In gently sloping areas, runoff is slow, erosion is minimal, and most of the water passes through the soil. Leaching, the translocation of clay, and other soil-forming processes are intensified in these areas. Soils in these areas generally show maximum profile development.

Soils on steep, south-facing slopes receive more direct sunlight and are drier than similar soils on north-facing slopes. Drier conditions influence soil formation by affecting the kind of vegetation, the susceptibility to erosion, and the cycles of freezing and thawing.

Time

The degree of profile development is dependent on the length of time that the parent material has been in place and subject to the soil-forming processes. Older soils show the effects of leaching and clay movement and have developed distinct horizons. Young soils show little profile development.

Kansan glacial till was deposited in a thick blanket over northern Missouri when the last ice sheet melted about 350,000 years ago. The soil-forming period that followed is called the Yarmouth interglacial episode. The soils that formed during this period are called Yarmouth paleosols. A paleosol is a soil that formed on an old landscape, such as the one that existed 350,000 years ago. Geologic erosion subsequently removed the Yarmouth paleosol from all but the more stable parts of the upland landscape. About 120,000 years ago, another soil-forming period began. This period is called the Sangamon interglacial episode. The associated soils, such as Armstrong and Keswick soils, are called Sangamon paleosols. The Sangamon paleosols formed in the Yarmouth paleosols or in the pre-Illinoian glacial till in areas where the Yarmouth paleosols had been removed by geologic erosion.

The Sangamon interglacial episode, which may have ended as recently as 30,000 years ago, was followed by the Peorian episode, during which the surface of the landscape was blanketed with loess. Peorian loess, represented by such soils as Grundy, Higginsville, and Wakenda soils, remains on the most stable parts of the landscape. Geologic erosion has removed it from the less stable parts (Ruhe and others, 1957).

Alluvial soils are the youngest soils. Dockery soils have no profile development because alluvial material is added nearly every year. Tina and Triplett soils, which are on stream terraces, are older alluvial soils and have developed distinct profiles.

The steep, shallower Gosport and Newcomer soils also formed in alluvium. The shale and limestone from which the parent material of these soils was derived is much older than the parent material in which other soils formed. Because the removal of materials through geologic erosion nearly keeps pace with the soil-forming processes, however, these soils are considered young.

The age of a soil is determined by the degree of development of a soil profile. It is a result of the interaction of soil-forming processes over a period of time, not a result of the number of years during which the material has existed.

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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

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and 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 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.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

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

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles 2 millimeters to 38 centimeters (15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

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

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

Congeliturbate. Soil material disturbed by frost action.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they 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.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

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

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

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

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

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

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

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

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

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 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of the 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.

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

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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 are 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

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

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 the 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, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or 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).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

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 with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

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

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

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

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

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

Percolation. The 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, such as 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.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly 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 drawbar 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.

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.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, 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 substratum. 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 sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

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 wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion 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). A layer of otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, 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.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded 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 1961-90 at Salisbury, Missouri)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	35.8	16.0	25.9	65	-14	17	1.53	0.48	2.48	3	6.1
February----	41.2	20.7	31.0	71	-11	42	1.42	.69	2.05	3	4.8
March-------	53.9	31.8	42.8	82	7	187	3.05	1.60	4.32	6	3.8
April-------	66.3	43.0	54.7	88	22	433	3.65	1.78	5.26	6	.5
May---------	75.7	52.6	64.2	91	34	724	4.82	3.09	6.39	8	.0
June--------	83.9	61.5	72.7	97	45	980	4.76	2.26	6.91	6	.0
July--------	88.8	66.0	77.4	100	51	1,160	4.32	1.95	6.34	6	.0
August------	86.8	63.0	74.9	101	46	1,081	3.95	1.29	6.13	5	.0
September---	79.4	55.5	67.5	95	33	816	4.88	2.10	7.24	5	.0
October-----	68.4	44.1	56.3	89	24	507	3.72	1.93	5.51	5	.0
November----	53.8	33.5	43.7	78	10	189	2.74	1.32	4.14	4	1.3
December----	39.9	21.7	30.8	68	-9	39	2.22	1.02	3.25	4	5.1
Yearly:											
Average---	64.5	42.5	53.5	---	---	---	---	---	---	---	---
Extreme---	---	---	---	102	-17	---	---	---	---	---	---
Total-----	---	---	---	---	---	6,175	41.06	33.26	47.90	61	21.6

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

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1961-90 at Salisbury, Missouri)

Probability	Temperature		
	24 ^{o}F or lower	28 ^{o}F or lower	32 ^{o}F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 10	Apr. 20	Apr. 30
2 years in 10 later than--	Apr. 5	Apr. 16	Apr. 25
5 years in 10 later than--	Mar. 27	Apr. 7	Apr. 16
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 20	Oct. 4	Sept. 29
2 years in 10 earlier than--	Oct. 26	Oct. 11	Oct. 4
5 years in 10 earlier than--	Nov. 7	Oct. 23	Oct. 13

TABLE 3.--GROWING SEASON

(Recorded in the period 1961-90 at Salisbury, Missouri)

Probability	Daily minimum temperature during growing season		
	Higher than 24 ^{o}F	Higher than 28 ^{o}F	Higher than 32 ^{o}F
	Days	Days	Days
9 years in 10	190	172	156
8 years in 10	197	179	163
5 years in 10	209	194	178
2 years in 10	222	209	192
1 year in 10	229	217	200

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
10B2	Lagonda silt loam, 2 to 5 percent slopes, eroded	20,915	4.3
11C2	Lagonda silty clay loam, 5 to 9 percent slopes, eroded	21,965	4.5
12B2	Bevier silty clay loam, 2 to 5 percent slopes, eroded	9,445	1.9
15B	Grundy silt loam, 2 to 5 percent slopes	26,155	5.3
16	Crestmeade silt loam	2,820	0.6
19C2	Menfro silt loam, 3 to 9 percent slopes, eroded	1,610	0.3
19F	Menfro silt loam, 9 to 30 percent slopes	6,745	1.4
20A	Shannondale silt loam, 0 to 2 percent slopes	4,905	1.0
20C2	Shannondale silt loam, 2 to 7 percent slopes, eroded, rarely flooded	990	0.2
21C2	Knox silty clay loam, 5 to 9 percent slopes, eroded	3,785	0.8
22F3	Knox silty clay loam, 9 to 30 percent slopes, severely eroded	4,530	0.9
23B2	Higginsville silt loam, 2 to 5 percent slopes, eroded	710	0.1
23C2	Higginsville silt loam, 5 to 9 percent slopes, eroded	9,110	1.9
25B	Wakenda silt loam, 2 to 5 percent slopes	9,880	2.0
25C2	Wakenda silt loam, 5 to 9 percent slopes, eroded	870	0.2
26B	Armstrong loam, 2 to 5 percent slopes	1,755	0.4
26C2	Armstrong loam, 5 to 9 percent slopes, eroded	71,695	14.6
26D2	Armstrong loam, 9 to 14 percent slopes, eroded	30,100	6.1
27D3	Armstrong clay loam, 9 to 14 percent slopes, severely eroded	9,595	2.0
28C	Keswick loam, 5 to 9 percent slopes	1,830	0.4
31F	Winnegan loam, 9 to 30 percent slopes	13,220	2.7
36D2	Gosport silty clay loam, 9 to 14 percent slopes, eroded	4,380	0.9
36F	Gosport silty clay loam, 14 to 30 percent slopes	6,760	1.4
37D2	Newcomer loam, 9 to 14 percent slopes, eroded	2,985	0.6
37F	Newcomer loam, 14 to 30 percent slopes	295	0.1
40F	Putco clay loam, 9 to 50 percent slopes	350	0.1
42F	Schuline-Pits complex, 5 to 30 percent slopes	460	0.1
47	Dockery silt loam, frequently flooded	37,380	7.6
50	Blackoar silt loam, occasionally flooded	880	0.2
53	Colo silt loam, occasionally flooded	6,465	1.3
54	Zook silty clay loam, occasionally flooded	8,000	1.6
56	Triplett silt loam, rarely flooded	10,405	2.1
60	Portage silty clay, occasionally flooded	3,600	0.7
61	Carlow silty clay, occasionally flooded	35,285	7.2
62	Carlow silty clay, rarely flooded	9,465	1.9
64	Tina silt loam, rarely flooded	22,365	4.6
66C2	Gifford silty clay loam, 2 to 9 percent slopes, eroded, rarely flooded	1,340	0.3
68	Tuskeego silty clay loam, occasionally flooded	7,220	1.5
70	Speed silt loam, occasionally flooded	14,475	2.9
72	Tice silt loam, frequently flooded	19,400	4.0
73	Tice silty clay loam, rarely flooded	2,490	0.5
78	Levasy silty clay, rarely flooded	855	0.2
81	Haynie very fine sandy loam, rarely flooded	2,945	0.6
82	Sarpy loamy fine sand, rarely flooded	225	*
83	Landes fine sandy loam, rarely flooded	240	*
84	Haynie-Waldron complex, rarely flooded	4,755	1.0
85	Waldron silty clay, loamy substratum, rarely flooded	3,235	0.7
86	Parkville silty clay loam, rarely flooded	3,120	0.6
87	Modale silt loam, rarely flooded	2,035	0.4
88	Cotter silt loam, rarely flooded	2,885	0.6
89	Norborne loam, rarely flooded	2,140	0.4
93	Booker silty clay, rarely flooded	11,435	2.3
94	Grable silt loam, rarely flooded	236	*
99	Haynie-Waldron complex, frequently flooded	4,145	0.8
	Water areas larger than 40 acres	6,089	1.2
	Total	490,970	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
10B2	Lagonda silt loam, 2 to 5 percent slopes, eroded
12B2	Bevier silty clay loam, 2 to 5 percent slopes, eroded
15B	Grundy silt loam, 2 to 5 percent slopes
16	Crestmeade silt loam (where drained)
20A	Shannondale silt loam, 0 to 2 percent slopes
20C2	Shannondale silt loam, 2 to 7 percent slopes, eroded, rarely flooded
23B2	Higginsville silt loam, 2 to 5 percent slopes, eroded
25B	Wakenda silt loam, 2 to 5 percent slopes
26B	Armstrong loam, 2 to 5 percent slopes
47	Dockery silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
50	Blackoar silt loam, occasionally flooded (where drained)
53	Colo silt loam, occasionally flooded (where drained)
54	Zook silty clay loam, occasionally flooded (where drained)
56	Triplett silt loam, rarely flooded (where drained)
60	Portage silty clay, occasionally flooded (where drained)
61	Carlow silty clay, occasionally flooded (where drained)
62	Carlow silty clay, rarely flooded (where drained)
64	Tina silt loam, rarely flooded
68	Tuskeego silty clay loam, occasionally flooded (where drained)
70	Speed silt loam, occasionally flooded (where drained)
72	Tice silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
73	Tice silty clay loam, rarely flooded
78	Levasy silty clay, rarely flooded (where drained)
81	Haynie very fine sandy loam, rarely flooded
83	Landes fine sandy loam, rarely flooded
84	Haynie-Waldron complex, rarely flooded (where drained)
85	Waldron silty clay, loamy substratum, rarely flooded (where drained)
86	Parkville silty clay loam, rarely flooded
87	Modale silt loam, rarely flooded
88	Cotter silt loam, rarely flooded
89	Norborne loam, rarely flooded
93	Booker silty clay, rarely flooded (where drained)
94	Grable silt loam, rarely flooded
99	Haynie-Waldron complex, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Tall fescue	Orchard-grass-red clover hay	Switchgrass
		Bu	Bu	Bu	Bu	AUM*	Tons	AUM*
10B2------------ Lagonda	IIIe	96	36	84	42	5.8	3.6	6.1
11C2------------ Lagonda	IIIe	89	33	77	39	5.3	3.3	5.6
12B2------------ Bevier	IIIe	97	36	85	42	5.8	3.6	6.1
15B------------- Grundy	IIe	103	38	89	46	6.1	3.7	6.5
16-------------- Crestmeade	IIw	102	38	89	46	6.1	3.9	6.5
19C2------------ Menfro	IIIe	94	35	83	42	5.6	3.5	6.0
19F------------- Menfro	VIe	---	---	---	---	4.3	2.7	4.6
20A------------- Shannondale	I	135	50	118	60	8.0	5.0	8.5
20C2------------ Shannondale	IIe	116	43	102	52	6.9	4.3	7.3
21C2------------ Knox	IIIe	100	37	87	45	5.9	3.7	6.3
22F3------------ Knox	VIe	---	---	---	33	4.6	2.9	4.9
23B2------------ Higginsville	IIe	120	45	105	54	7.1	4.5	7.6
23C2------------ Higginsville	IIIe	116	42	101	52	6.9	4.3	7.3
25B------------- Wakenda	IIe	119	45	104	53	7.0	4.4	7.5
25C2------------ Wakenda	IIIe	113	42	98	49	6.7	4.2	7.1
26B------------- Armstrong	IIe	103	38	90	46	6.1	4.2	6.5
26C2------------ Armstrong	IIIe	84	31	73	37	5.0	3.1	5.3
26D2------------ Armstrong	IVe	73	27	64	32	4.3	2.7	4.6
27D3------------ Armstrong	VIe	---	---	---	30	4.0	2.5	4.3

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Tall fescue	Orchard-grass-red clover hay	Switchgrass
		Bu	Bu	Bu	Bu	AUM*	Tons	AUM*
28C------------- Keswick	IIIe	89	33	78	40	5.3	3.3	5.6
31F------------- Winnegan	VIe	---	---	---	---	3.7	2.8	3.9
36D2------------ Gosport	VIe	---	---	---	22	2.9	1.8	3.1
36F------------- Gosport	VIIe	---	---	---	---	2.2	---	2.4
37D2------------ Newcomer	VIe	---	---	---	28	3.7	2.3	3.9
37F------------- Newcomer	VIIe	---	---	---	24	3.2	---	3.4
40F------------- Putco	VIe	---	---	---	17	2.2	---	2.4
42F:								
Schuline--------	IVe	82	28	70	30	4.0	---	4.3
Pits------------	VIIIs	---	---	---	---	---	---	---
47-------------- Dockery	IIIw	100	37	90	45	6.1	3.8	6.5
50-------------- Blackoar	IIw	113	41	98	50	6.7	4.2	7.1
53-------------- Colo	IIw	113	42	99	50	6.7	4.2	7.1
54-------------- Zook	IIw	86	32	76	38	5.1	3.2	5.4
56-------------- Triplett	IIw	102	38	90	46	6.1	3.7	6.5
60-------------- Portage	IIIw	70	26	61	30	4.2	2.6	4.4
61-------------- Carlow	IIIw	86	31	76	39	5.1	3.2	5.4
62-------------- Carlow	IIIw	97	36	85	43	5.8	3.6	6.1
64-------------- Tina	IIw	115	43	100	51	6.8	4.3	7.2
66C2------------ Gifford	IIIe	73	27	63	33	4.3	2.6	4.6
68-------------- Tuskeego	IIIw	81	30	71	36	4.8	3.0	5.1
70-------------- Speed	IIw	102	38	89	46	6.1	3.8	6.5

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Tall fescue	Orchard-grass-red clover hay	Switchgrass
		Bu	Bu	Bu	Bu	AUM*	Tons	AUM*
72: Tice	IIIw	105	39	92	47	6.2	---	6.6
73: Tice	I	132	49	116	59	7.8	4.9	8.3
78: Levasy	IIIw	97	36	85	43	---	---	---
81: Haynie	I	119	44	104	53	7.0	4.4	7.5
82: Sarpy	IVs	54	20	47	24	3.2	---	3.4
83: Landes	IIs	89	34	78	40	5.3	3.3	5.6
84:								
Haynie	I	119	44	88	53	7.0	4.4	7.5
Waldron	IIw	113	42	104	50	6.7	4.2	7.1
85: Waldron	IIw	96	35	85	42	5.8	3.6	6.1
86: Parkville	IIw	108	40	94	48	6.4	4.0	6.8
87: Modale	I	124	46	109	54	7.8	4.6	7.8
88: Cotter	I	124	45	110	54	7.4	4.6	7.8
89: Norborne	I	111	41	97	49	6.6	4.1	7.0
93: Booker	IIIw	86	32	76	38	5.1	3.6	5.4
94: Grable	IIs	97	35	85	43	5.8	3.6	6.1
99:								
Haynie	IIIw	90	35	82	40	5.3	3.7	5.7
Waldron	IIIw	88	33	77	39	5.2	3.3	5.5

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

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: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
12B2----------- Bevier	3C	Slight	Slight	Severe	Slight	White oak-----------	55	38	White oak, eastern white pine.
19C2----------- Menfro	4A	Slight	Slight	Slight	Slight	Northern red oak----	81	63	White oak, white ash, black walnut, northern red oak.
						Black oak-----------	73	55	
						White ash-----------	70	66	
						Sugar maple---------	68	42	
						White oak-----------	59	42	
19F------------ Menfro	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	81	63	White oak, white ash, black walnut, northern red oak.
						Black oak-----------	73	55	
						White ash-----------	70	66	
						Sugar maple---------	68	42	
						White oak-----------	59	42	
21C2----------- Knox	4A	Slight	Slight	Slight	Slight	White oak-----------	69	51	Black walnut, northern red oak, white oak.
						Northern red oak----	78	60	
						Black oak-----------	74	56	
22F3----------- Knox	4R	Moderate	Moderate	Moderate	Slight	White oak-----------	69	51	Black walnut, northern red oak, white oak.
						Northern red oak----	78	60	
						Black oak-----------	74	56	
26B, 26C2, 26D2, 27D3----------- Armstrong	3C	Slight	Slight	Moderate	Severe	White oak-----------	55	38	Eastern white pine, northern red oak, black oak.
						Northern red oak----	55	38	
						Black oak-----------	---	---	
28C------------ Keswick	3C	Slight	Slight	Moderate	Severe	White oak-----------	57	40	Eastern white pine, black oak.
						Northern red oak----	55	38	
						Black oak-----------	62	45	
31F------------ Winnegan	3R	Moderate	Moderate	Slight	Slight	White oak-----------	60	43	White oak, black oak, white ash, northern red oak.
						Post oak------------	---	---	
						Black oak-----------	---	---	
36D2----------- Gosport	2C	Slight	Slight	Severe	Severe	White oak-----------	45	30	Eastern white pine, eastern redcedar.
						Post oak------------	45	30	
36F------------ Gosport	2R	Moderate	Moderate	Severe	Severe	White oak-----------	45	30	Eastern white pine, eastern redcedar.
						Post oak------------	45	30	
37D2----------- Newcomer	3A	Slight	Slight	Slight	Slight	White oak-----------	60	43	White oak, white ash, black oak.
						Black walnut--------	---	---	
						Black oak-----------	---	---	
						Shagbark hickory----	---	---	
						White ash-----------	---	---	

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
37F: Newcomer	3R	Moderate	Moderate	Moderate	Slight	White oak	60	43	White oak, white ash, black oak.
						Black walnut	---	---	
						Black oak	---	---	
						Shagbark hickory	---	---	
						White ash	---	---	
40F: Putco	2R	Severe	Severe	Severe	Slight	River birch	50	32	Eastern white pine, green ash, cottonwood, bur oak.
						Eastern cottonwood	---	---	
						American elm	---	---	
47: Dockery	4W	Slight	Moderate	Slight	Slight	Pin oak	76	58	Pin oak, pecan, eastern cottonwood.
						Green ash	---	---	
50: Blackoar	5W	Slight	Severe	Moderate	Moderate	Pin oak	70	52	Pin oak, eastern cottonwood.
						Eastern cottonwood	85	91	
60: Portage	6W	Slight	Severe	Severe	Severe	Eastern cottonwood	85	91	Eastern cottonwood, pin oak, green ash, silver maple, baldcypress.
						Silver maple	80	34	
						Pin oak	75	57	
61, 62: Carlow	4W	Slight	Severe	Severe	Moderate	Pin oak	75	57	Eastern cottonwood, pin oak, green ash, baldcypress, silver maple.
						Eastern cottonwood	85	91	
64: Tina	4A	Slight	Slight	Slight	Slight	Pin oak	70	52	Pin oak, eastern cottonwood, pecan.
						Eastern cottonwood	---	---	
68: Tuskeego	2W	Slight	Severe	Moderate	Moderate	Silver maple	80	34	Silver maple, eastern cottonwood, American sycamore, green ash.
						Eastern cottonwood	90	103	
72: Tice	5A	Slight	Slight	Slight	Slight	Pin oak	96	78	Yellow-poplar, eastern cottonwood, American sycamore, green ash, red maple.
						Eastern cottonwood	---	---	
						Green ash	---	---	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
73-------------- Tice	5A	Slight	Slight	Slight	Slight	Pin oak------------- Eastern cottonwood-- Green ash-----------	90 --- ---	72 --- ---	American sycamore, eastern cottonwood, green ash, red maple.
78-------------- Levasy	7W	Slight	Severe	Moderate	Moderate	Eastern cottonwood-- Black willow--------	90 ---	103 ---	Eastern cottonwood.
81-------------- Haynie	11A	Slight	Slight	Slight	Slight	Eastern cottonwood-- American sycamore--- Black walnut-------- Green ash-----------	110 110 --- ---	156 157 --- ---	Eastern cottonwood, black walnut.
82-------------- Sarpy	3S	Slight	Slight	Severe	Slight	Silver maple-------- Eastern cottonwood--	90 95	42 116	Eastern cottonwood, American sycamore.
83-------------- Landes	7A	Slight	Slight	Slight	Slight	Eastern cottonwood-- American sycamore--- Green ash-----------	105 --- ---	141 --- ---	Eastern cottonwood, American sycamore, sweetgum, green ash, black walnut.
84:									
Haynie---------	11A	Slight	Slight	Slight	Slight	Eastern cottonwood-- American sycamore--- Black walnut-------- Green ash-----------	110 110 --- ---	156 157 --- ---	Eastern cottonwood, black walnut.
Waldron--------	11C	Slight	Moderate	Severe	Slight	Eastern cottonwood-- Pin oak-------------	110 80	156 62	Eastern cottonwood, pin oak, green ash, silver maple.
85-------------- Waldron	11C	Slight	Moderate	Severe	Slight	Eastern cottonwood-- Pin oak-------------	110 80	156 62	Eastern cottonwood, pin oak, green ash, silver maple.
86-------------- Parkville	5C	Slight	Moderate	Severe	Slight	Pin oak------------- Eastern cottonwood--	90 100	72 128	Eastern cottonwood, pin oak, pecan, American sycamore.
88-------------- Cotter	9A	Slight	Slight	Slight	Slight	Eastern cottonwood--	100	128	Eastern cottonwood, yellow-poplar, black walnut.

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
89------------- Norborne	5A	Slight	Slight	Slight	Slight	Pin oak------------- Pecan---------------	90 ---	73 ---	Pin oak, pecan, green ash, eastern cottonwood.
93------------- Booker	6W	Slight	Severe	Severe	Severe	Eastern cottonwood-- Silver maple--------	85 80	91 34	Eastern cottonwood, pin oak, pecan, green ash, silver maple.
99:									
Haynie---------	11A	Slight	Slight	Slight	Slight	Eastern cottonwood-- American sycamore--- Black walnut-------- Green ash-----------	110 110 --- ---	156 157 --- ---	Eastern cottonwood, black walnut.
Waldron--------	11C	Slight	Moderate	Severe	Slight	Eastern cottonwood-- Pin oak-------------	110 80	152 62	Eastern cottonwood, pin oak, green ash, silver maple.

* 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
10B2, 11C2 Lagonda	Fragrant sumac	Amur maple, gray dogwood, eastern redcedar.	Norway spruce, hackberry, green ash, autumn-olive.	Pin oak, Austrian pine, honeylocust, American sycamore.	---
12B2 Bevier	Fragrant sumac	Amur maple, gray dogwood, common ninebark.	Hackberry, Norway spruce, Virginia pine, eastern redcedar.	Honeylocust, pin oak.	---
15B Grundy	---	Washington hawthorn, eastern redcedar, gray dogwood, Amur privet, American cranberrybush, arrowwood.	Austrian pine, Osage-orange, green ash.	Pin oak, eastern white pine.	---
16 Crestmeade	Lilac	Gray dogwood, Amur maple, Manchurian crabapple.	Austrian pine, hackberry, eastern redcedar, green ash, Russian-olive, Norway spruce.	Honeylocust	---
19C2, 19F Menfro	---	Silky dogwood, gray dogwood, Amur privet, American cranberrybush.	Northern whitecedar, Washington hawthorn, blue spruce, white fir.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
20A, 20C2 Shannondale	---	Gray dogwood, lilac, autumn-olive, Amur maple.	Eastern redcedar	Austrian pine, eastern white pine, honeylocust, hackberry, green ash, pin oak.	Eastern cottonwood.
21C2, 22F3 Knox	---	Gray dogwood, autumn-olive, lilac, Amur maple.	Hackberry, eastern redcedar, green ash, bur oak, Russian-olive.	Austrian pine, eastern white pine, honeylocust.	---
23B2, 23C2 Higginsville	---	Gray dogwood, lilac, autumn-olive, Amur maple.	Eastern redcedar	Austrian pine, eastern white pine, honeylocust, hackberry, green ash, pin oak.	Eastern cottonwood.
25B, 25C2 Wakenda	---	Amur maple, American plum, lilac.	Eastern redcedar, bur oak, hackberry, green ash, flowering dogwood.	Austrian pine, eastern white pine, honeylocust.	---

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
26B, 26C2, 26D2, 27D3-------------Armstrong	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, American cranberrybush.	Austrian pine, green ash, bur oak.	Eastern white pine, pin oak.	---
28C---------------Keswick	---	Eastern redcedar, American cranberrybush, Washington hawthorn, arrowwood, Amur privet.	Austrian pine, green ash, bur oak.	Eastern white pine, pin oak.	---
31F---------------Winnegan	Fragrant sumac----	Amur maple, gray dogwood.	Hackberry, eastern redcedar, Norway spruce, Virginia pine.	Honeylocust, pin oak.	---
36D2, 36F---------Gosport	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, American cranberrybush.	Austrian pine, green ash, bur oak.	Eastern white pine, pin oak.	---
37D2, 37F---------Newcomer	Fragrant sumac, lilac.	American plum, Amur maple, gray dogwood, eastern redcedar, Washington hawthorn.	Austrian pine, hackberry, Virginia pine, honeylocust.	---	---
40F---------------Putco	Siberian peashrub, wahoo.	Russian-olive, Washington hawthorn, eastern redcedar.	Black locust, bur oak, green ash, honeylocust, northern catalpa.	Eastern cottonwood	---
42F:					
Schuline---------	Siberian peashrub	Eastern redcedar, silky dogwood, Washington hawthorn, eastern redbud, Russian-olive.	Honeylocust, northern catalpa.	---	---
Pits.					
47---------------Dockery	Fragrant sumac----	American plum, silky dogwood, blackhaw.	Washington hawthorn, nannyberry viburnum, white fir.	Green ash, eastern white pine, Norway spruce.	Pin oak, eastern cottonwood.

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
50 Blackoar	Redosier dogwood	Silky dogwood, American plum, common chokecherry, American cranberrybush.	Blue spruce, Norway spruce, northern whitecedar, hackberry.	Austrian pine, green ash, northern red oak.	Pin oak, eastern cottonwood.
53 Colo	---	Amur privet, deciduous holly, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, blue spruce, white fir, northern whitecedar, Washington hawthorn.	Eastern white pine	Pin oak.
54 Zook	---	Silky dogwood, deciduous holly, American cranberrybush, Amur privet.	Norway spruce, northern whitecedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
56 Triplett	---	Amur privet, arrowwood, Washington hawthorn, eastern redcedar, American cranberrybush.	Austrian pine, green ash.	Eastern white pine, pin oak.	---
60 Portage	---	Deciduous holly, silky dogwood, Amur privet, American cranberrybush.	Austrian pine, Washington hawthorn, northern whitecedar, blue spruce, Norway spruce, white fir.	Eastern white pine	Pin oak.
61, 62 Carlow	Buttonbush	Redosier dogwood, American plum.	Nannyberry viburnum, green ash, northern whitecedar, Washington hawthorn, white spruce.	Baldcypress, pin oak.	Eastern cottonwood.
64 Tina	---	Deciduous holly, Amur privet, American cranberrybush, silky dogwood.	Austrian pine, white fir, northern whitecedar, blue spruce, Washington hawthorn, Norway spruce.	---	Eastern white pine, pin oak.
66C2 Gifford	Fragrant sumac	Amur maple, gray dogwood.	Hackberry, eastern redcedar, Norway spruce, Virginia pine.	Honeylocust, pin oak.	---

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
68 Tuskeego	---	Amur privet, silky dogwood, deciduous holly, American cranberrybush.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
70 Speed	---	American cranberrybush, deciduous holly, Amur privet, silky dogwood.	Washington hawthorn, Austrian pine, blue spruce, northern whitecedar, white fir.	Norway spruce	Eastern white pine, pin oak.
72 Tice	---	Silky dogwood, Amur privet, American cranberrybush, blackhaw.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
73 Tice	Redosier dogwood, gray dogwood.	Silky dogwood, deciduous holly.	Amur maple, Russian-olive, baldcypress.	Eastern white pine, Norway spruce.	Eastern cottonwood, American sycamore, red maple.
78 Levasy	Buttonbush, redosier dogwood.	American plum, silky dogwood, pussy willow.	Eastern redcedar, hackberry, northern whitecedar, green ash, white spruce.	Bur oak	---
81 Haynie	Blackhaw	Siberian peashrub	Russian-olive, eastern redcedar, Washington hawthorn.	Green ash, hackberry, honeylocust, bur oak.	Eastern cottonwood.
82 Sarpy	Blackhaw	Washington hawthorn, Siberian peashrub.	Eastern redcedar, Russian-olive.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
83 Landes	---	Silky dogwood, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
84: Haynie	Blackhaw	Siberian peashrub	Russian-olive, eastern redcedar, Washington hawthorn.	Green ash, hackberry, honeylocust, bur oak.	Eastern cottonwood.

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
84: Waldron	---	American plum, blackhaw, nannyberry viburnum, Washington hawthorn.	Eastern redcedar, green ash, northern whitecedar, white spruce.	Bur oak	---
85 Waldron	---	American plum, blackhaw, nannyberry viburnum, Washington hawthorn.	Eastern redcedar, green ash, northern whitecedar, white spruce.	Bur oak	---
86 Parkville	Blackhaw	Siberian peashrub	Eastern redcedar, Russian-olive, Osage-orange, Washington hawthorn.	Honeylocust, hackberry, green ash, bur oak.	Eastern cottonwood.
87 Modale	Blackhaw	Siberian peashrub	Osage-orange, Washington hawthorn, Russian-olive, eastern redcedar.	Honeylocust, bur oak, green ash, hackberry.	Eastern cottonwood.
88 Cotter	---	Amur maple, lilac, arrowwood, deciduous holly.	Green ash, hackberry, bur oak, eastern redcedar, Russian-olive.	Eastern white pine, Austrian pine, honeylocust.	---
89 Norborne	---	Amur privet, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
93 Booker	Redosier dogwood	American plum, silky dogwood, common chokecherry.	Blue spruce, Austrian pine, northern whitecedar, Washington hawthorn, hackberry.	Silver maple, green ash.	Eastern cottonwood, pin oak.
94 Grable	Blackhaw	Siberian peashrub	Russian-olive, Washington hawthorn, eastern redcedar.	Honeylocust, bur oak, green ash, hackberry.	Eastern cottonwood.
99: Haynie	Blackhaw	Siberian peashrub	Russian-olive, eastern redcedar, Washington hawthorn.	Green ash, hackberry, honeylocust, bur oak.	Eastern cottonwood.

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
99: Waldron	---	American plum, blackhaw, nannyberry viburnum, Washington hawthorn.	Eastern redcedar, green ash, northern whitecedar, white spruce.	Bur oak	---

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
10B2------------------- Lagonda	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
11C2------------------- Lagonda	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Moderate: wetness.	Moderate: wetness.
12B2------------------- Bevier	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
15B-------------------- Grundy	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness.
16--------------------- Crestmeade	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
19C2------------------- Menfro	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
19F-------------------- Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
20A-------------------- Shannondale	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
20C2------------------- Shannondale	Severe: flooding.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness.
21C2------------------- Knox	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
22F3------------------- Knox	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
23B2------------------- Higginsville	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Severe: erodes easily.	Moderate: wetness.
23C2------------------- Higginsville	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Severe: erodes easily.	Moderate: wetness.
25B-------------------- Wakenda	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
25C2------------------- Wakenda	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
26B, 26C2-------------- Armstrong	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
26D2 Armstrong	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
27D3 Armstrong	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
28C Keswick	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
31F Winnegan	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
36D2 Gosport	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope, depth to rock.
36F Gosport	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.
37D2 Newcomer	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, depth to rock.
37F Newcomer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
40F Putco	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, droughty, slope.
42F:					
Schuline	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Pits	Variable	Variable	Variable	Variable	Variable.
47 Dockery	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.	Severe: flooding.
50 Blackoar	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
53 Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
54 Zook	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
56 Triplett	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
60: Portage	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
61, 62: Carlow	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
64: Tina	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
66C2: Gifford	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: slope, wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
68: Tuskeego	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
70: Speed	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.	Moderate: wetness, flooding.
72: Tice	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.	Severe: flooding.
73: Tice	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
78: Levasy	Severe: flooding, ponding, too clayey.	Severe: ponding, too clayey.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
81: Haynie	Severe: flooding.	Slight	Slight	Slight	Slight.
82: Sarpy	Severe: flooding.	Slight	Slight	Slight	Moderate: droughty.
83: Landes	Severe: flooding.	Slight	Slight	Slight	Moderate: small stones.
84:					
Haynie	Severe: flooding.	Slight	Slight	Slight	Slight.
Waldron	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
85: Waldron	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
86-------------------- Parkville	Severe: flooding, wetness, percs slowly.	Severe: percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
87-------------------- Modale	Severe: flooding, percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: wetness.	Moderate: wetness.
88-------------------- Cotter	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
89-------------------- Norborne	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
93-------------------- Booker	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
94-------------------- Grable	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
99:					
Haynie---------------	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Waldron--------------	Severe: flooding, wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness, flooding.	Severe: too clayey.	Severe: flooding, too clayey.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
10B2, 11C2 Lagonda	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
12B2 Bevier	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
15B Grundy	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
16 Crestmeade	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
19C2 Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
19F Menfro	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
20A, 20C2 Shannondale	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Very poor.
21C2 Knox	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
22F3 Knox	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
23B2 Higginsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
23C2 Higginsville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
25B Wakenda	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
25C2 Wakenda	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
26B, 26C2, 26D2, 27D3 Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
28C Keswick	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
31F Winnegan	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
36D2, 36F Gosport	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
37D2 Newcomer	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
37F Newcomer	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	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
40F: Putco	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
42F:										
Schuline	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Pits	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
47: Dockery	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
50: Blackoar	Good	Good	Good	Fair	Fair	Good	Fair	Good	Fair	Fair.
53: Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
54: Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
56: Triplett	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
60: Portage	Poor	Poor	Poor	Poor	Poor	Poor	Good	Very poor.	Very poor.	Poor.
61, 62: Carlow	Poor	Fair	Fair	Fair	Fair	Poor	Good	Poor	Fair	Fair.
64: Tina	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
66C2: Gifford	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
68: Tuskeego	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
70: Speed	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
72: Tice	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
73: Tice	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
78: Levasy	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
81: Haynie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
82: Sarpy	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
83: Landes	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	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
84:										
Haynie	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Waldron	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Fair	Poor.
85 Waldron	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Fair	Poor.
86 Parkville	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Good	Poor.
87 Modale	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Good.
88 Cotter	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
89 Norborne	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
93 Booker	Poor	Poor	Fair	Poor	Poor	Poor	Good	Poor	Poor	Fair.
94 Grable	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.
99:										
Haynie	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Fair	Poor.
Waldron	Fair	Fair	Fair	Good	Good	Poor	Fair	Fair	Fair	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
10B2, 11C2: Lagonda	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
12B2: Bevier	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
15B: Grundy	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
16: Crestmeade	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
19C2: Menfro	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
19F: Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
20A: Shannondale	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness.	Severe: low strength, frost action.	Moderate: wetness.
20C2: Shannondale	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, frost action.	Moderate: wetness.
21C2: Knox	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
22F3: Knox	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
23B2: Higginsville	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: wetness.
23C2: Higginsville	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness.

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
25B Wakenda	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
25C2 Wakenda	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
26B, 26C2 Armstrong	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
26D2, 27D3 Armstrong	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
28C Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
31F Winnegan	Severe: wetness, slope.	Severe: shrink-swell, slope.	Severe: wetness, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
36D2 Gosport	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Moderate: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope, depth to rock.
36F Gosport	Severe: wetness, slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
37D2 Newcomer	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope, depth to rock.
37F Newcomer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
40F Putco	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: small stones, droughty, slope.
42F:						
Schuline	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Pits	Variable	Variable	Variable	Variable	Variable	Variable.
47 Dockery	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	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
50----------------- Blackoar	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
53----------------- Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
54----------------- Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
56----------------- Triplett	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
60----------------- Portage	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
61, 62------------- Carlow	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
64----------------- Tina	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
66C2--------------- Gifford	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
68----------------- Tuskeego	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
70----------------- Speed	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: wetness, flooding.
72----------------- Tice	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.
73----------------- Tice	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, frost action.	Moderate: wetness.
78----------------- Levasy	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.

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
81----------------- Haynie	Slight----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
82----------------- Sarpy	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
83----------------- Landes	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Moderate: small stones.
84:						
Haynie------------	Slight----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
Waldron-----------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
85----------------- Waldron	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
86----------------- Parkville	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Moderate: wetness, flooding, frost action.	Moderate: wetness.
87----------------- Modale	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
88----------------- Cotter	Slight----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
89----------------- Norborne	Slight----------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
93----------------- Booker	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
94----------------- Grable	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
99:						
Haynie------------	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.
Waldron-----------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: flooding, too clayey.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," 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
10B2: Lagonda	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
11C2: Lagonda	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
12B2: Bevier	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
15B: Grundy	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
16: Crestmeade	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
19C2: Menfro	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
19F: Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
20A, 20C2: Shannondale	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Fair: too clayey, wetness.
21C2: Knox	Slight	Severe: slope.	Slight	Slight	Good.
22F3: Knox	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
23B2: Higginsville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
23C2: Higginsville	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
25B: Wakenda	Moderate: wetness.	Moderate: seepage, slope, wetness.	Moderate: too clayey.	Moderate: wetness.	Fair: too clayey.
25C2: Wakenda	Moderate: wetness.	Severe: slope.	Moderate: too clayey.	Moderate: wetness.	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
26B, 26C2, 26D2, 27D3 Armstrong	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
28C Keswick	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
31F Winnegan	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
36D2 Gosport	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
36F Gosport	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
37D2 Newcomer	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
37F Newcomer	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
40F Putco	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, small stones.
42F:					
Schuline	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Pits	Variable	Variable	Variable	Variable	Variable.
47 Dockery	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
50 Blackoar	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
53 Colo	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
54 Zook	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.

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
56 Triplett	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
60 Portage	Severe: flooding, ponding, percs slowly.	Severe: flooding, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
61 Carlow	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
62 Carlow	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
64 Tina	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
66C2 Gifford	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
68 Tuskeego	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
70 Speed	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
72 Tice	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack.
73 Tice	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack.
78 Levasy	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
81 Haynie	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
82 Sarpy	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
83 Landes	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

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
84:					
Haynie	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Waldron	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
85 Waldron	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
86 Parkville	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
87 Modale	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
88 Cotter	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
89 Norborne	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
93 Booker	Severe: ponding, percs slowly.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
94 Grable	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
99:					
Haynie	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Waldron	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.

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
10B2, 11C2------------ Lagonda	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
12B2------------------ Bevier	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
15B------------------- Grundy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
16-------------------- Crestmeade	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
19C2------------------ Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
19F------------------- Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
20A, 20C2------------- Shannondale	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
21C2------------------ Knox	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
22F3------------------ Knox	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
23B2, 23C2------------ Higginsville	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
25B, 25C2------------- Wakenda	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
26B, 26C2, 26D2, 27D3- Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
28C------------------- Keswick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
31F------------------- Winnegan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
36D2------------------ Gosport	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
36F------------------- Gosport	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
37D2: Newcomer	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey, slope.
37F: Newcomer	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
40F: Putco	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
42F:				
Schuline	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Pits	Variable	Variable	Variable	Variable.
47: Dockery	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
50: Blackoar	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
53: Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
54: Zook	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
56: Triplett	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
60: Portage	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
61, 62: Carlow	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
64: Tina	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
66C2: Gifford	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
68: Tuskeego	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
70: Speed	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
72: Tice	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
73: Tice	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
78: Levasy	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
81: Haynie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
82: Sarpy	Good	Probable	Improbable: too sandy.	Poor: too sandy.
83: Landes	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones, thin layer.
84:				
Haynie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Waldron	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
85: Waldron	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
86: Parkville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
87: Modale	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
88: Cotter	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
89: Norborne	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
93: Booker	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
94: Grable	Good	Probable	Improbable: too sandy.	Fair: thin layer.
99:				
Haynie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Waldron	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

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
10B2, 11C2: Lagonda	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
12B2: Bevier	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
15B: Grundy	Moderate: slope.	Severe: hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
16: Crestmeade	Slight	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
19C2: Menfro	Moderate: seepage, slope.	Slight	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
19F: Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
20A: Shannondale	Severe: seepage.	Severe: wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
20C2: Shannondale	Severe: seepage.	Severe: wetness.	Frost action, slope.	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
21C2: Knox	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
22F3: Knox	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
23B2, 23C2: Higginsville	Moderate: seepage, slope.	Moderate: wetness.	Frost action, slope.	Slope, wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
25B, 25C2: Wakenda	Moderate: seepage, slope.	Slight	Deep to water	Slope	Favorable	Favorable.
26B, 26C2: Armstrong	Moderate: slope.	Severe: hard to pack.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
26D2: Armstrong	Severe: slope.	Severe: hard to pack.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, wetness, percs slowly.	Wetness, slope, percs slowly.
27D3: Armstrong	Severe: slope.	Severe: hard to pack.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.

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
28C---------------- Keswick	Moderate: slope.	Moderate: wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
31F---------------- Winnegan	Severe: slope.	Moderate: wetness.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, wetness.	Slope, percs slowly.
36D2--------------- Gosport	Severe: slope.	Slight---------	Deep to water	Slope, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
36F---------------- Gosport	Severe: slope.	Slight---------	Percs slowly, depth to rock, slope.	Slope, wetness, percs slowly.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
37D2, 37F--------- Newcomer	Severe: slope.	Severe: thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
40F---------------- Putco	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope, droughty.	Slope, percs slowly.	Slope, droughty, percs slowly.
42F:						
Schuline---------	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope, percs slowly, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
Pits--------------	Variable-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable.
47----------------- Dockery	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
50----------------- Blackoar	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
53----------------- Colo	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness---------	Wetness.
54----------------- Zook	Slight---------	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
56----------------- Triplett	Slight---------	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
60----------------- Portage	Slight---------	Severe: hard to pack, ponding.	Ponding, percs slowly, flooding.	Ponding, slow intake, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
61----------------- Carlow	Slight---------	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, droughty, slow intake.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, droughty.
62----------------- Carlow	Slight---------	Severe: hard to pack, wetness.	Percs slowly---	Wetness, droughty, slow intake.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, droughty.
64----------------- Tina	Moderate: seepage.	Severe: wetness.	Favorable------	Wetness--------	Wetness--------	Favorable.

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
66C2-------------- Gifford	Moderate: slope.	Severe: wetness.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
68---------------- Tuskeego	Slight---------	Severe: wetness.	Percs slowly, flooding.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
70---------------- Speed	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Erodes easily.
72---------------- Tice	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness--------	Wetness--------	Favorable.
73---------------- Tice	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness--------	Wetness--------	Favorable.
78---------------- Levasy	Moderate: seepage.	Severe: piping, ponding.	Ponding, percs slowly.	Ponding, slow intake, percs slowly.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
81---------------- Haynie	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Erodes easily.
82---------------- Sarpy	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
83---------------- Landes	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable------	Too sandy, soil blowing.	Favorable.
84:						
Haynie-----------	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Erodes easily.
Waldron----------	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
85---------------- Waldron	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
86---------------- Parkville	Severe: seepage.	Severe: piping, wetness.	Percs slowly, cutbanks cave.	Wetness, percs slowly.	Wetness--------	Wetness, percs slowly.
87---------------- Modale	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, percs slowly.
88---------------- Cotter	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
89---------------- Norborne	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
93---------------- Booker	Slight---------	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.

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
94----------------- Grable	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable------	Erodes easily, too sandy.	Erodes easily.
99:						
Haynie-----------	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Erodes easily.
Waldron----------	Moderate: seepage.	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.

TABLE 15.--ENGINEERING INDEX PROPERTIES

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

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 10 inches	Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
10B2----------- Lagonda	0-5	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	90-100	20-40	5-15
	5-26	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	95-100	95-100	40-70	25-40
	26-60	Silty clay loam, clay loam.	CL, CH	A-7	0	0	95-100	90-100	80-95	75-90	45-60	25-40
11C2----------- Lagonda	0-9	Silty clay loam.	CL	A-7	0	0	100	100	95-100	90-100	40-50	15-25
	9-60	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	95-100	95-100	40-70	25-40
12B2----------- Bevier	0-8	Silty clay loam.	CL	A-7	0	0	100	100	95-100	85-95	42-48	22-27
	8-24	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	85-95	55-65	30-40
	24-60	Silty clay loam.	CL, CH	A-7	0	0	100	100	95-100	85-95	43-56	20-33
15B------------ Grundy	0-8	Silt loam-----	CL	A-6, A-7	0	0	100	100	95-100	90-100	30-45	10-20
	8-15	Silty clay loam, silty clay.	CH, CL	A-7	0	0	100	100	95-100	90-100	45-55	25-35
	15-48	Silty clay----	CH	A-7	0	0	100	100	95-100	90-100	50-70	30-45
	48-60	Silty clay loam.	CH, CL	A-7	0	0	100	100	90-100	90-100	40-55	25-35
16------------- Crestmeade	0-8	Silt loam-----	CL	A-4, A-6	0	0	100	100	90-100	70-90	25-35	7-15
	8-14	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	70-95	25-40	12-25
	14-34	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	70-95	55-75	33-49
	34-53	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	85-95	42-58	22-35
	53-74	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	90-100	90-100	80-95	70-90	36-50	17-30
19C2----------- Menfro	0-4	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-35	11-20
	4-36	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25
	36-60	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	90-100	25-35	5-15
19F------------ Menfro	0-7	Silt loam-----	CL	A-6	0	0	100	100	95-100	90-100	25-35	11-20
	7-12	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	90-100	25-40	11-20
	12-60	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	95-100	35-45	20-25

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
20A, 20C2----- Shannondale	0-9	Silt loam-----	CL	A-6, A-4	0	0	100	100	100	90-100	25-35	7-15
	9-17	Silt loam, silty clay loam.	CL	A-6, A-4	0	0	100	100	100	90-100	25-40	7-20
	17-58	Silty clay loam.	CL	A-7, A-6	0	0	100	100	100	90-100	35-44	15-22
	58-75	Silt loam, loam, very fine sandy loam.	CL	A-6, A-4	0	0	100	100	90-100	60-80	25-35	7-15
21C2---------- Knox	0-6	Silty clay loam.	CL	A-6	0	0	100	100	95-100	95-100	30-35	10-15
	6-55	Silty clay loam, silt loam.	CL	A-7	0	0	100	100	95-100	95-100	40-50	20-30
	55-70	Silt loam-----	CL	A-6, A-7	0	0	100	100	95-100	90-100	30-45	10-25
22F3---------- Knox	0-3	Silty clay loam.	CL	A-6	0	0	100	100	95-100	95-100	30-35	10-15
	3-50	Silty clay loam, silt loam.	CL	A-7	0	0	100	100	95-100	95-100	40-50	20-30
	50-60	Silt loam-----	CL	A-6, A-7	0	0	100	100	95-100	90-100	30-45	10-25
23B2---------- Higginsville	0-6	Silt loam-----	CL	A-6	0	0	100	100	95-100	95-100	30-40	10-15
	6-10	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-50	15-25
	10-30	Silty clay loam.	CL	A-7	0	0	100	100	95-100	90-100	40-50	15-25
	30-60	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	0	100	100	95-100	90-100	35-45	10-20
23C2---------- Higginsville	0-7	Silt loam-----	CL	A-6	0	0	100	100	95-100	95-100	30-40	10-15
	7-12	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-50	15-25
	12-30	Silty clay loam.	CL	A-7	0	0	100	100	95-100	90-100	40-50	15-25
	30-60	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	0	100	100	95-100	90-100	35-45	10-20
25B----------- Wakenda	0-14	Silt loam-----	CL, ML	A-6, A-4	0	0	100	100	100	90-100	30-40	5-15
	14-52	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	90-100	35-45	15-25
	52-60	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	100	90-100	30-40	11-20
25C2---------- Wakenda	0-12	Silt loam-----	CL, ML	A-6, A-4	0	0	100	100	100	90-100	30-40	5-15
	12-50	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	90-100	35-45	15-25
	50-60	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	100	90-100	30-40	11-20

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
26B----------- Armstrong	0-18	Loam----------	CL, CL-ML	A-6, A-4	0	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	18-52	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	52-60	Clay loam-----	CL	A-6	0	0-5	90-100	80-95	70-90	55-80	30-40	15-20
26C2---------- Armstrong	0-7	Loam----------	CL, CL-ML	A-6, A-4	0	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	7-33	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	33-60	Clay loam-----	CL	A-6	0	0-5	90-100	80-95	70-90	55-80	30-40	15-20
26D2---------- Armstrong	0-5	Loam----------	CL, CL-ML	A-6, A-4	0	0-5	90-100	80-95	75-90	55-80	20-30	5-15
	5-51	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	51-60	Clay loam-----	CL	A-6	0	0-5	90-100	80-95	70-90	55-80	30-40	15-20
27D3---------- Armstrong	0-6	Clay loam-----	CL	A-6, A-7	0	0-5	90-100	80-95	75-90	55-80	35-45	15-25
	6-50	Clay loam, clay, silty clay loam.	CL, CH, ML, MH	A-7	0	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	50-60	Clay loam-----	CL	A-6	0	0-5	90-100	80-95	70-90	55-80	30-40	15-20
28C----------- Keswick	0-8	Loam----------	CL, CL-ML	A-6, A-4	0	0-5	90-100	80-100	75-90	55-70	20-30	5-15
	8-40	Clay loam, clay.	CH, CL	A-7	0	0-5	90-100	80-100	70-90	55-80	40-70	20-40
	40-60	Clay loam-----	CL	A-6	0	0-5	90-100	80-100	70-90	55-80	30-40	15-25
31F----------- Winnegan	0-7	Loam----------	CL-ML, CL	A-4, A-6	0	0	95-100	95-100	80-90	60-80	20-30	5-15
	7-31	Clay loam, clay.	CL	A-7	0	0	95-100	95-100	85-95	65-85	40-50	20-30
	31-64	Clay loam, clay.	CL	A-7	0	0	95-100	95-100	85-95	65-85	40-50	20-30
36D2---------- Gosport	0-3	Silty clay loam.	ML, MH	A-7	0	0	100	90-100	90-100	85-100	41-55	11-20
	3-33	Clay, silty clay, silty clay loam.	CH	A-7	0	0	100	90-100	90-100	85-100	50-65	35-50
	33-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
36F----------- Gosport	0-5	Silty clay loam.	ML, MH	A-7	0	0	100	90-100	90-100	85-100	41-55	11-20
	5-36	Clay, silty clay, silty clay loam.	CH	A-7	0	0	100	90-100	90-100	85-100	50-65	35-50
	36-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
37D2---------- Newcomer	0-7	Loam----------	CL, CL-ML	A-4	0	0	90-100	85-100	75-95	50-70	25-30	5-10
	7-27	Silt loam, loam, clay loam.	CL, SC	A-4, A-6	0	0	85-100	60-100	60-100	15-70	22-40	9-22
	27-34	Loam, sandy clay loam, sandy loam.	CL-ML, CL, SC	A-4, A-6	0	0	85-100	60-100	60-100	15-70	20-40	6-21
	34-50	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
37F----------- Newcomer	0-9	Loam----------	CL, CL-ML	A-4	0	0	90-100	85-100	75-95	50-70	25-30	5-10
	9-29	Silt loam, loam, clay loam.	CL, SC	A-4, A-6	0	0	85-100	60-100	60-100	15-70	22-40	9-22
	29-35	Loam, sandy clay loam, sandy loam.	CL-ML, CL, SC	A-4, A-6	0	0	85-100	60-100	60-100	15-70	20-40	6-21
	35-51	Weathered bedrock.	---	---	---	---	---	---	---	---	---	---
	51	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
40F----------- Putco	0-12	Clay loam-----	CL, GC, SC	A-6, A-7	0-10	0-15	40-60	35-55	35-55	45-75	35-50	15-25
	12-60	Silty clay----	CL, CH, GC	A-7, A-2-7	0-10	0-5	30-80	25-80	25-80	25-75	45-65	25-40
42F:												
Schuline-----	0-10	Silty clay loam.	CL	A-6, A-7	0-1	0-2	90-100	85-100	80-95	75-90	30-50	10-25
	10-16	Loam, silty clay loam, clay loam.	CL	A-6, A-7	0-2	0-5	90-100	85-100	80-95	70-85	30-50	10-25
	16-60	Loam, silty clay loam, clay loam.	CL	A-4, A-6, A-7	0-5	0-15	85-95	85-90	75-85	60-80	25-50	7-25
Pits---------	0-60	---	---	---	---	---	---	---	---	---	---	---
47------------ Dockery	0-5	Silt loam-----	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	85-100	25-35	5-15
	5-60	Silt loam, silty clay loam.	CL	A-4, A-6	0	0	100	100	90-100	85-95	25-40	8-20
50------------ Blackoar	0-11	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	85-100	25-40	5-18
	11-48	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	85-100	25-40	5-18
	48-65	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	85-100	25-40	5-20
53------------ Colo	0-16	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	95-100	25-40	5-15
	16-60	Silty clay loam.	CL, CH	A-7	0	0	100	100	90-100	90-100	40-55	20-30
54------------ Zook	0-8	Silty clay loam.	CH, CL	A-7	0	0	100	100	95-100	95-100	45-65	20-35
	8-40	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	95-100	60-85	35-55
	40-75	Silty clay loam, silty clay, silt loam.	CH, CL, ML, MH	A-7, A-6	0	0	100	100	95-100	95-100	35-80	10-50

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
56------------ Triplett	0-7	Silt loam-----	CL	A-4, A-6	0	0	100	100	90-100	70-90	24-35	8-20
	7-14	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	90-100	70-95	25-40	12-25
	14-33	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	75-95	55-70	33-45
	33-53	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	95-100	75-95	45-55	25-35
	53-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	90-100	70-95	30-43	11-20
60------------ Portage	0-9	Silty clay----	CH	A-7	0	0	100	100	95-100	90-100	55-80	30-50
	9-44	Clay----------	CH	A-7	0	0	100	100	100	95-100	65-85	35-55
	44-60	Clay----------	CH	A-7	0	0	100	100	100	95-100	65-85	35-55
61, 62-------- Carlow	0-13	Silty clay----	CL, CH	A-7	0	0	100	100	95-100	95-100	40-65	25-40
	13-60	Silty clay, clay.	CL, CH	A-7	0	0	100	100	95-100	95-100	45-75	30-50
64------------ Tina	0-12	Silt loam-----	CL	A-6	0	0	100	100	95-100	85-100	34-40	15-20
	12-41	Silty clay loam, silty clay.	CH	A-7	0	0	100	100	95-100	85-100	51-64	29-39
	41-60	Very fine sandy loam, clay loam, loam.	CL-ML, CL, ML	A-4, A-6	0	0	100	100	95-100	50-80	16-34	3-13
66C2---------- Gifford	0-3	Silty clay loam.	CL	A-6	0	0	100	100	90-100	85-95	30-40	10-20
	3-30	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	95-100	50-65	30-40
	30-60	Silty clay loam, clay loam.	CL	A-6, A-7	0	0	100	100	85-100	75-90	35-45	20-25
68------------ Tuskeego	0-8	Silty clay loam.	CL	A-6	0	0	100	100	95-100	95-100	35-40	15-20
	8-24	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	95-100	30-35	11-15
	24-46	Silty clay loam, silty clay.	CH	A-7	0	0	100	100	95-100	95-100	50-60	25-35
	46-60	Silty clay loam.	CH, CL	A-7	0	0	100	100	95-100	95-100	45-55	25-35
70------------ Speed	0-15	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	90-100	23-32	6-13
	15-27	Silt loam-----	CL, CL-ML	A-4	0	0	100	100	95-100	90-100	23-30	6-10
	27-38	Silt loam, silty clay loam.	CL	A-4, A-6	0	0	100	100	95-100	90-100	28-40	9-18
	38-60	Silt loam, silty clay loam.	CL	A-6	0	0	100	100	95-100	90-100	30-40	11-20

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 10 inches	Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
72------------ Tice	0-5	Silt loam-----	CL	A-6, A-7	0	0	100	100	90-100	80-95	30-45	10-20
	5-60	Silty clay loam, silt loam.	CL, CH	A-7	0	0	100	100	95-100	85-95	40-55	15-30
73------------ Tice	0-11	Silty clay loam.	CL	A-6, A-7	0	0	100	100	90-100	80-95	30-45	10-20
	11-60	Silty clay loam, silt loam.	CL, CH	A-7	0	0	100	100	95-100	85-95	40-55	15-30
78------------ Levasy	0-20	Silty clay----	CH, CL	A-7	0	0	100	100	95-100	85-95	40-60	20-40
	20-29	Silty clay, silty clay loam, clay.	CH, CL	A-7	0	0	100	100	95-100	75-95	40-60	20-40
	29-60	Very fine sandy loam, silt loam, fine sandy loam.	CL, SC, CL-ML	A-6, A-4	0	0	100	100	70-95	40-75	20-40	4-15
81------------ Haynie	0-9	Very fine sandy loam.	CL-ML, ML	A-4	0	0	100	100	85-100	70-100	<25	NP-5
	9-60	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	0	100	100	85-100	85-100	25-35	5-15
82------------ Sarpy	0-7	Loamy fine sand.	SM	A-2-4	0	0	100	100	60-80	15-35	---	NP
	7-60	Fine sand, loamy fine sand, sand.	SM, SP, SP-SM	A-2-4, A-3	0	0	100	100	60-80	2-35	---	NP
83------------ Landes	0-12	Fine sandy loam.	SM, SC, SC-SM	A-4, A-2-4	0	0	100	70-100	70-95	20-50	<25	NP-10
	12-34	Loam, very fine sandy loam, loamy fine sand.	SM, CL-ML, SC, SC-SM	A-4, A-2-4	0	0	100	85-100	70-100	15-60	<25	NP-10
	34-60	Stratified sand to silt loam.	SM, SP-SM, SC, SC-SM	A-4, A-2-4	0	0	100	85-100	70-85	10-50	<30	NP-10
84:												
Haynie-------	0-9	Very fine sandy loam.	CL-ML, ML	A-4	0	0	100	100	85-100	70-100	<25	NP-5
	9-60	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	0	100	100	85-100	85-100	25-35	5-15
Waldron------	0-6	Silty clay----	CL, CH	A-7	0	0	100	100	95-100	90-100	45-65	30-45
	6-52	Stratified silty clay loam to silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	40-65	20-45
	52-60	Stratified very fine sandy loam to silt loam.	CL, CL-ML	A-4, A-6	0	0	100	100	85-95	50-65	25-35	5-15

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
85------------ Waldron	0-4	Silty clay----	CL, CH	A-7	0	0	100	100	95-100	90-100	45-65	30-45
	4-48	Stratified silty clay loam to silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	40-65	20-45
	48-60	Stratified very fine sandy loam to silt loam.	CL, CL-ML	A-4, A-6	0	0	100	100	85-95	50-65	25-35	5-15
86------------ Parkville	0-4	Silty clay loam.	CL	A-6, A-7	0	0	100	100	95-100	90-100	35-50	15-25
	4-20	Clay, silty clay.	CH	A-7	0	0	100	100	95-100	95-100	55-80	30-55
	20-60	Stratified very fine sand to silt loam.	ML, CL, CL-ML	A-4, A-6	0	0	100	100	85-100	60-90	20-35	NP-15
87------------ Modale	0-22	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	80-90	25-40	5-15
	22-60	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	95-100	65-85	40-60
88------------ Cotter	0-16	Silt loam-----	CL	A-6	0	0	100	100	90-100	80-95	30-40	13-20
	16-46	Silty clay loam, silt loam.	CL	A-6	0	0	100	100	95-100	80-90	30-40	14-22
	46-60	Loam, silt loam.	CL	A-4, A-6	0	0	100	100	90-100	65-80	25-40	8-18
89------------ Norborne	0-8	Loam----------	ML, CL-ML	A-4	0	0	100	100	90-100	60-75	<20	2-6
	8-40	Loam, silt loam, very fine sandy loam.	CL-ML, CL	A-4	0	0	100	100	90-100	60-75	<25	5-10
	40-65	Loam, very fine sandy loam, fine sandy loam.	ML, CL-ML	A-4	0	0	100	100	85-100	50-75	<20	2-6
93------------ Booker	0-13	Silty clay----	CL, CH	A-7	0	0	100	100	95-100	95-100	45-75	30-45
	13-48	Clay----------	CH	A-7	0	0	100	100	100	95-100	65-85	40-55
	48-60	Clay, silty clay.	CH	A-7	0	0	100	100	95-100	95-100	50-75	30-45
94------------ Grable	0-8	Silt loam-----	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	80-95	25-40	5-20
	8-26	Silt loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	80-95	<25	5-15
	26-60	Fine sand, loamy sand, sand.	SM, SC-SM, SP-SM	A-2, A-3	0	0	100	100	65-80	5-35	<20	NP-5
99: Haynie--------	0-7	Very fine sandy loam.	CL-ML, ML	A-4	0	0	100	100	85-100	70-100	<25	NP-5
	7-60	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	0	100	100	85-100	85-100	25-35	5-15

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
99:												
Waldron------	0-14	Silty clay----	CL, CH	A-7	0	0	100	100	95-100	90-100	45-65	30-45
	14-50	Stratified silty clay loam to silty clay.	CL, CH	A-7	0	0	100	100	95-100	90-100	40-65	20-45
	50-60	Stratified very fine sandy loam to silt loam.	CL, CL-ML	A-4, A-6	0	0	100	100	85-95	50-65	25-35	5-15

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodi-bility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
10B2 Lagonda	0-5	24-27	1.35-1.50	0.6-2.0	0.21-0.24	5.6-7.3	Moderate	0.37	3	6	2-4
	5-26	32-50	1.30-1.40	0.06-0.2	0.13-0.18	6.1-7.8	High	0.37			
	26-60	35-45	1.30-1.40	0.06-0.2	0.10-0.18	6.1-7.8	High	0.37			
11C2 Lagonda	0-9	27-32	1.35-1.50	0.2-0.6	0.18-0.20	5.6-7.3	Moderate	0.37	2	7	.5-2
	9-60	32-50	1.30-1.40	0.06-0.2	0.13-0.18	6.1-7.8	High	0.37			
12B2 Bevier	0-8	27-32	1.30-1.50	0.2-0.6	0.20-0.23	5.6-7.3	Moderate	0.37	3	7	2-4
	8-24	35-52	1.30-1.50	0.06-0.2	0.11-0.20	5.1-7.3	High	0.28			
	24-60	27-40	1.30-1.50	0.2-0.6	0.18-0.20	5.1-7.3	High	0.32			
15B Grundy	0-8	12-27	1.35-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Moderate	0.37	3	6	2-4
	8-15	32-45	1.35-1.45	0.2-0.6	0.18-0.20	5.6-6.5	High	0.37			
	15-48	40-50	1.30-1.40	0.06-0.2	0.11-0.13	5.1-7.3	High	0.37			
	48-60	28-35	1.35-1.40	0.06-0.2	0.18-0.20	5.6-7.3	High	0.37			
16 Crestmeade	0-8	15-27	1.35-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.37	3	6	2-4
	8-14	15-30	1.30-1.45	0.2-0.6	0.18-0.22	5.1-7.3	Moderate	0.43			
	14-34	42-60	1.30-1.45	0.06-0.2	0.14-0.17	5.1-6.5	High	0.32			
	34-53	27-42	1.35-1.50	0.2-0.6	0.14-0.20	5.1-7.3	High	0.32			
	53-74	15-30	1.30-1.50	0.2-0.6	0.16-0.20	5.6-7.3	Moderate	0.43			
19C2 Menfro	0-4	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.37	5	6	1-2
	4-36	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate	0.37			
	36-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.37			
19F Menfro	0-7	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.37	5	6	1-2
	7-12	25-30	1.30-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Moderate	0.37			
	12-60	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate	0.37			
20A, 20C2 Shannondale	0-9	15-27	1.20-1.30	0.6-2.0	0.20-0.24	5.1-7.3	Low	0.32	5	6	1-3
	9-17	15-30	1.20-1.50	0.6-2.0	0.18-0.22	4.5-7.3	Moderate	0.32			
	17-58	27-35	1.30-1.50	0.6-2.0	0.20-0.22	4.5-7.3	Moderate	0.43			
	58-75	15-27	1.20-1.30	0.6-6.0	0.16-0.24	4.5-7.3	Low	0.43			
21C2 Knox	0-6	27-30	1.20-1.30	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.32	5-4	7	2-3
	6-55	25-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.43			
	55-70	18-27	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.43			
22F3 Knox	0-3	27-30	1.20-1.30	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.32	5-4	7	1-2
	3-50	25-35	1.30-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.43			
	50-60	18-27	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.43			
23B2 Higginsville	0-6	18-27	1.30-1.50	0.6-2.0	0.21-0.24	5.6-7.3	Low	0.37	5	6	3-4
	6-10	27-35	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.37			
	10-30	27-35	1.40-1.50	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.37			
	30-60	25-30	1.50-1.60	0.6-2.0	0.18-0.22	5.1-6.5	Moderate	0.37			
23C2 Higginsville	0-7	18-27	1.30-1.50	0.6-2.0	0.21-0.24	5.6-7.3	Low	0.37	5	6	3-4
	7-12	27-35	1.30-1.40	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.37			
	12-30	27-35	1.40-1.50	0.6-2.0	0.18-0.20	5.1-6.5	Moderate	0.37			
	30-60	25-30	1.50-1.60	0.6-2.0	0.18-0.22	5.1-6.5	Moderate	0.37			
25B Wakenda	0-14	18-27	1.20-1.30	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.28	5	6	3-4
	14-52	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.6-7.3	Moderate	0.28			
	52-60	20-30	1.20-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate	0.43			

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	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
25C2----------- Wakenda	0-12	18-27	1.20-1.30	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.28	5	6	3-4
	12-50	25-35	1.30-1.50	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.28			
	50-60	20-30	1.20-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.43			
26B----------- Armstrong	0-18	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6	2-3
	18-52	36-60	1.55-1.60	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32			
	52-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32			
26C2----------- Armstrong	0-7	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6	2-3
	7-33	36-60	1.55-1.60	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32			
	33-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-8.4	Moderate-----	0.32			
26D2----------- Armstrong	0-5	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.32	3	6	2-3
	5-51	36-60	1.55-1.60	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32			
	51-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32			
27D3----------- Armstrong	0-6	35-42	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	Moderate-----	0.37	2	4	1-2
	6-50	36-60	1.55-1.60	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32			
	50-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32			
28C----------- Keswick	0-8	22-27	1.45-1.50	0.6-2.0	0.17-0.22	4.5-7.3	Moderate-----	0.32	3	6	2-3
	8-40	35-60	1.55-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High---------	0.37			
	40-60	30-40	1.60-1.75	0.2-0.6	0.12-0.16	4.5-7.8	Moderate-----	0.37			
31F----------- Winnegan	0-7	18-27	1.20-1.40	0.6-2.0	0.20-0.24	4.5-7.3	Low----------	0.32	3	6	.5-2
	7-31	35-45	1.35-1.55	0.06-0.2	0.09-0.15	4.5-6.5	High---------	0.32			
	31-64	35-45	1.35-1.55	0.06-0.2	0.09-0.15	7.4-8.4	High---------	0.32			
36D2----------- Gosport	0-3	27-34	1.30-1.40	0.2-0.6	0.14-0.16	5.1-7.3	Moderate-----	0.43	3	7	1-2
	3-33	36-60	1.50-1.60	<0.06	0.12-0.14	3.6-5.5	High---------	0.32			
	33-60	---	---	<0.06	---	---	-------------	----			
36F----------- Gosport	0-5	27-34	1.30-1.40	0.2-0.6	0.14-0.16	5.1-7.3	Moderate-----	0.43	3	7	2-3
	5-36	36-60	1.50-1.60	<0.06	0.12-0.14	3.6-5.5	High---------	0.32			
	36-60	---	---	<0.06	---	---	-------------	----			
37D2----------- Newcomer	0-7	15-23	1.30-1.45	0.6-2.0	0.15-0.20	5.6-7.8	Low----------	0.32	4	5	2-4
	7-27	18-35	1.45-1.65	0.6-2.0	0.15-0.24	5.1-7.3	Moderate-----	0.32			
	27-34	12-35	1.45-1.65	0.6-2.0	0.10-0.22	5.1-7.3	Low----------	0.32			
	34-50	---	---	0.2-2.0	---	---	-------------	----			
	50	---	---	0.2-2.0	---	---	-------------	----			
37F----------- Newcomer	0-9	15-23	1.30-1.45	0.6-2.0	0.15-0.20	5.6-7.8	Low----------	0.32	4	5	2-4
	9-29	18-35	1.45-1.65	0.6-2.0	0.15-0.24	5.1-7.3	Moderate-----	0.32			
	29-35	12-35	1.45-1.65	0.6-2.0	0.10-0.22	5.1-7.3	Low----------	0.32			
	35-51	---	---	0.2-2.0	---	---	-------------	----			
	51	---	---	0.2-2.0	---	---	-------------	----			
40F----------- Putco	0-12	27-40	1.10-1.30	0.06-0.2	0.08-0.16	6.6-8.4	Moderate-----	0.28	5	4	.5-1
	12-60	40-60	1.40-1.60	0.06-0.2	0.04-0.10	7.4-8.4	High---------	0.24			
42F:											
Schuline--------	0-10	27-35	1.30-1.60	0.6-2.0	0.18-0.21	5.6-8.4	Moderate-----	0.37	5	7	.5-2
	10-16	18-35	1.60-1.80	0.06-0.2	0.08-0.12	5.6-8.4	Moderate-----	0.37			
	16-60	18-35	1.40-1.70	0.2-0.6	0.15-0.21	7.4-8.4	Moderate-----	0.37			
Pits-----------	0-60	---	---	---	---	---	-------------	----	---	8	---
47----------- Dockery	0-5	15-27	1.35-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	6	2-4
	5-60	18-30	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.8	Moderate-----	0.43			

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	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
50---------------- Blackoar	0-11	18-27	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.28	5	6	2-4
	11-48	18-27	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.43			
	48-65	18-30	1.35-1.45	0.6-2.0	0.18-0.22	5.6-7.3	Low-----------	0.43			
53---------------- Colo	0-16	20-26	1.25-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Moderate------	0.28	5	6	4-5
	16-60	30-35	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	Moderate------	0.28			
54---------------- Zook	0-8	35-40	1.30-1.35	0.2-0.6	0.21-0.23	5.6-7.3	High----------	0.37	5	7	5-7
	8-40	36-45	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.8	High----------	0.28			
	40-75	20-45	1.30-1.45	0.06-0.6	0.11-0.22	5.6-7.8	High----------	0.28			
56---------------- Triplett	0-7	15-27	1.35-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	3	6	1-4
	7-14	15-30	1.30-1.45	0.2-0.6	0.18-0.22	4.5-7.3	Moderate------	0.43			
	14-33	42-52	1.30-1.45	0.06-0.2	0.14-0.17	4.5-6.5	High----------	0.32			
	33-53	28-45	1.30-1.45	0.2-0.6	0.15-0.18	4.5-6.5	High----------	0.32			
	53-60	18-35	1.30-1.50	0.2-0.6	0.16-0.20	5.1-6.5	Moderate------	0.43			
60---------------- Portage	0-9	45-75	1.25-1.45	<0.06	0.12-0.14	5.1-7.3	Very high-----	0.37	5	4	2-4
	9-44	60-80	1.30-1.45	<0.06	0.09-0.11	4.5-5.5	Very high-----	0.37			
	44-60	60-80	1.30-1.45	<0.06	0.09-0.11	4.5-6.0	Very high-----	0.37			
61, 62------------ Carlow	0-13	40-50	1.30-1.40	0.06-0.2	0.12-0.14	5.1-7.3	High----------	0.37	5	4	2-4
	13-60	45-60	1.25-1.35	<0.06	0.09-0.12	4.5-6.0	High----------	0.37			
64---------------- Tina	0-12	18-27	1.40-1.50	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.28	5	6	3-4
	12-41	35-48	1.40-1.60	0.2-0.6	0.14-0.22	5.6-7.3	High----------	0.28			
	41-60	10-30	1.40-1.60	0.6-2.0	0.14-0.22	5.6-7.3	Low-----------	0.32			
66C2-------------- Gifford	0-3	27-35	1.30-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.43	3	7	2-4
	3-30	35-50	1.30-1.45	<0.06	0.11-0.14	5.1-7.3	High----------	0.32			
	30-60	25-35	1.35-1.50	0.06-0.2	0.18-0.20	5.6-7.3	Moderate------	0.43			
68---------------- Tuskeego	0-8	28-35	1.35-1.40	0.2-0.6	0.21-0.23	5.1-7.3	--------------	0.37	3	7	2-4
	8-24	18-30	1.40-1.50	0.06-0.2	0.18-0.22	5.1-6.5	--------------	0.43			
	24-46	32-48	1.30-1.45	<0.06	0.13-0.17	5.1-6.5	High----------	0.43			
	46-60	28-40	1.40-1.50	0.06-0.2	0.16-0.19	5.6-6.5	Moderate------	0.43			
70---------------- Speed	0-15	12-22	1.25-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.32	5	5	2-3
	15-27	12-20	1.30-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.43			
	27-38	18-30	1.30-1.50	0.6-2.0	0.20-0.22	4.5-7.3	Moderate------	0.43			
	38-60	20-32	1.30-1.50	0.6-2.0	0.18-0.20	4.5-7.3	Moderate------	0.43			
72---------------- Tice	0-5	22-27	1.25-1.45	0.6-2.0	0.21-0.24	6.1-7.8	Moderate------	0.32	5	6	2-3
	5-60	24-35	1.30-1.50	0.6-2.0	0.18-0.20	5.6-7.8	Moderate------	0.32			
73---------------- Tice	0-11	27-35	1.25-1.45	0.6-2.0	0.21-0.24	6.1-7.8	Moderate------	0.32	5	7	2-3
	11-60	27-35	1.30-1.50	0.6-2.0	0.18-0.21	5.6-7.8	Moderate------	0.32			
78---------------- Levasy	0-20	40-60	1.25-1.40	0.06-0.2	0.12-0.20	7.4-8.4	High----------	0.28	5	4	2-4
	20-29	35-60	1.25-1.40	0.06-0.2	0.12-0.20	7.4-8.4	High----------	0.28			
	29-60	7-27	1.35-1.50	0.6-2.0	0.10-0.18	7.4-8.4	Low-----------	0.43			
81---------------- Haynie	0-9	15-20	1.20-1.35	0.6-2.0	0.18-0.23	6.6-8.4	Low-----------	0.32	5	3	1-2
	9-60	15-18	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low-----------	0.43			
82---------------- Sarpy	0-7	2-5	1.20-1.50	6.0-20	0.05-0.09	6.6-8.4	Low-----------	0.17	5	2	.5-1
	7-60	2-5	1.20-1.50	6.0-20	0.05-0.09	6.6-8.4	Low-----------	0.15			
83---------------- Landes	0-12	7-20	1.40-1.60	2.0-6.0	0.13-0.20	5.6-8.4	Low-----------	0.24	4	3	1-2
	12-34	5-18	1.60-1.70	2.0-6.0	0.10-0.15	5.6-8.4	Low-----------	0.32			
	34-60	5-18	1.60-1.80	6.0-20	0.05-0.15	5.6-8.4	Low-----------	0.20			

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	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
84:											
Haynie----------	0-9	15-20	1.20-1.35	0.6-2.0	0.18-0.23	6.6-8.4	Low----------	0.32	5	3	1-3
	9-60	15-18	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low----------	0.43			
Waldron---------	0-6	40-50	1.35-1.45	0.06-0.2	0.12-0.14	6.6-7.8	High---------	0.32	5	4	2-4
	6-52	35-50	1.30-1.50	0.06-0.2	0.10-0.18	7.4-8.4	High---------	0.32			
	52-60	15-20	1.40-1.50	0.6-2.0	0.18-0.20	7.4-8.4	Low----------	0.43			
85--------------- Waldron	0-4	40-50	1.35-1.45	0.06-0.2	0.12-0.14	6.6-7.8	High---------	0.32	5	4	2-4
	4-48	35-50	1.30-1.50	0.06-0.2	0.10-0.18	7.4-8.4	High---------	0.32			
	48-60	15-20	1.40-1.50	0.6-2.0	0.18-0.20	7.4-8.4	Low----------	0.43			
86--------------- Parkville	0-4	35-40	1.30-1.50	0.06-0.2	0.12-0.21	6.6-8.4	Moderate-----	0.28	5	4	2-3
	4-20	40-70	1.30-1.50	<0.06	0.11-0.13	6.6-8.4	High---------	0.28			
	20-60	4-25	1.40-1.60	0.6-2.0	0.18-0.22	7.4-8.4	Low----------	0.28			
87--------------- Modale	0-22	10-18	1.20-1.30	0.6-2.0	0.21-0.23	7.4-8.4	Low----------	0.37	4	4L	1-2
	22-60	50-60	1.35-1.45	<0.06	0.11-0.13	7.4-8.4	High---------	0.28			
88--------------- Cotter	0-16	18-27	1.35-1.45	0.6-2.0	0.21-0.25	5.6-7.8	Moderate-----	0.32	5	6	3-4
	16-46	25-35	1.25-1.40	0.6-2.0	0.18-0.21	5.1-7.3	Moderate-----	0.43			
	46-60	18-27	1.30-1.45	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.43			
89--------------- Norborne	0-8	8-12	1.20-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.28	5	5	2-4
	8-40	12-18	1.20-1.40	0.6-2.0	0.17-0.22	5.6-7.3	Low----------	0.43			
	40-65	9-13	1.20-1.40	0.6-2.0	0.14-0.22	5.6-7.3	Low----------	0.43			
93--------------- Booker	0-13	40-70	1.30-1.50	<0.06	0.12-0.14	5.6-7.3	Very high----	0.28	5	4	2-3
	13-48	60-75	1.30-1.45	<0.06	0.09-0.11	5.6-7.3	Very high----	0.28			
	48-60	50-70	1.30-1.50	<0.06	0.12-0.14	5.6-7.3	Very high----	0.28			
94--------------- Grable	0-8	18-27	1.20-1.25	0.6-2.0	0.22-0.24	7.4-8.4	Low----------	0.32	4	4L	2-3
	8-26	12-16	1.25-1.50	0.6-2.0	0.20-0.22	7.4-8.4	Low----------	0.43			
	26-60	2-10	1.20-1.50	6.0-20	0.02-0.07	7.4-8.4	Low----------	0.15			
99:											
Haynie----------	0-7	15-20	1.20-1.35	0.6-2.0	0.18-0.23	6.6-8.4	Low----------	0.32	5	3	1-2
	7-60	15-18	1.20-1.35	0.6-2.0	0.18-0.23	7.4-8.4	Low----------	0.43			
Waldron---------	0-14	40-50	1.35-1.45	0.06-0.2	0.12-0.14	6.6-7.8	High---------	0.32	5	4	2-4
	14-50	35-50	1.30-1.50	0.06-0.2	0.10-0.18	7.4-8.4	High---------	0.32			
	50-60	15-20	1.40-1.50	0.6-2.0	0.18-0.20	7.4-8.4	Low----------	0.43			

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	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				
10B2, 11C2: Lagonda	C	None	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	High	High	Low.
12B2: Bevier	C	None	---	---	2.0-4.0	Perched	Nov-Apr	>60	---	High	High	Moderate.
15B: Grundy	C	None	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	High	High	Moderate.
16: Crestmeade	D	None	---	---	0.5-1.5	Perched	Nov-Apr	>60	---	High	High	Moderate.
19C2, 19F: Menfro	B	None	---	---	>6.0	---	---	>60	---	High	Low	Moderate.
20A: Shannondale	D	None	---	---	1.5-3.0	Apparent	Nov-Apr	>60	---	High	Low	Moderate.
20C2: Shannondale	D	Rare	---	---	1.5-3.0	Apparent	Nov-Apr	>60	---	High	Low	Moderate.
21C2, 22F3: Knox	B	None	---	---	>6.0	---	---	>60	---	High	Low	Low.
23B2, 23C2: Higginsville	C	None	---	---	1.5-3.0	Perched	Nov-Apr	>60	---	High	Moderate	Moderate.
25B, 25C2: Wakenda	B	None	---	---	4.0-6.0	Perched	Nov-May	>60	---	High	Low	Moderate.
26B, 26C2, 26D2, 27D3: Armstrong	C	None	---	---	1.0-3.0	Perched	Nov-Apr	>60	---	High	High	Moderate.
28C: Keswick	C	None	---	---	1.0-3.0	Perched	Nov-Apr	>60	---	High	High	Moderate.
31F: Winnegan	C	None	---	---	2.0-3.5	Perched	Nov-Apr	>60	---	Moderate	High	High.
36D2: Gosport	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	High.

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				
36F: Gosport	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	High.
37D2, 37F: Newcomer	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low	Moderate.
40F: Putco	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
42F:												
Schuline	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Pits	---	None	---	---	>6.0	---	---	>60	---	---	---	---
47: Dockery	C	Frequent	Brief	Nov-Apr	2.0-3.0	Apparent	Nov-Jun	>60	---	High	Moderate	Low.
50: Blackoar	B/D	Occasional	Brief	Nov-May	0-1.0	Apparent	Nov-May	>60	---	High	High	Low.
53: Colo	B/D	Occasional	Brief	Nov-Apr	1.0-3.0	Apparent	Nov-Apr	>60	---	High	High	Moderate.
54: Zook	C/D	Occasional	Brief	Nov-Apr	0-3.0	Apparent	Nov-May	>60	---	High	High	Moderate.
56: Triplett	D	None	---	---	0.5-1.5	Perched	Nov-Apr	>60	---	High	High	Moderate.
60: Portage	D	Occasional	Brief	Nov-Apr	+.5-1.0	Apparent	Nov-Jun	>60	---	Moderate	High	High.
61: Carlow	D	Occasional	Brief	Nov-Apr	0-1.0	Apparent	Nov-May	>60	---	Moderate	High	Moderate.
62: Carlow	D	Rare	---	---	0-1.0	Apparent	Nov-May	>60	---	Moderate	High	Moderate.
64: Tina	C	Rare	---	---	1.5-3.0	Apparent	Nov-May	>60	---	Moderate	High	Moderate.
66C2: Gifford	D	Rare	---	---	0.5-2.0	Perched	Nov-Apr	>60	---	Moderate	High	Moderate.
68: Tuskeego	C/D	Occasional	---	---	0-1.0	Apparent	Nov-May	>60	---	Moderate	High	Moderate.
70: Speed	C	Occasional	Brief	Nov-May	1.5-3.0	Apparent	Nov-May	>60	---	High	High	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				
72 Tice	B	Frequent	Brief	Nov-May	1.5-3.0	Apparent	Nov-May	>60	---	High	High	Low.
73 Tice	B	Rare	---	---	1.5-3.0	Apparent	Nov-May	>60	---	High	High	Low.
78 Levasy	C	Rare	---	---	+1-1.5	Apparent	Nov-Jun	>60	---	High	High	Low.
81 Haynie	B	Rare	---	---	>6.0	---	---	>60	---	High	Low	Low.
82 Sarpy	A	Rare	---	---	>6.0	---	---	>60	---	Low	Low	Low.
83 Landes	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
84:												
Haynie	B	Rare	---	---	>6.0	---	---	>60	---	High	Low	Low.
Waldron	D	Rare	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High	High	Low.
85 Waldron	D	Rare	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High	High	Low.
86 Parkville	C	Rare	---	---	1.0-2.0	Apparent	Nov-Apr	>60	---	Moderate	High	Low.
87 Modale	C	Rare	---	---	1.5-3.0	Apparent	Nov-May	>60	---	High	High	Low.
88 Cotter	B	Rare	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.
89 Norborne	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
93 Booker	D	Rare	---	---	+.5-1.0	Apparent	Nov-Jun	>60	---	Moderate	High	Moderate.
94 Grable	B	Rare	---	---	>6.0	---	---	>60	---	Low	Low	Low.
99:												
Haynie	B	Frequent	Brief	Nov-May	>6.0	---	---	>60	---	High	Low	Low.
Waldron	D	Frequent	Brief	Nov-May	1.0-3.0	Apparent	Nov-May	>60	---	High	High	Low.

TABLE 18.--CLASSIFICATION OF THE SOILS

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

Soil name	Family or higher taxonomic class
Armstrong	Fine, montmorillonitic, mesic Aquertic Hapludalfs
Bevier	Fine, montmorillonitic, mesic Vertic Epiaqualfs
Blackoar	Fine-silty, mixed, mesic Fluvaquentic Endoaquolls
Booker	Very fine, montmorillonitic, mesic Vertic Endoaquolls
Carlow	Fine, montmorillonitic, mesic Vertic Endoaquolls
Colo	Fine-silty, mixed, mesic Cumulic Endoaquolls
Cotter	Fine-silty, mixed, mesic Typic Argiudolls
Crestmeade	Fine, montmorillonitic, mesic Vertic Argialbolls
Dockery	Fine-silty, mixed, nonacid, mesic Aquic Udifluvents
Gifford	Fine, montmorillonitic, mesic Vertic Epiaqualfs
Gosport	Fine, illitic, mesic Typic Dystrochrepts
Grable	Coarse-silty over sandy or sandy-skeletal, mixed (calcareous), mesic Mollic Udifluvents
Grundy	Fine, montmorillonitic, mesic Aquertic Argiudolls
Haynie	Coarse-silty, mixed (calcareous), mesic Mollic Udifluvents
*Higginsville	Fine-silty, mixed, mesic Aquic Argiudolls
Keswick	Fine, montmorillonitic, mesic Aquertic Hapludalfs
Knox	Fine-silty, mixed, mesic Mollic Hapludalfs
*Lagonda	Fine, montmorillonitic, mesic Aquertic Argiudolls
Landes	Coarse-loamy, mixed, mesic Fluventic Hapludolls
Levasy	Clayey over loamy, montmorillonitic (calcareous), mesic Fluvaquentic Endoaquolls
Menfro	Fine-silty, mixed, mesic Typic Hapludalfs
Modale	Coarse-silty over clayey, mixed (calcareous), mesic Aquic Udifluvents
Newcomer	Fine-loamy, mixed, mesic Mollic Hapludalfs
Norborne	Coarse-loamy, mixed, mesic Typic Argiudolls
Parkville	Clayey over loamy, montmorillonitic, mesic Fluvaquentic Hapludolls
Portage	Very fine, montmorillonitic, mesic Vertic Endoaquolls
Putco	Fine, mixed (calcareous), mesic Typic Udorthents
Sarpy	Mixed, mesic Typic Udipsamments
*Schuline	Fine-loamy, mixed (calcareous), mesic Typic Udorthents
Shannondale	Fine-silty, mixed, mesic Aquic Argiudolls
Speed	Fine-silty, mixed, mesic Argiaquic Argialbolls
Tice	Fine-silty, mixed, mesic Fluvaquentic Hapludolls
Tina	Fine, montmorillonitic, mesic Aquertic Argiudolls
Triplett	Fine, montmorillonitic, mesic Vertic Argialbolls
Tuskeego	Fine, montmorillonitic, mesic Vertic Epiaqualfs
Wakenda	Fine-silty, mixed, mesic Typic Argiudolls
Waldron	Fine, montmorillonitic (calcareous), mesic Aeric Fluvaquents
Winnegan	Fine, mixed, mesic Oxyaquic Hapludalfs
Zook	Fine, montmorillonitic, mesic Vertic Endoaquolls

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