United States
Department of
Agriculture

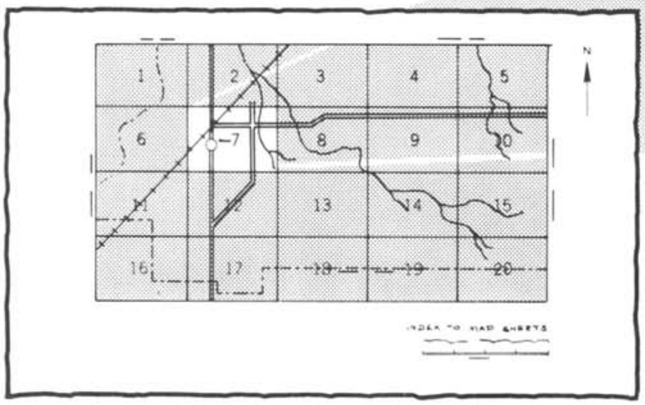
Soil
Conservation
Service

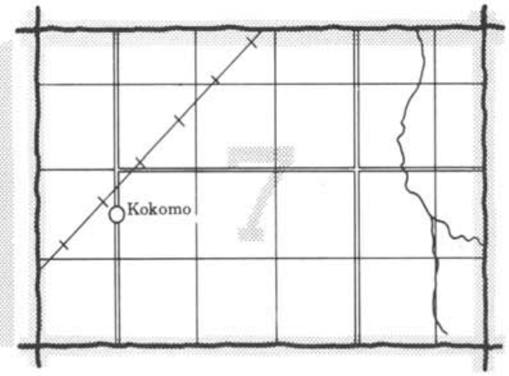
In cooperation with the
Minnesota Agricultural
Experiment Station

Soil Survey of Rock County, Minnesota

HOW TO USE

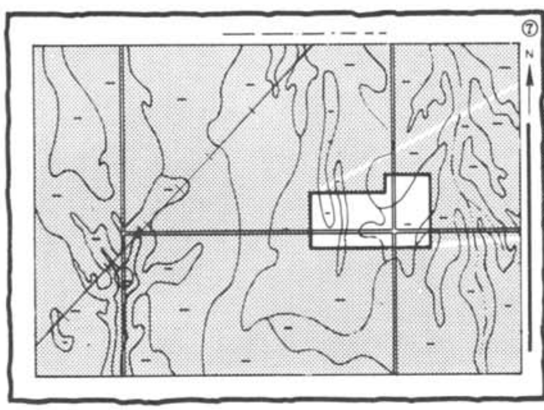
1. Locate your area of interest on the "Index to Map Sheets"

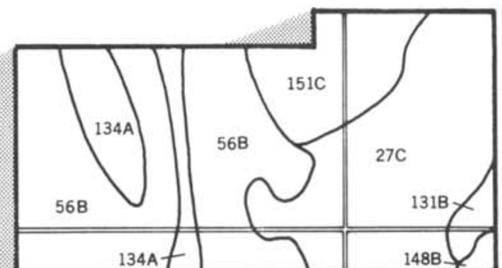




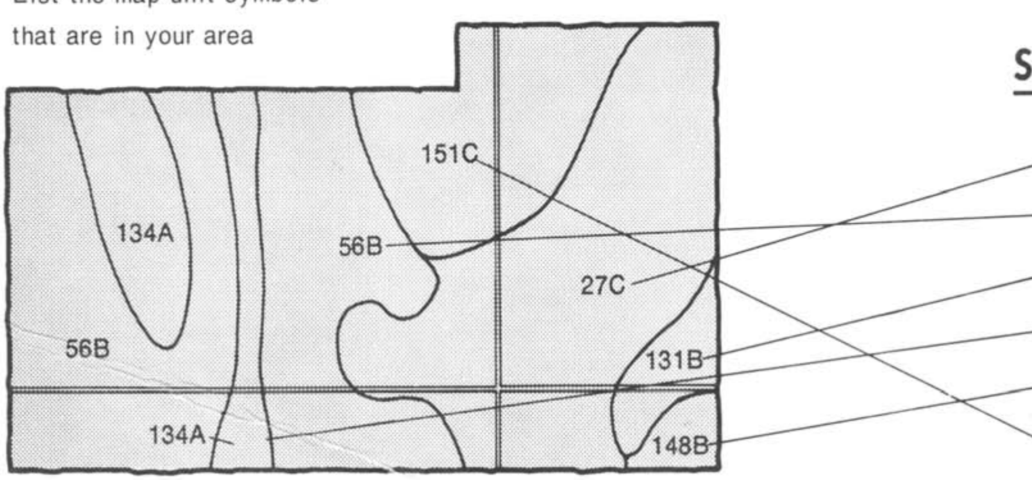
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





4. List the map unit symbols that are in your area

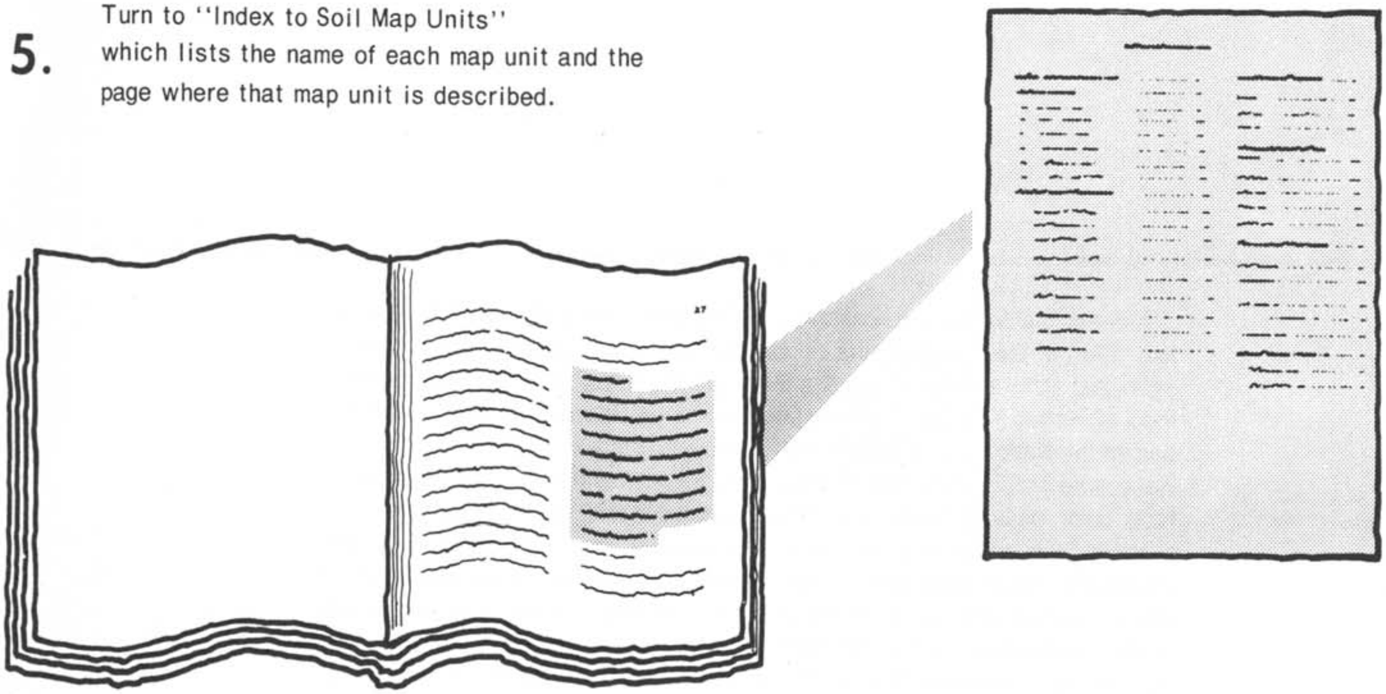


Symbols

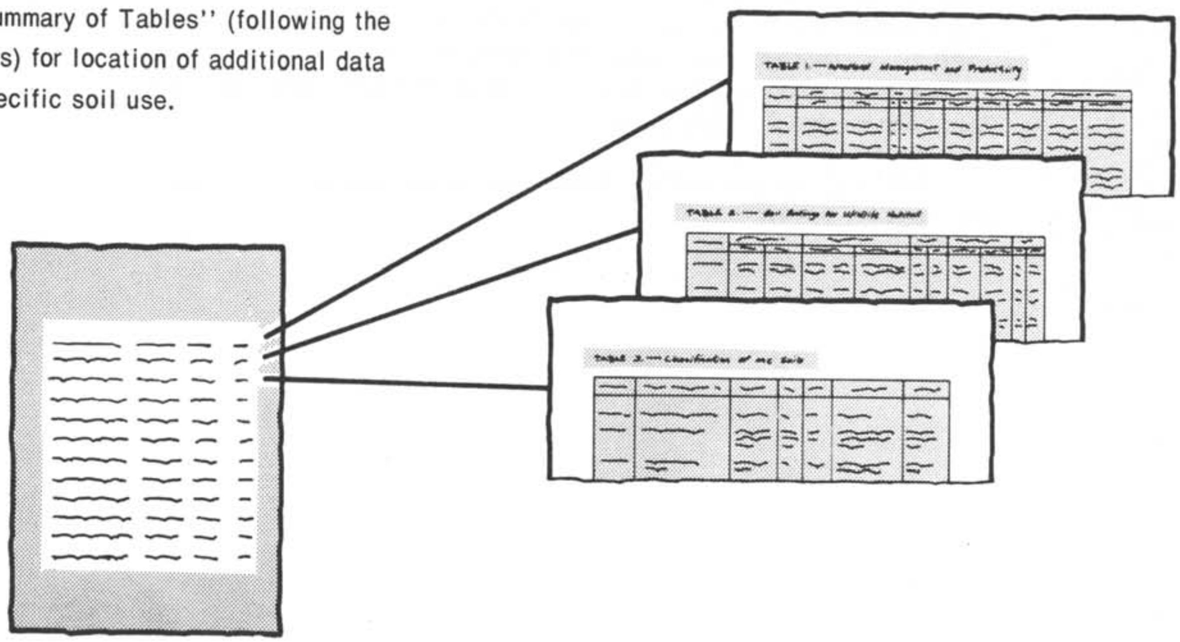
27C
56B
131B
134A
148B
151C

THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



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



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

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

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service and the Minnesota Agricultural Experiment Station. The survey is part of the technical assistance furnished to the Rock County Soil and Water Conservation District. It was partially funded by the Legislative Committee for Minnesota Resources. Other assistance was provided by the Minnesota Agricultural Extension Service, the Minnesota Soil and Water Conservation Board, and the Rock 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.

Cover: Native prairie on Blue Mound. Fields of corn and soybeans are near the Rock River in the background.

Contents

Soil Series

Issued April 1988

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Summary of Tables

Foreword

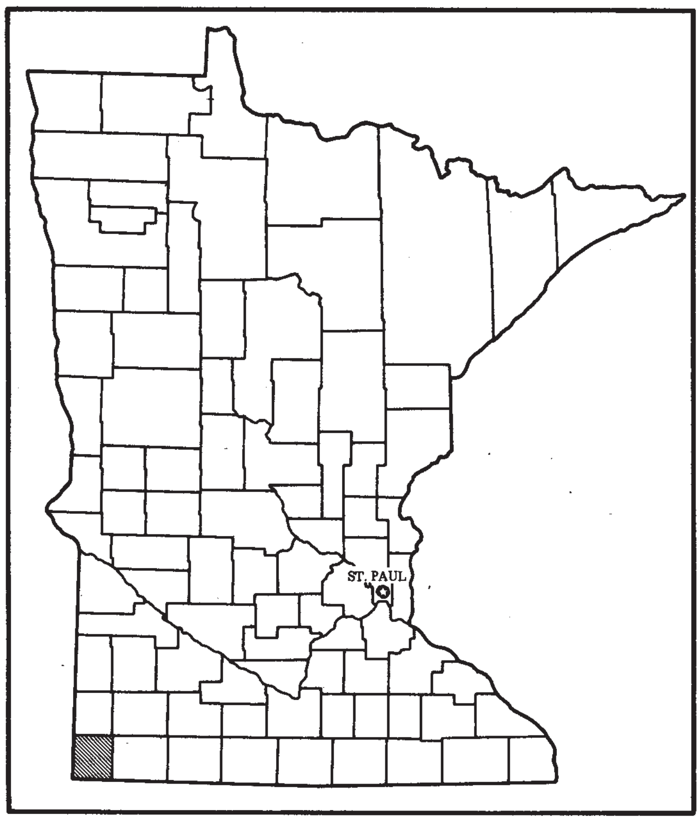
This soil survey contains information that can be used in land-planning programs in Rock County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of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

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

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

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

Donald G. Ferren
State Conservationist
Soil Conservation Service



Location of Rock County in Minnesota.

Soil Survey of
Rock County, Minnesota

By Marc P. Diers, Soil Conservation Service

Fieldwork by Marc P. Diers, Soil Conservation Service, and
Norman D. Kuhlman, Minnesota Agricultural Experiment Station

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

Rock County is in the extreme southwest corner of Minnesota. It has a land area of 310,400 acres. The county has a population of 10,717. Luverne, the county seat, has a population of 4,583.

Farming and farm-related businesses are dominant in the county. Corn, soybeans, small grain, and hay are the common crops. Beef cattle, dairy cattle, and swine are the main types of livestock.

The soils of Rock County are varied. They formed in several types of parent materials: loess; loess over glacial till; loess over Sioux quartzite bedrock, some of which is exposed at the surface; sand (and gravel) glacial outwash; alluvium; lacustrine and lacustrine-modified glacial till sediments; and glacial till.

This soil survey updates the survey of Rock County published in 1949 (*7*). It provides additional information and larger scale maps, which show the soils in greater detail.

Physiography, Relief, and Drainage

Rock County was once covered by the Kansan ice sheet, which left a plain of glacial drift. Thousands of years later, this plain was blanketed by loess. Between the time of glaciation and the deposition of the loess, erosion dissected the landscape, creating hills and valleys over the entire county.

The loess is 2.5 to 6 feet thick and is generally thinner on sloping areas and thicker in valleys and drainageways. It is thickest in the west-central part of the county and thinnest in the northeast corner.

Islands of Sioux quartzite bedrock rise up through the loess-covered plain in the central and northwest parts of the county. One of these islands near Luverne rises 200 feet above the level of the city. The bare rock is covered with moss and lichens, giving it a bluish color when seen from a distance. This bedrock area has been named Blue Mound. The city of Jasper, built on another island of quartzite in the northwest corner of the county, still has an active quarry. The quartzite is mined and used as a lining for ovens, as decorative stone, or as an aid in milling. In the past the rock was quarried for building stone. Many of the towns surrounding Jasper still have buildings of quartzite.

Rock County is characterized by a mature landscape dissected by numerous small and large waterways draining into the Big Sioux River in South Dakota. The Big Sioux River eventually flows into the Missouri River. The major waterways in the county are the Rock River and its tributaries and Champepedan, Kanaranzi, and Elk Creeks. The Rock River drains the eastern third of the county. The northwest part of the county is drained by Spilt Rock Creek, and the central and southwest parts are drained by Beaver Creek (*11*).

The Rock River originates northeast of Rock County along the Bemis Moraine. It developed originally as a glacial river that carried meltwater from the Wisconsin glacier, and in places it was over 1.5 miles wide. The present-day Rock River utilizes only a small portion of the original glacial channel (*4*).

Along with the meltwater from the Wisconsin ice sheet, the river also carried soil materials formerly trapped in the ice. These materials were deposited along the channel as the amount of water in the glacial river decreased. A large part of the city of Luverne is built on a glacial river terrace of sand and gravel.

Beaver Creek begins in a circular depression between two islands of bedrock in the north-central part of the county. Over a period of time Beaver Creek deeply dissected the landscape. The areas northwest of the city of Beaver Creek is hilly in comparison with the gently rolling topography over the rest of the county.

The highest elevation in Rock County is a gravelly ridge in the north-central part of the county. It is about 1,790 feet above sea level. The lowest point is about 1,340 feet above sea level. It is in an area where Beaver Creek leaves the county, near Manley.

Climate

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

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Luverne in the period 1958 to 1980. 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 16 degrees F, and the average daily minimum temperature is 6 degrees. The lowest temperature on record, which occurred at Luverne on January 19, 1970, is -37 degrees. In summer the average temperature is 71 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred at Luverne on July 9, 1976, is 106 degrees.

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

The total annual precipitation is 26.83 inches. Of this, 19.71 inches, or 73 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. The heaviest 1-day rainfall during the period of record was 4.12 inches at Luverne on October 31, 1979. Thunderstorms occur on about 44 days each year.

The average seasonal snowfall is nearly 41 inches. The greatest snow depth at any one time during the period of record was 50 inches. On the average, 72 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in spring.

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

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

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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.

As a result of changes in the system of soil classification and of the range in slope of map units in other surveys, some of the boundaries and soil series names on the general soil map of Rock County do not match those on the general soil maps of adjacent counties.

Soil Descriptions

Nearly Level, Silty and Loamy Soils on Flood Plains

These soils formed dominantly in medium textured and moderately fine textured alluvium on flood plains. They are somewhat poorly or poorly drained and are subject to flooding in the spring and after heavy rains. The dominant uses are cropland and pasture. Corn, soybeans, and small grain are the major crops. The main management concerns are flooding and a seasonal high water table. In some areas channel cutting has created irregular ground surface. These areas provide good habitat for upland wildlife.

1. Spillco-Millington Association

Nearly level, somewhat poorly drained and poorly drained, silty and loamy soils on flood plains

The soils in this association are on flood plains along major streams and rivers. The areas range in width from a few hundred feet to several thousand feet. Slope ranges from 0 to 2 percent.

This association makes up about 6 percent of the survey area. The association is about 30 percent Spillco soils, 25 percent Millington soils, and 45 percent soils of minor extent (fig. 1).

The Spillco soils are somewhat poorly drained. They are adjacent to stream channels on flood plains. Typically, the surface layer is black silt loam. The subsurface layer is black silt loam and loam. The subsoil is very dark brown loam. The underlying material is very dark grayish brown loam.

The Millington soils are poorly drained. They generally are adjacent to stream channels on flood plains and in shallow drainageways dissecting flood plains. Typically, the surface and the subsurface layers are black clay loam and the underlying material is dark gray clay loam.

Of minor extent are somewhat poorly drained Cylinder soils on stream benches and well drained Fairhaven soils and moderately well drained Graceville soils on the higher parts of the landscape. Also included are areas of Spillco soils that are subject to frequent flooding and channel cutting.

Most of this association is used as cropland or pasture. The frequently flooded soils are generally used for pasture or are idle. The major crops are corn, soybeans, some small grain, and alfalfa. This association is generally well suited to crops. There is a hazard of flooding during the spring and after periods of heavy rain. The irregular surface and flooding hazard of the Spillco soils make those areas poorly suited to crops. Most soils in this association need a combination of surface and subsurface drainage for good crop production.

This association is generally unsuitable as a site for sanitary facilities and buildings. The hazard of flooding is the major limitation.

2. Calco-Spillco Association

Nearly level, poorly drained and somewhat poorly drained, silty soils on flood plains

The soils in this association are along major creeks and streams. The areas range in width from less than a hundred feet to about a thousand feet. Slope ranges from 0 to 2 percent.

This association makes up about 5 percent of the survey area. The association is about 50 percent Calco

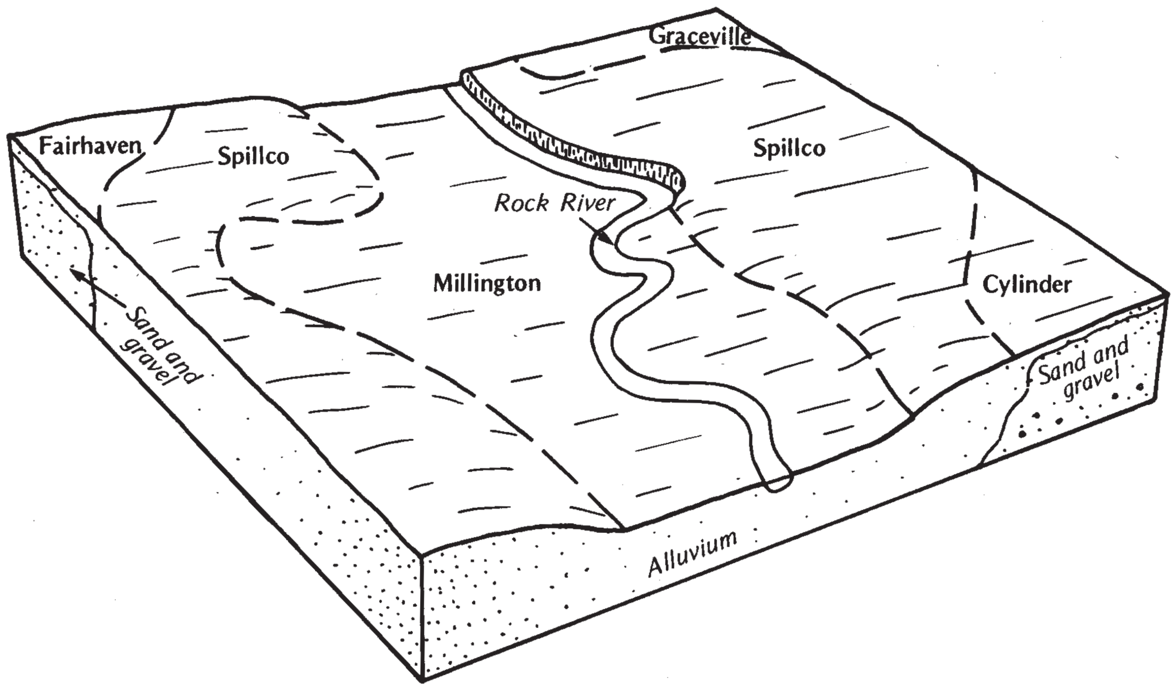

Figure 1.—Typical pattern of soils and underlying material in the Spillco-Millington association.

soils, 20 percent Spillco soils, and 30 percent soils of minor extent.

The Calco soils are poorly drained. They generally are adjacent to stream channels on flood plains. Typically, the surface layer is black silty clay loam. The subsurface layer is black and very dark gray silty clay loam. The subsoil is very dark gray silty clay loam. The underlying material is olive gray silty clay loam.

The Spillco soils are somewhat poorly drained. They generally are adjacent to or a short distance from stream channels on flood plains. Typically, the surface layer is black silt loam. The subsurface layer is black silt loam and loam. The subsoil is very dark brown loam. The underlying material is very dark grayish brown loam.

Of minor extent are moderately well drained and well drained Alcester soils on adjacent upland toe slopes, somewhat poorly drained Cylinder soils on stream benches, well drained Dempster soils and moderately well drained and well drained Graceville soils on the higher parts of the landscape. Also included are areas of Spillco soils that are subject to frequent flooding and channel cutting.

Most of this association is used as cropland or pasture. The frequently flooded soils are generally used for pasture or are idle. The major crops are corn, soybeans, some small grain, and alfalfa. This association is generally well suited to crops. There is a hazard of flooding during the spring and after periods of heavy rains. The irregular ground surface and flooding hazard of the Spillco soils make those areas poorly suited to crops. Most of this association needs a combination of surface and subsurface drainage for good crop production.

This association is generally unsuitable as a site for sanitary facilities and buildings. The hazard of flooding is the major limitation.

Nearly Level and Gently Sloping, Loamy and Silty Soils on Flood Plains and Outwash Plains

These soils formed dominantly in moderately fine textured alluvium on flood plains or in medium textured and moderately fine textured deposits on outwash plains. They are poorly drained or well drained. The soils on flood plains are subject to spring flooding. The dominant land uses are cropland and pasture. Corn, soybeans, and small grain are the major crops. The main management concerns are flooding and the seasonal high water table in the Millington and Talcot soils and a moisture shortage in the Fairhaven soils.

3. Millington-Fairhaven-Talcot Association

Nearly level and gently sloping, poorly drained and well drained, loamy and silty soils on flood plains and outwash plains

The soils in this association are on flood plains and outwash plains along major streams and rivers in the eastern half of the county. The areas range in width from a few hundred feet to several thousand feet. Slope ranges from 0 to 6 percent.

This association makes up about 7 percent of the survey area. The association is about 30 percent Millington soils, 25 percent Fairhaven soils, 10 percent Talcot soils, and 35 percent soils of minor extent (fig. 2).

The Millington soils are poorly drained. They generally are adjacent to stream channels on flood plains. Typically, the surface and subsurface layers are black clay loam. The underlying material is dark gray clay loam.

The Fairhaven soils are well drained. They generally are on outwash plains. Typically, the surface layer is black silt loam. The subsurface layer is very dark grayish brown loam. The subsoil is dark yellowish brown and yellowish brown loam. The underlying material is yellowish brown and brown gravelly sand.

The Talcot soils are poorly drained. They are on outwash plains. Typically, the surface layer is black silty clay loam. The subsurface layer is black and very dark grayish brown silty clay loam. The subsoil is dark grayish brown and olive brown, mottled silty clay loam. The underlying material is grayish brown coarse sand.

Of minor extent are somewhat poorly drained Cylinder soils on stream benches, somewhat poorly drained Spillco soils on the slightly higher parts of flood plains, and moderately well drained and well drained Graceville and somewhat excessively drained Salida soils on outwash plains.

Most of this association is used as cropland or pasture. The major crops are corn, soybeans, small grain, and alfalfa. This association is generally well suited to crops. There is a hazard of flooding on the Millington soils during the spring and after periods of heavy rain. The Fairhaven soils have a moderate or low available water capacity, and crops on those soils are subject to moisture stress during the summer. The poorly drained soils in this association need a combination of surface and subsurface drainage for good crop production.

The Millington soils in this association are generally unsuitable as sites for sanitary facilities because of the flooding hazard, and the Fairhaven soils are poorly suited because of a hazard of ground-water contamination. The higher parts of the outwash plains provide good sites for buildings and are probable sources of sand and gravel.

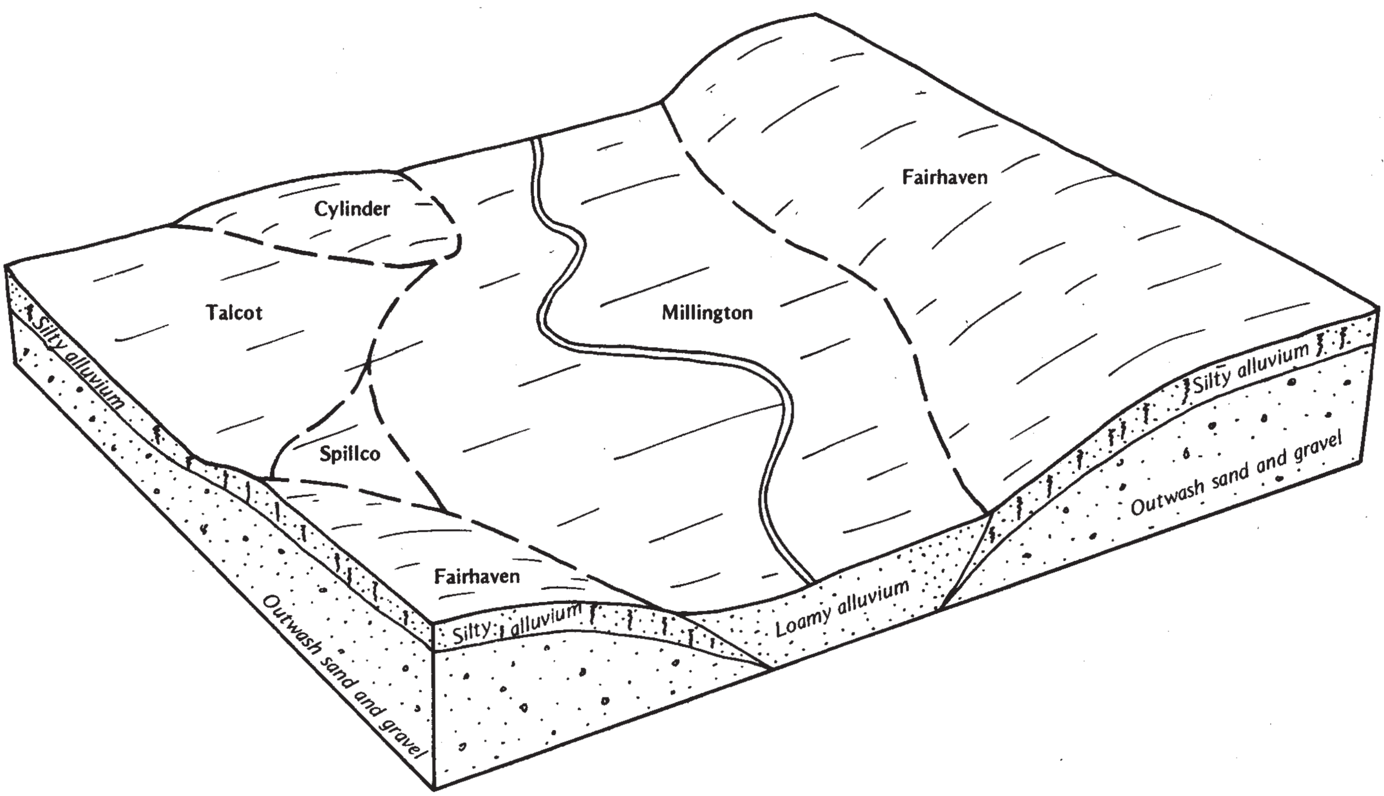

Figure 2.—Typical pattern of soils and underlying material in the Millington-Fairhaven-Talcot association.

Nearly Level and Gently Sloping, Silty Soils on Alluvial Terraces and Outwash Plains

These soils formed in medium textured and moderately fine textured deposits on outwash plains. They are moderately well drained or well drained. Cropland is the dominant use. Corn, soybeans, and small grain are the major crops. The main management concern is moisture shortage. In some areas sand and gravel are mined.

4. Graceville-Dempster Association

Nearly level and gently sloping, moderately well drained and well drained, silty soils on alluvial terraces and outwash plains

The soils in this association are on glacial terraces above major stream and river flood plains. Most areas are nearly level, and short slopes separate the terrace levels. Slope ranges from 0 to 6 percent.

This association makes up about 4 percent of the survey area. The association is about 40 percent Graceville soils, 30 percent Dempster soils, and 30 percent soils of minor extent.

The Graceville soils are moderately well drained and well drained. They are on outwash plains. Typically, the surface layer is black silt loam. The subsurface layer is very dark grayish brown silt loam. The subsoil is dark yellowish brown silt loam. The underlying material is brown gravelly sand.

The Dempster soils are well drained. They are on outwash plains. Typically, the surface layer is very dark brown silt loam. The subsurface layer is very dark grayish brown silt loam. The subsoil is dark brown silt loam and silty clay loam. The underlying material is brown gravelly sand.

Of minor extent are somewhat poorly drained Cylinder soils on stream benches, well drained Flandreau soils on adjacent upland side slopes, and somewhat poorly drained Spillco soils on flood plains.

Most of this association is used as cropland. The major crops are corn, soybeans, small grain, and alfalfa. This association is well suited to crops. The Dempster soils have a moderate available water capacity, and crops on those soils are subject to moisture stress during summer.

This association has poor to fair suitability as a site for sanitary facilities. The Dempster soils have a poor filtering capacity, causing a hazard of ground-water pollution. The soils are generally well suited to building site development. This association is a probable source of sand and gravel.

Nearly Level to Sloping, Loamy and Silty Soils on Uplands and Outwash Plains

These soils formed in medium textured and moderately coarse textured deposits. They are well drained. The dominant land use is cropland. Corn, soybeans, and small grain are the major crops. The main management concerns are erosion and moisture shortage. Some isolated areas are steep. They are adjacent to streams and rivers and provide good habitat for upland wildlife.

5. Flandreau-Dickman Association

Nearly level to sloping, well drained, silty and loamy soils on uplands and outwash plains

The soils in this association are on knolls with plane and convex summits and on side slopes along the east side of the Rock River. Slopes generally are concave to convex and range from 0 to 12 percent. The soils are dissected by numerous drainageways.

This association makes up about 2 percent of the survey area. The association is about 50 percent Flandreau soils, 20 percent Dickman soils, and 30 percent minor soils.

The Flandreau soils generally are on nearly level and gently sloping summits and side slopes on uplands. Typically, the surface layer is very dark brown silt loam. The subsurface layer is very dark grayish brown silt loam. The subsoil is dark brown silt loam and dark yellowish brown loam. The next layer is dark yellowish brown loamy sand. The underlying material is yellowish brown loamy sand.

The Dickman soils generally are on gently sloping and sloping outwash plains and on gently sloping and sloping summits and side slopes on uplands. Typically, the surface layer is very dark brown sandy loam. The subsoil is dark brown and dark yellowish brown sandy loam. The next layer is dark yellowish brown loamy sand. The underlying material is yellowish brown sand.

Of minor extent are moderately well drained and well drained Alcester soils on toe slopes, moderately well drained Trent soils in shallow drainageways, well drained Moody soils on side slopes, and poorly drained Biscay and Whitewood soils in wet drainageways. The Alcester, Trent, Moody, and Whitewood soils do not have coarse textured underlying material.

Most of this association is used as cropland. The major crops are corn, soybeans, small grain, and alfalfa. This association has fair suitability for crops. The soils tend to dry out during summer, and crops are subject to moisture stress. Erosion is a hazard on the sloping Dickman soils.

This association is poorly suited as a site for sanitary facilities. The Flandreau and Dickman soils have a poor filtering capacity. As a result, there is a ground-water pollution hazard. This association is well suited to building site development. It is a probable source of sand.

6. Everly-Flandreau Association

Nearly level to sloping, well drained, loamy and silty soils on uplands

The soils in this association are mainly on knolls. They occur as areas of glacial till on concave to convex side slopes and nose slopes and areas of outwash on concave to convex summits, side slopes, foot slopes, and drainageways. Slopes range from 0 to 12 percent.

This association makes up about 6 percent of the survey area. The association is about 30 percent Everly soils, 25 percent Flandreau soils, and 45 percent minor soils (fig. 3).

The Everly soils generally are on gently sloping and sloping nose slopes and side slopes. Typically, the surface layer is black clay loam. The subsurface layer is dark brown clay loam. The subsoil is dark yellowish brown clay loam. The underlying material is light olive brown clay loam.

The Flandreau soils generally are on nearly level and gently sloping summits and side slopes. Typically, the surface layer is very dark brown silt loam. The subsurface layer is very dark grayish brown silt loam. The subsoil is dark brown silt loam and dark yellowish brown loam. The next layer is dark yellowish brown loamy sand. The underlying material is yellowish brown loamy sand.

Of minor extent are well drained Dickman and Steinauer soils on side slopes, moderately well drained and somewhat poorly drained Ransom and Wilmonton soils on foot slopes and in shallow drainageways, and poorly drained Rushmore and Whitewood soils in wet drainageways. The Steinauer, Ransom, Wilmonton, and Rushmore soils are underlain by glacial till. The Dickman soils formed dominantly in sandy material.

Most of this association is used as cropland. The major crops are corn, soybeans, small grain, and alfalfa. This association is generally well suited to crops. The Flandreau soils tend to dry out during the summer, and crops on them are subject to moisture stress. Erosion is a hazard on the sloping soils. The wet drainageways need subsurface drainage for good crop production.

This association is poorly suited as a site for sanitary facilities. The Flandreau soils have a poor filtering capacity, and the Everly soils do not readily absorb effluent. Pollution of ground water is a hazard. The soils are suited to building site development.

Nearly Level to Moderately Steep, Silty Soils on Uplands

These soils formed in moderately fine textured and medium textured deposits. They are well drained or moderately well drained. The dominant land uses are cropland and pasture. Corn, soybeans, and small grain

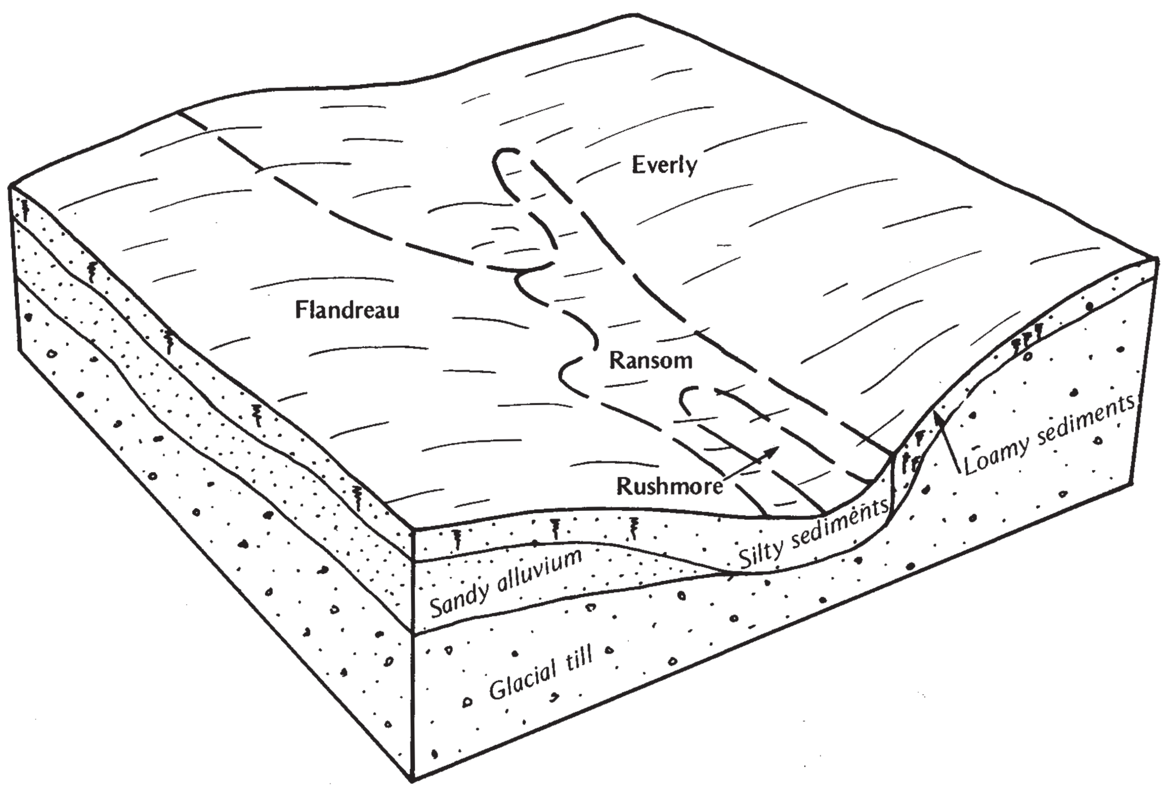

Figure 3.—Typical pattern of soils and underlying material in the Everly-Flandreau association.

are the major crops. The main management concern is erosion. Some isolated, moderately steep areas and deep draws are not used as cropland. They provide good habitat for upland wildlife.

7. Sac-Trent Association

Nearly level to sloping, well drained and moderately well drained, silty soils on uplands

The soils in this association are on knolls with plane and convex side slopes and summits. Slopes are generally concave to convex and range from 1 to 10 percent. The soils are dissected by wet drainageways.

This association makes up about 30 percent of the survey area. The association is about 40 percent Sac soils, 20 percent Trent soils, and 40 percent minor soils (fig. 4).

The Sac soils are well drained. They generally are on loess-covered summits and smooth side slopes. Typically, the surface layer is very dark brown silty clay loam. The subsurface layer is very dark grayish brown silty clay loam. The subsoil is dark yellowish brown silty clay loam. The underlying material is light olive brown clay loam.

The Trent soils are moderately well drained. They generally are on loess-covered foot slopes and at the upper end of drainageways. Typically, the surface layer is black silty clay loam. The subsurface layer is very dark brown and very dark grayish brown silty clay loam. The subsoil is brown and light yellowish brown, mottled silty clay loam. The underlying material is pale brown, mottled silt loam.

Of minor extent are poorly drained Calco, Marcus, Millington, and Whitewood soils. The Calco and Millington soils are on flood plains along small streams. The Marcus and Whitewood soils are in wet drainageways.

Most of this association is used as cropland. The major crops are corn, soybeans, small grain, and alfalfa. This association is well suited to crops. Erosion is a hazard if the more sloping areas of Sac soils are cultivated. The wet drainageways need subsurface drainage for good crop production.

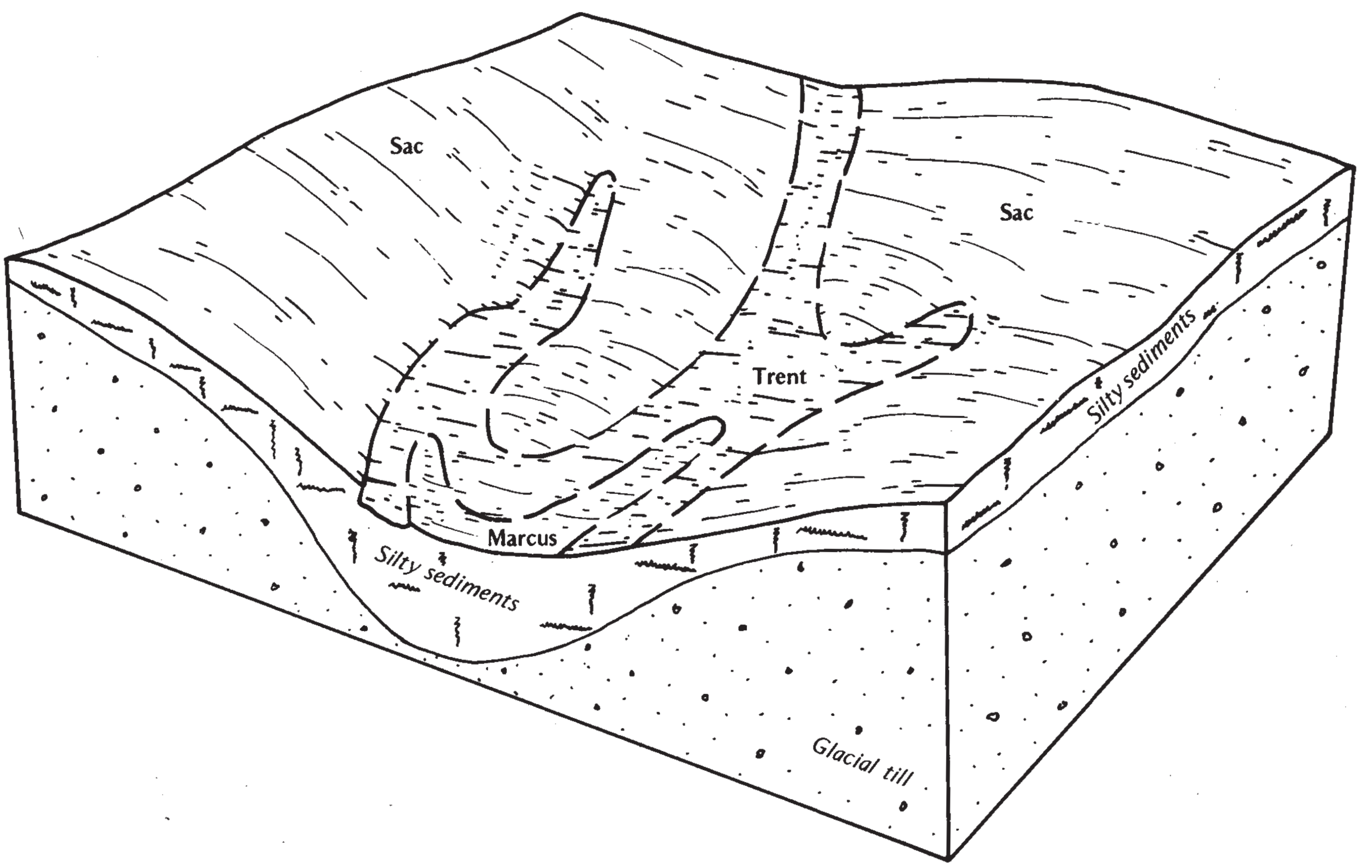

Figure 4.—Typical pattern of soils and underlying material in the Sac-Trent association.

This association is poorly suited as a site for sanitary facilities and buildings. The Trent soils are wet, and the Sac soils do not readily absorb effluent.

8. Moody-Trent Association

Nearly level to sloping, well drained and moderately well drained, silty soils on uplands

The soils in this association are on knolls with concave to convex side slopes and summits. Slopes range from 1 to 9 percent. The soils are dissected by wet drainageways.

This association makes up about 24 percent of the survey area. The association is about 40 percent Moody soils, 20 percent Trent soils, and 40 percent minor soils (fig. 5).

The Moody soils are well drained. They generally are on loess-covered summits and smooth side slopes. Typically, the surface layer is very dark brown silty clay loam. The subsoil is dark brown and dark yellowish brown silty clay loam. The underlying material is yellowish brown silt loam.

The Trent soils are moderately well drained. They generally are on loess-covered foot slopes and at the upper end of drainageways. Typically, the surface layer is black silty clay loam. The subsurface layer is very dark brown and very dark grayish brown silty clay loam. The subsoil is brown and light yellowish brown, mottled silty clay loam. The underlying material is pale brown, mottled silt loam.

Of minor extent are poorly drained Calco, Marcus, and Whitewood soils. The Calco soils are on flood plains along small streams. The Marcus and Whitewood soils are in wet drainageways.

Most of this association is used as cropland. The major crops are corn, soybeans, small grain, and alfalfa. This association is well suited to crops. Erosion is a hazard if the more sloping areas of Moody soils are cultivated. The wet drainageways need subsurface drainage for good crop production.

This association has fair suitability as a site for sanitary facilities and buildings. The high water table in the Trent soils is a major limitation on sites for sanitary facilities. A shrink-swell potential is a major limitation on building sites.

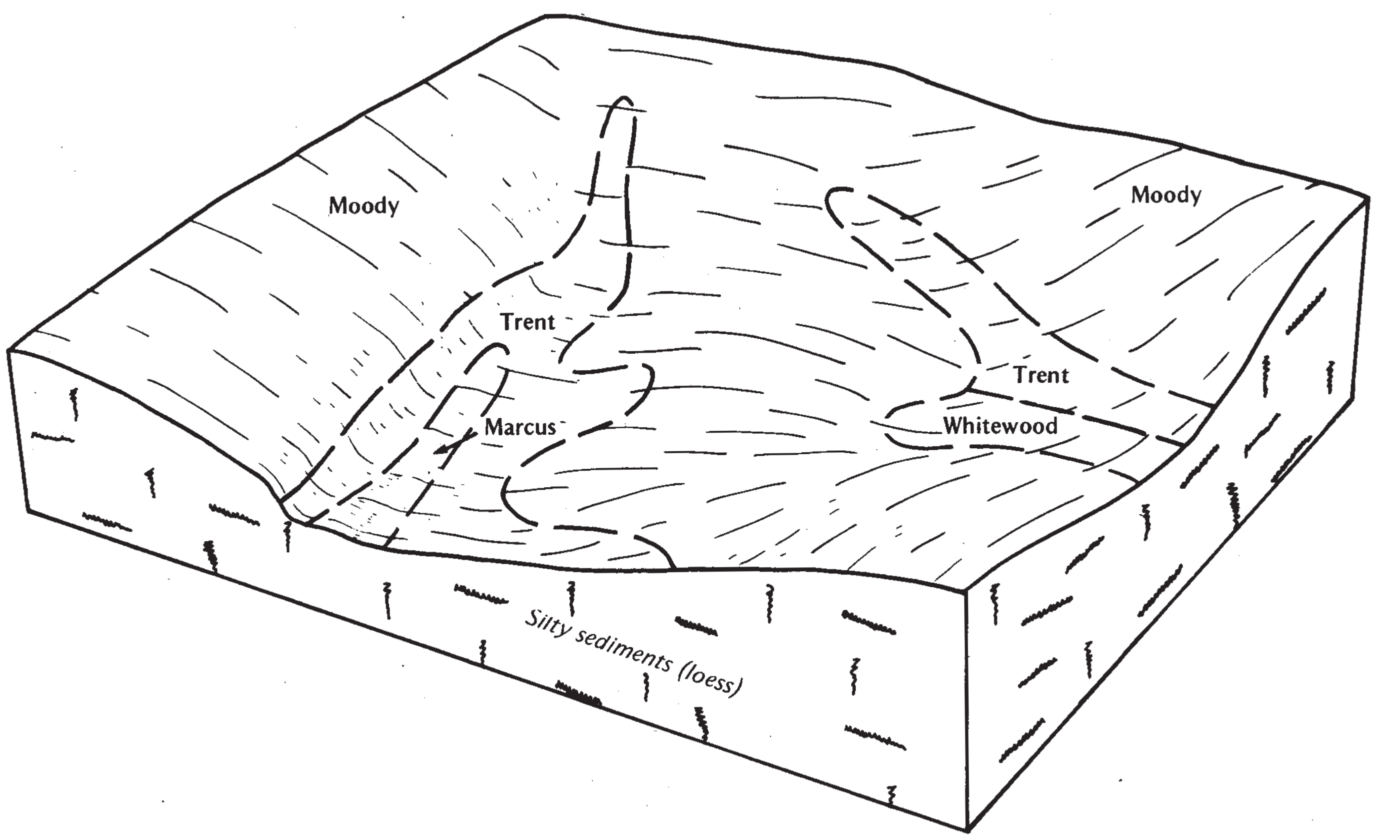

Figure 5.—Typical pattern of soils and underlying material in the Moody-Trent association.

9. Nora-Crofton-Alcester Association

Gently sloping to moderately steep, well drained and moderately well drained, silty soils on uplands

The soils in this association are on knolls and hills in the Beaver Creek and Spring Water Creek watersheds. The soils are dissected by numerous small streams and drainageways. Slopes are concave to convex and range from 1 to 18 percent.

This association makes up about 9 percent of the survey area. The association is about 35 percent Nora soils, 25 percent Crofton soils, 10 percent Alcester soils, and 30 percent minor soils (fig. 6).

The Nora soils are well drained. They generally are on loess-covered side slopes and summits. Typically, the surface layer is very dark brown silt loam. The subsoil is dark brown, brown, and yellowish brown silt loam. The underlying material is yellowish brown silt loam.

The Crofton soils are well drained. They generally are on loess-covered nose slopes and summits. Typically, the surface layer is dark brown silt loam. The subsurface layer is dark yellowish brown silt loam. The underlying material is yellowish brown silt loam.

The Alcester soils are moderately well drained and well drained. They generally are in loess-covered shallow drainageways and on concave toe slopes. Typically, the surface layer is very dark brown silt loam. The subsurface layer is very dark brown silt loam and black silty clay loam. The subsoil is multicolored silty clay loam. The underlying material is dark brown, mottled silty clay loam.

Of minor extent are poorly drained Calco and Whitewood soils and well drained Sac soils. The Calco soils are on flood plains adjacent to small streams. The Whitewood soils are in drainageways. The Sac soils are on side slopes and summits and have glacial till within 40 inches of the surface.

Most of this association is used as cropland or pasture. The major crops are corn, soybeans, small grain, and alfalfa. Most areas are fairly suited to these crops. Erosion is a hazard on the steeper slopes. Artificial drainage is needed in wet drainageways for good crop production.

This association has fair suitability as a site for sanitary facilities and buildings. A shrink-swell potential

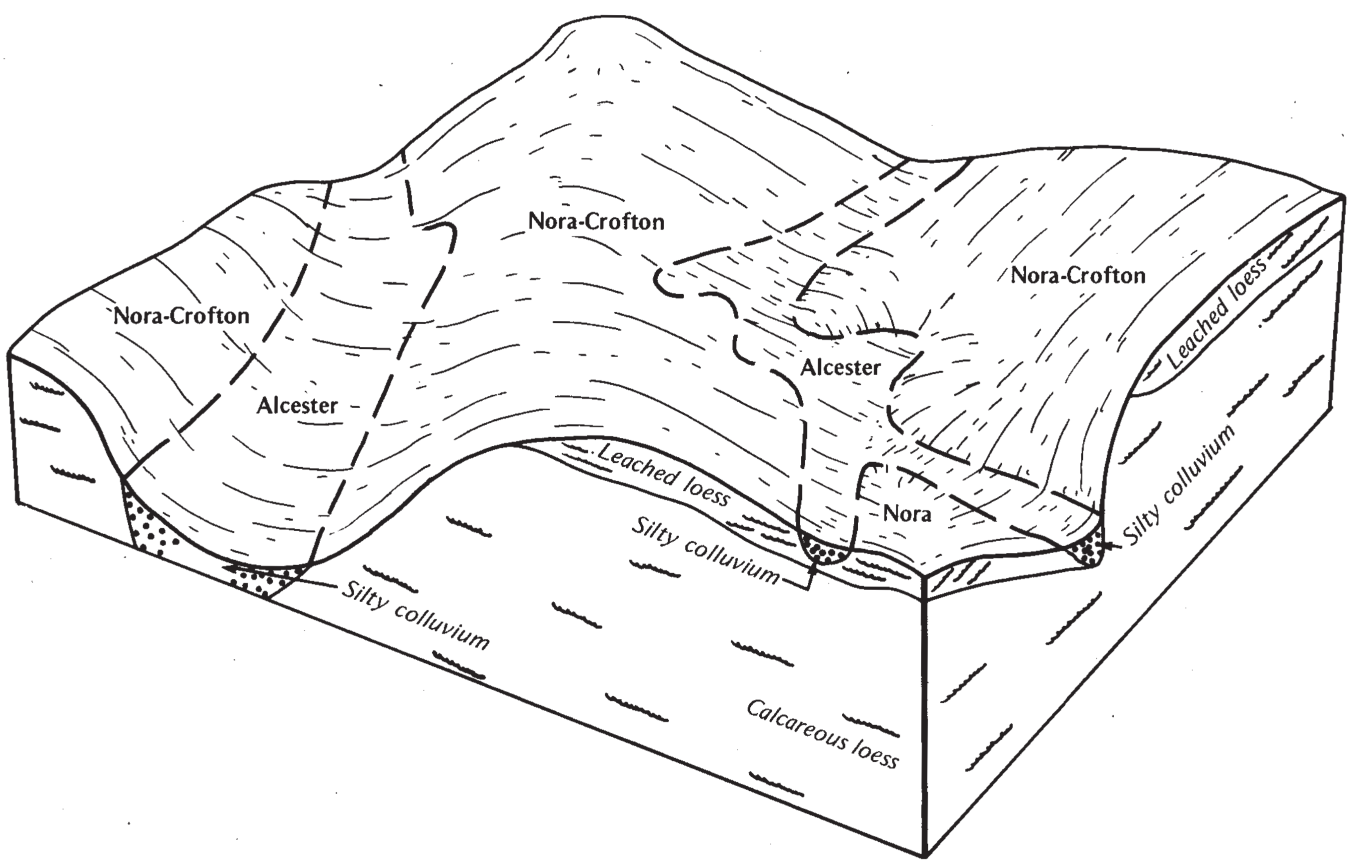

Figure 6.—Typical pattern of soils and underlying material in the Nora-Crofton-Alcester association.

and the slope are the major limitations. Erosion is a hazard on construction sites in the more sloping areas.

Nearly Level to Very Steep, Moderately Deep, Silty Soils and Rock Outcrops on Uplands

These soils formed in moderately fine textured and medium textured deposits over bedrock. They are well drained. Cropland, hayland, and pasture are the dominant land uses. A few areas are used for parks. Corn, soybeans, small grain, and alfalfa are the major crops. The main management concerns are the depth to bedrock, the bedrock outcroppings, and a lack of moisture.

10. Ihlen-Rock Outcrop Association

Nearly level to very steep, well drained, silty soils and rock outcrops on uplands

The soils in this association are on loess-covered uplands with bedrock near the surface. Rock outcrops are common in most areas. Slopes generally range from 0 to 35 percent; however, some included areas of rock outcrop have slopes of more than 100 percent.

This association makes up about 6 percent of the survey area. The association is about 60 percent Ihlen soils, 20 percent Rock outcrop, and 20 percent minor soils.

The Ihlen soils are well drained. Typically, the surface layer is black silty clay loam. The subsurface layer is very dark grayish brown silty clay loam. The subsoil is brown and dark yellowish brown silty clay loam. It is underlain by bedrock.

Of minor extent are deep, moderately well drained and well drained Alcester soils on toe slopes; deep, moderately well drained Trent soils in drainageways; and deep, well drained Moody soils on small knolls and side slopes.

About 15 percent of this association is in Blue Mound State Park. Most of the land in the park is idle, but a small portion is used for pasture and hay. About 65 percent of this association outside of the park is pastured. This association is fairly suited or poorly suited to crops. The bedrock outcrops and the low or moderate available water capacity are the main limitations. The available water capacity is also the main limitation affecting pasture and hay. Controlled grazing increases the plant recovery rate during summer and fall.

This association is generally unsuitable as a site for sanitary facilities and buildings. The major limitation is the depth to bedrock.

Nearly Level, Silty Soils on Lake Plains

These soils formed dominantly in moderately fine deposits on lake plains. They are poorly drained. Cropland is the dominant use. Corn and soybeans are the major crops. The main management concern is the seasonal high water table.

11. Marcus Variant Association

Nearly level, poorly drained, silty soils on glacial lake plains

The soils in this association are on lake plains where the slope is 0 to 1 percent.

This association makes up less than 1 percent of the survey area. The association is about 80 percent Marcus Variant soils and 20 percent minor soils.

Typically, the surface layer of the Marcus Variant soils is black silty clay loam. The subsoil is dark grayish brown clay loam. The underlying material is olive, mottled clay loam. A few stones and small boulders are on the surface.

Of minor extent are poorly drained Spicer soils on the rims of depressions and on slight rises.

Most of this association is used as cropland. The major crops are corn, soybeans, and alfalfa. This association has fair suitability for crops. Artificial drainage is needed for maximum crop production.

This association is generally unsuitable as a site for sanitary facilities and buildings. Restricted permeability and a high water table are the major limitations.

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Detailed Soil Map Units

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

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

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

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, 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 underlying material. 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, Moody silty clay loam, 1 to 5 percent slopes, is a phase of the Moody 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. Nora-Crofton silt loams, 6 to 12 percent slopes, eroded, is an example.

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel, 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

18—Comfrey clay loam. This level, poorly drained soil is on flood plains. It is occasionally flooded. Individual areas on the large flood plains are long and broad and range from 20 to about 500 acres in size. Those along the smaller streams are long and narrow and range from 5 to about 40 acres in size.

Typically, the surface layer is black clay loam about 14 inches thick. The subsurface layer also is black clay loam. It is about 12 inches thick. The subsoil is very dark gray and dark gray clay loam about 12 inches thick. It is mottled in the lower part. The underlying material to a depth of about 60 inches is dark gray, mottled clay loam. In some areas the soil is calcareous. In other areas it has less sand. In places coarse textured sediments are within 60 inches of the surface.

Included with this soil in mapping are small areas of moderately well and well drained Alcester, somewhat poorly drained Spillco, and poorly drained Whitewood soils. The Alcester soils are on upland toe slopes. The Spillco soils are on the slightly higher parts of the flood plains. The Whitewood soils are in upland drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in this Comfrey soil, and runoff is slow. The available water capacity is high or very high. Organic matter content is high. The seasonal high water table is within a depth of 3 feet.

Most areas are used as cropland. Corn and soybeans are the most common crops. Some areas are pastured. If drained, this soil is well suited to crops. The seasonal wetness and the occasional flooding are the main management concerns. A drainage system can reduce the wetness, but adequate drainage outlets are not available in all areas. If tilled in the fall, the soil warms up and dries out sooner in the spring, allowing earlier seedbed preparation. Working the soil when it is wet causes compaction of the root zone. Grazing pastures when this soil is wet also causes compaction.

This soil is fairly well suited to the trees and shrubs grown as windbreaks. Seedling mortality is moderate because of the wetness. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting include eastern cottonwood, green ash, and Amur maple. The shrubs that are generally selected include Tatarian honeysuckle and redosier dogwood.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings because of the seasonal high water table and the flooding. Local roads and streets built on this soil should be raised above the expected level of flooding. The damage caused by the low strength of the soil can be minimized by providing coarse textured base material.

The land capability classification is IIw.

28A—Alcester silty clay loam, 1 to 3 percent slopes. This nearly level, moderately well drained soil is on concave toe slopes and in drainageways. The areas are long and narrow and range from 3 to about 25 acres in size.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsurface layer is silty clay loam about 30 inches thick. The upper part is black, and the lower part is very dark grayish brown. The subsoil is brown, mottled silty clay loam about 12 inches thick. The underlying material to a depth of about 60 inches is yellowish brown, mottled silty clay loam. In some areas the surface layer and subsurface layer are thinner. In some other areas the slope is more than 3 percent. In places this soil contains more sand.

Included with this soil in mapping are small areas of poorly drained Calco and Whitewood soils and well drained Crofton, Moody, Nora, and Sac soils. The Calco soils are on flood plains. The Whitewood soils are in wet drainageways. The Crofton, Moody, Nora, and Sac soils are on side slopes. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in this Alcester soil, and runoff is slow. The available water capacity is high or very high. Organic matter content is high. The seasonal high water table is at a depth of 3 to 6 feet.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, small grain, and alfalfa. This soil is well suited to crops. A system of conservation tillage that leaves crop residue on the surface helps maintain soil tilth and the organic matter content.

This soil is well suited to the trees and shrubs used in windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, ponderosa pine, hackberry, and green ash. The shrubs that are generally selected are American plum, Tatarian honeysuckle, and lilac.

This soil is poorly suited to septic tank absorption fields. Seasonal wetness and runoff from upslope areas are the major limitations. Subsurface drainage helps to remove excess water from the field, and placing the absorption field in a mound of suitable filtering material will keep the system above the zone of wetness. Diverting upslope runoff away from the site is also helpful.

This soil has fair suitability as a building site. A shrink-swell potential is the main limitation. The structural damage caused by shrinking and swelling can be prevented by diverting upslope runoff away from building sites and landscaping the site to remove surface water.

The damage to local roads and streets caused by low strength and frost action in this soil can be minimized by constructing the roads on coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches.

The land capability classification is I.

28B—Alcester silt loam, 3 to 8 percent slopes. This gently sloping, well drained soil is on concave toe slopes and in drainageways. The areas of this unit are long and narrow and range from 3 to about 15 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is about 28 inches of very dark brown silt loam and black silty clay loam. The subsoil is very dark grayish brown, dark grayish brown, and dark brown silty clay loam about 20 inches thick. The underlying material to a depth of about 60 inches is dark brown, mottled silty clay loam. In places the surface layer and subsurface layer are thinner. In some areas the slope is less than 3 percent.

Included with this soil in mapping are small areas of poorly drained Calco and Whitewood soils and well drained Crofton and Nora soils. The Calco soils are on flood plains. The Whitewood soils are in wet drainageways. The Crofton and Nora soils are on side slopes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in this Alcester soil, and runoff is slow or medium. The available water capacity is high or very high. Organic matter content is high.

Most areas of this soil are used as cropland. Corn, soybeans, small grain, and alfalfa are the most common crops. This soil is well suited to crops. If the soil is cultivated, surface runoff and erosion are management concerns. Crop rotation, a system of conservation tillage that leaves crop residue on the surface, terraces and diversions, and grassed waterways help to control erosion. Crop residue on or in the soil and cover crops also help to control erosion and improve or maintain soil tilth and the organic matter content.

This soil is well suited to the trees and shrubs used in windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, ponderosa pine, hackberry, and green ash. The shrubs that are generally selected are American plum, Tatarian honeysuckle, and lilac.

This soil is well suited to septic tank absorption fields, but sometimes after heavy rainfall runoff from upslope areas is a limitation. Diverting the runoff away from the site helps to overcome that limitation.

This soil has fair suitability as a building site. A shrink-swell potential is the main limitation. The structural damage caused by shrinking and swelling can be prevented by diverting upslope runoff away from the building site and landscaping the site to remove surface water.

The damage to local roads and streets caused by low strength and frost action in this soil can be minimized by constructing the roads on coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches.

The land capability classification is IIe.

42B—Salida gravelly sandy loam, 2 to 6 percent slopes. This gently sloping, excessively drained soil is on convex ridgetops and plane and convex side slopes. The areas are irregular in shape or long and narrow and range from 3 to about 10 acres in size.

Typically, the surface layer is very dark brown gravelly sandy loam about 7 inches thick. The subsoil is dark brown gravelly loamy sand about 3 inches thick. The underlying material to a depth of about 60 inches is grayish brown, brown, and yellowish brown gravelly coarse sand. In places the surface layer is loam. In some areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of well drained Dickman, Dempster, and Fairhaven soils. The Dickman soils have less gravel and more sand throughout than this Salida soil and are on side slopes. The Dempster and Fairhaven soils have gravel at a depth of more than 20 inches. Included soils make up 5 to 10 percent of the unit.

Permeability is very rapid in this Salida soil, and runoff is slow. The available water capacity is very low. Organic matter content is low.

Most areas of this soil are used as cropland or pasture. Corn, soybeans, and small grain are the most common crops. This soil is poorly suited to crops. The very low available water capacity is the main limitation, but the moisture supply in this soil can be conserved by conservation tillage or increased by irrigation. Overgrazing pastured areas will cause poor regeneration of plants. Deferred grazing will help maintain the quality of pasture plants.

This soil is poorly suited to the trees and shrubs used in windbreaks. Seedling mortality is severe because of the lack of moisture. Onsite evaluation is necessary to determine the treatment needs and the species to be planted.

This soil is poorly suited to septic tank absorption fields. It does not adequately filter the effluent, causing a hazard of ground-water contamination. Placing filter fields in a layer or mound of suitable material will help overcome this limitation.

This soil is well suited as a site for buildings and local roads and streets and is a good source of roadfill and sand and gravel.

The land capability classification is IVs.

42D—Salida gravelly sandy loam, 6 to 35 percent slopes. This sloping to steep, excessively drained soil is on side slopes. The areas are irregular in shape or long and narrow and range from 3 to about 25 acres in size.

Typically, the surface layer is black gravelly sandy loam about 9 inches thick. The subsoil is dark brown gravelly loamy sand about 3 inches thick. The underlying material to a depth of about 60 inches is grayish brown, brown, and dark yellowish brown very gravelly sand. In places the surface layer is loam. In some areas the slope is less than 6 percent.

Included with this soil in mapping are small areas of moderately well drained and well drained Alcester soils and well drained Dickman soils. The Alcester soils are on toe slopes and in shallow drainageways. The Dickman soils have less gravel and more sand throughout than this Salida soil and are on side slopes. Included soils make up 1 to 15 percent of the unit.

Permeability is very rapid in this Salida soil, and runoff is slow or medium. The available water capacity is very low. Organic matter content is low.

Most areas of this soil are used for pasture or hay. Some areas are idle. This soil is generally unsuitable for crops because of the very low available water capacity and the steep slopes. Overgrazing pastured areas will cause poor plant regeneration, and grazing on steep areas exposes the soil surface and increases erosion. Deferred grazing will reduce erosion and improve the quality of plants.

This soil is poorly suited to the trees and shrubs used in windbreaks. Seedling mortality is severe because of the lack of moisture. Onsite evaluation is necessary to determine the treatment needs of the species to be planted.

This soil is poorly suited to septic tank absorption fields. It does not adequately filter the effluent, causing a hazard of ground-water contamination. Placing filter fields in a layer or mound of suitable material will help overcome this limitation.

Depending on the slope, this soil is fairly suited or poorly suited to building site development and to local roads and streets. Erosion is a hazard on the steeper slopes. Diverting water away from sites before and during construction and establishing a plant cover on the sites as soon as construction is complete will help reduce erosion. This soil is a good source of roadfill and sand and gravel.

The land capability classification is VIs.

54A—Ihlen silty clay loam, 0 to 2 percent slopes. This nearly level, well drained soil is on concave and convex side slopes that are underlain by quartzite bedrock. The areas of this unit are irregular in shape and range from 5 to about 200 acres in size.

Typically, the surface layer is black silty clay loam about 12 inches thick. The subsoil is dark brown and dark yellowish brown silty clay loam about 26 inches thick. It is underlain by red and pale red quartzite bedrock. In places the depth to bedrock is less than 20 inches or more than 40 inches. In some areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of poorly drained Marcus soils, moderately well drained Trent soils, and well drained Moody soils, all of which have bedrock at a depth of more than 40 inches. The Marcus soils are in wet drainageways. The Trent soils are in shallow drainageways. The Moody soils are on side slopes. Bedrock outcrops are at the surface of some areas. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in this Ihlen soil, and runoff is slow. Available water capacity is low or moderate. Organic matter content is moderate.

Most areas of this soil are used for pasture and hay. Some areas are used as cropland. Corn, soybeans, and small grain are the most common crops. This soil is well suited to crops where bedrock outcroppings are not common. Crops on this soil are subject to moisture stress because of the shallow root zone and the low or moderate available water capacity. A conservation tillage system helps conserve moisture. Overgrazing pastured areas will cause poor regeneration of pasture plants. Deferred grazing will help maintain the quality of the plants.

This soil is well suited to the trees and shrubs used in windbreaks. Plant competition is moderate. The trees that are generally selected for planting are ponderosa pine, green ash, and Manchurian crabapple. The shrubs that are generally selected are lilac and Tatarian honeysuckle.

This soil is poorly suited to septic tank absorption fields and building site development. The main limitation is the bedrock near the surface. A mound-type absorption field is suitable in some areas.

Low strength is the main limitation affecting local roads and streets on this soil. The damage caused by low strength can be minimized by constructing the road on coarse textured base material. This soil is a fair source of topsoil.

The land capability classification is IIs.

54B—Ihlen silty clay loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on plane and convex side slopes that are underlain by quartzite bedrock. The areas of this unit are irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 3 inches thick. The subsoil is silty clay loam about 13 inches thick. The upper part is brown, and the lower part is dark yellowish brown. The subsoil is underlain by red and pale red quartzite bedrock. In places the depth to bedrock is more than 40 inches or less than 20 inches. In some areas the slope is less than 2 percent.

Included with this soil in mapping are small areas of poorly drained Marcus soils, moderately well drained Trent soils, and well drained Moody soils, all of which have bedrock at a depth of more than 40 inches. The Marcus soils are in wet drainageways. The Trent soils are in shallow drainageways. The Moody soils are on side slopes. In some areas bedrock outcrops are at the surface. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in this Ihlen soil, and runoff is medium. The available water capacity is low or moderate. Organic matter content is moderate.

Most areas of this soil are used for pasture or hay. Some areas are used as cropland. Corn, soybeans, and small grain are the most common crops. This soil is well suited to crops where bedrock outcroppings are not common. Crops on this soil are subject to moisture stress because of the shallow root zone and the low or moderate available water capacity. A system of conservation tillage that leaves crop residue on the surface helps to reduce runoff and conserve moisture. Overgrazing pastured areas of this soil causes poor regeneration of pasture plants and can expose the soil surface and increase erosion. Deferred grazing will help to prevent erosion and maintain the quality of pasture plants.

This soil has fair suitability for the trees and shrubs used in windbreaks. Plant competition is moderate. The trees that are generally selected for planting are ponderosa pine, green ash, and Manchurian crabapple. The shrubs that are generally selected are lilac and Tatarian honeysuckle.

This soil is poorly suited to septic tank absorption fields and building sites. The main limitation is the bedrock near the surface. A mound-type absorption field is suitable in some places.

Low strength is the main limitation affecting local roads and streets on this soil. The damage caused by low strength can be minimized by constructing the road on coarse textured base material. This soil is a fair source of topsoil.

The land capability classification is IIe.

85—Calco silty clay loam, occasionally flooded. This level, poorly drained soil is on flood plains. The areas on the large flood plains are long and broad and range from 20 to about 500 acres in size. Those along the smaller streams are long and narrow and range from 5 to about 1,000 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is silty clay loam about 30 inches thick. The upper part of the subsurface layer is black, and the lower part is very dark gray. The subsoil is very dark gray silty clay loam about 7 inches thick. The underlying material to a depth of about 60 inches is olive gray, mottled silty clay loam. In places coarse textured sediments are within 60 inches of the surface. In some areas the soil is leached or has more sand. Some places are frequently flooded.

Included with this soil in mapping are small areas of moderately well drained and well drained Alcester soils, somewhat poorly drained Spillco soils, and poorly drained Marcus and Whitewood soils. The Alcester soils are on upland toe slopes. The Spillco soils contain more sand than this Calco soil and are on slightly higher parts of the flood plain. The Marcus and Whitewood soils are in upland drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in this Calco soil, and runoff is slow. The available water capacity is very high or high. Organic matter content is high. The seasonal high water table is at a depth of 1 to 3 feet.

Most areas of this soil are used as cropland. Corn and soybeans are the most common crops. Some areas are used as pasture. If drained, this soil is well suited to crops. It is seasonally wet and occasionally flooded. A drainage system can reduce the wetness, but adequate drainage outlets are not available in all areas. The high content of lime in this soil causes a fertility imbalance. Soybeans, for example, often exhibit iron chlorosis, or "yellowing." Supplemental fertilization helps to overcome this limitation. If tilled in the fall, this soil will warm up and dry out earlier in the spring, allowing earlier seedbed preparation. Working this soil when it is wet causes compaction and destruction of soil tilth. Grazing when this soil is wet causes compaction.

This soil is poorly suited to the trees and shrubs used in windbreaks. Seedling mortality is moderate or severe because of the wetness and high content of lime. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are eastern cottonwood and golden willow. The shrubs that are generally selected are Tatarian honeysuckle and lilac.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings because of the seasonal high water table and the flooding. Soils that are better suited to these uses generally are nearby. Local roads and streets on this soil need drainage to lower the water table and should be constructed above the expected level of flooding. The damage caused by low strength in this soil can be minimized by constructing roads on a coarse textured base material.

The land capability classification is IIw.

90B—Moody silty clay loam, 1 to 5 percent slopes. This gently sloping, well drained soil is on plane and slightly convex side slopes and summits. The areas are irregular in shape and range from 15 to about 1,000 acres in size.

Typically, the surface layer is very dark brown silty clay loam about 8 inches thick. The subsoil is about 42 inches thick. The upper part of the subsoil is dark brown and dark yellowish brown silty clay loam, and the lower part is dark yellowish brown silty clay loam and yellowish brown silt loam. The underlying material to a depth of about 60 inches is yellowish brown silt loam. In places free carbonates are within 30 inches of the surface. In some areas the slope is more than 5 percent. Some places have glacial till within 40 inches of the surface.

Included with this soil in mapping are small areas of well drained Flandreau soils, poorly drained Marcus and Whitewood soils, and moderately well drained Trent soils. The Flandreau soils are on side slopes and have sandy underlying material. The Marcus and Whitewood soils are in wet drainageways. The Trent soils are in shallow drainageways and on foot slopes. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in this Moody soil, and runoff is slow or medium. The available water capacity is high or very high. Organic matter content is moderate.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, small grain, and alfalfa. This soil is well suited to crops. A system of conservation tillage that leaves crop residue on the surface helps to reduce runoff and conserves moisture and helps to prevent erosion on areas with short, irregular slopes. Erosion is a hazard on long slopes. Where slopes are smooth and uniform, farming on the contour helps prevent erosion.

This soil is well suited to the trees and shrubs used in windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, ponderosa pine, hackberry, and green ash. The shrubs that are generally selected are American plum and lilac.

This soil has fair suitability as a site for septic tank absorption fields. The restricted permeability is the main limitation, but it can be overcome by enlarging the absorption field area.

The soil has fair suitability as a site for buildings. A shrink-swell potential is the main limitation of the soil as a building site. The structural damage caused by shrinking and swelling can be prevented by landscaping sites to remove surface water and backfilling around foundations with suitable coarse material.

The damage to local roads and streets caused by low strength and frost action in this soil can be minimized by constructing the roads on coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches. This soil is a fair source of topsoil.

The land capability classification is IIe.

90C—Moody silty clay loam, 5 to 9 percent slopes. This sloping, well drained soil is on plane and convex side slopes. The areas of this unit are irregular in shape and range from 3 to about 160 acres in size.

Typically, the surface layer is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is silty clay loam about 26 inches thick. The upper part of the subsoil is dark yellowish brown, and the lower part is light olive brown. The underlying material to a depth of about 60 inches is light olive brown silt loam. Some places have glacial till within 40 inches of the surface. In places free carbonates are within 30 inches of the surface. In some areas the slope is less than 5 percent.

Included with this soil in mapping are small areas of moderately well drained Alcester and Trent soils and poorly drained Whitewood soils. The Alcester soils are on toe slopes. The Trent soils are in shallow drainageways and on foot slopes. The Whitewood soils are in wet drainageways. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in this Moody soil, and runoff is medium. The available water capacity is high or very high. Organic matter content is moderate.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, small grain, and alfalfa. This soil has fair suitability for crops. Erosion is a hazard on long slopes. Where slopes are smooth and uniform, farming on the contour or terracing helps prevent erosion. On short, irregular slopes, a conservation tillage system that leaves crop residue on the surface will reduce runoff, help prevent erosion, and retain moisture. Using alfalfa as a cover crop also helps prevent erosion.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, ponderosa pine, hackberry, and green ash. The shrubs that are generally selected are American plum and lilac.

This soil has fair suitability as a site for septic tank absorption fields and buildings. The restricted permeability of this soil can be overcome by enlarging the absorption field area. Landscaping sites to remove surface water and backfilling around foundations with suitable coarse material will help prevent the structural damage caused by shrinking and swelling.

The damage to local roads and streets caused by low strength and frost action in this soil can be minimized by providing coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches. This soil is a fair source of topsoil.

The land capability classification is IIIe.

92A—Flandreau silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on concave to convex areas on outwash plains and on concave to slightly convex summits in the uplands. The areas of this unit are irregular in shape and range from 5 to about 60 acres in size.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 32 inches thick. The upper part of the subsoil is dark brown silt loam; the lower part is dark yellowish brown loam and sandy loam. The underlying material to a depth of about 60 inches is yellowish brown loamy sand. Some areas are more sloping. In places there is an abrupt change in texture between the surface layer and the underlying material.

Included with this soil in mapping are small areas of well drained Dickman, Everly, and Moody soils; moderately well drained Trent soils; and poorly drained Biscay soils. The Dickman soils are on side slopes and contain more sand than this Flandreau soil. The Everly and Moody soils are on side slopes and contain less sand. The Trent soils are in shallow drainageways, and the Biscay soils are in wet drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability in this Flandreau soil is moderate in the upper part and rapid in the lower part. Runoff is slow. The available water capacity is moderate or high. Organic matter content is moderate.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, and small grain. This soil is well suited to crops. Some crops on this soil are subject to moisture stress late in the growing season. A conservation tillage system that leaves crop residue on the surface helps to conserve moisture. Irrigation improves production.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is moderate. The trees that are generally selected for planting are green ash, ponderosa pine, and Siberian crabapple. The shrubs that are generally selected are lilac and Tatarian honeysuckle.

This soil is well suited as a site for septic tank absorption fields and buildings, but the soil does not adequately filter effluent from septic tanks, causing a hazard of ground-water contamination.

The damage to local roads and streets caused by low strength and a frost-action potential in this soil can be minimized by using coarse textured base material.

The lower part of this soil is a probable source of sand and a good source of roadfill material. This soil is a fair source of topsoil.

The land capability classification is IIs.

92B—Flandreau silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on concave to convex upland side slopes. The areas of this unit are irregular in shape or long and narrow and range from 5 to about 300 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 21 inches thick. The upper part of the subsoil is dark brown silt loam. The middle part is dark yellowish brown loam. The lower part is dark yellowish brown loamy sand. The underlying material to a depth of about 60 inches is yellowish brown loamy sand. Some areas have a slope of less than 2 percent. In places there is an abrupt change in texture between the surface layer and the underlying material.

Included with this soil in mapping are small areas of well drained Dickman, Everly, and Moody soils; moderately well drained Trent soils; and poorly drained Biscay soils. The Dickman soils are on side slopes and contain more sand than this Flandreau soil. The Everly and Moody soils are on side slopes and contain less sand. The Trent soils are in shallow drainageways. The Biscay soils are in wet drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability in this Flandreau soil is moderate in the upper part and rapid in the lower part. Runoff is slow or medium. The available water capacity is moderate or high. Organic matter content is moderate.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, and small grain. This soil is well suited to crops. Some crops grown on this soil are subject to moisture stress late in the growing season. A conservation tillage system that leaves crop residue on the surface helps to conserve moisture. Irrigation improves production. Erosion is a hazard on long slopes. Farming on the contour and using conservation tillage help to reduce runoff.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is moderate. The trees that are generally selected for planting are green ash, ponderosa pine, and Siberian crabapple. The shrubs that are generally selected are lilac and Tatarian honeysuckle.

This soil is well suited as a site for septic tank absorption fields and buildings, but the soil does not adequately filter the effluent from septic tanks, causing a hazard of ground-water contamination.

The damage to local roads and streets caused by low strength and frost action in this soil can be minimized by providing coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches.

The lower part of this soil is a probable source of sand and a good source of roadfill material. This soil is a fair source of topsoil.

The land capability classification is IIe.

97—Trent silty clay loam. This nearly level, moderately well drained soil is on concave foot slopes and in shallow drainageways. The areas of this unit are irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is silty clay loam about 14 inches thick. The upper part of the subsurface layer is very dark brown, and the lower part is very dark grayish brown. The subsoil is silty clay loam about 18 inches thick. The upper part is brown, and the lower part is light yellowish brown and mottled. The underlying material to a depth of about 60 inches is pale brown, mottled silt loam. In places the surface and subsurface layers are thinner or thicker.

Included with this soil in mapping are small areas of well drained Ihlen, Moody, and Sac soils and poorly drained Marcus and Whitewood soils. The Ihlen, Moody, and Sac soils are on side slopes above the Trent soil. The Ihlen soils have bedrock at a depth of 20 to 40 inches. The Marcus and Whitewood soils are in wet drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability in this Trent soil is moderate, and runoff is slow. The available water capacity is high or very high. Organic matter content is high. The seasonal high water table is at a depth of 3 to 6 feet.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, small grain, and alfalfa. This soil is well suited to crops. Drainage will improve crop production. Working this soil when it is wet causes compaction and destruction of soil tilth. Grassed waterways will help prevent gullying.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, ponderosa pine, Siberian crabapple, hackberry, and green ash. The shrubs that are generally selected are American plum and lilac.

This soil is poorly suited as a site for septic tank absorption fields. The seasonal wetness and the restricted permeability are the main limitations. Subsurface drainage helps to remove water from the field, and placing the absorption field in a mound of suitable filtering material will keep the system above the zone of wetness. The restricted permeability generally can be overcome by increasing the size of the absorption field.

This soil has fair suitability as a building site. A shrink-swell potential is the main limitation. The structural damage caused by shrinking and swelling can be prevented by landscaping the site to remove surface water, building on a layer of suitable fill material, using subsurface drainage, and backfilling around foundations with suitable coarse material.

The damage to local roads and streets caused by low strength and frost action in this soil can be minimized by constructing the roads on coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches.

The land capability classification is I.

98—Colo silty clay loam. This level, poorly drained soil is on flood plains that are occasionally flooded. The areas of this unit on the large flood plains are long and broad and range from 20 to about 250 acres in size. Those along the smaller streams are long and narrow and range from 5 to about 30 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray silty clay loam about 36 inches thick. The underlying material to a depth of about 60 inches is olive gray, mottled silty clay loam. In places, there is more sand or the soil is calcareous. In some other places coarse textured sediments are within 60 inches of the surface.

Included with this soil in mapping are small areas of moderately well drained and well drained Alcester soils, poorly drained Marcus and Whitewood soils, and somewhat poorly drained Spillco soils. The Alcester soils are on upland toe slopes. The Marcus and Whitewood soils are in upland drainageways. The Spillco soils are on the slightly higher parts of the flood plains. Included soils make up 10 to 15 percent of the unit.

Permeability in this Colo soil is moderate, and runoff is slow. The available water capacity is very high or high. Organic matter content is high. The seasonal high water table is at a depth of 1 to 3 feet.

Most areas are used as cropland. Corn and soybeans are the most common crops. Some areas are pastured. If drained, this soil is well suited to crops. The seasonal wetness and the occasional flooding are the main management concerns. A drainage system can reduce the wetness, but adequate drainage outlets are not available in all areas. If tilled in the fall, the soil warms up and dries out sooner in the spring, allowing earlier seedbed preparation. Working the soil when it is wet causes compaction of the root zone. Grazing pastures when this soil is wet also causes compaction.

This soil has fair suitability for the trees and shrubs grown as windbreaks. Seedling mortality is moderate because of the wetness. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are eastern cottonwood, golden willow, green ash, and silver maple. The shrubs that are generally selected are Tatarian honeysuckle and lilac.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings because of the seasonal high water table and the flooding. Soils that are better suited to these uses usually are nearby. Local roads and streets built on this soil need drainage to lower the water table and should be above the level of flooding. The damage caused by the low strength of this soil can be minimized by providing coarse textured base material.

The land capability classification is IIw.

129—Cylinder loam, occasionally flooded. This nearly level, somewhat poorly drained soil is on stream benches. The areas of this unit are irregular in shape and range from 3 to about 100 acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is loam about 14 inches thick. The upper part is black, and the lower part is very dark grayish brown. The subsoil is dark grayish brown loam about 10 inches thick. The next layer is olive brown, mottled sandy loam about 4 inches thick. The underlying material to a depth of about 60 inches is olive brown and dark grayish brown gravelly sand. In places the surface and subsurface layers are thicker.

Included with this soil in mapping are small areas of well drained Fairhaven soils, poorly drained Millington and Talcot soils, and somewhat poorly drained Spillco soils. The Fairhaven soils are on rises on outwash plains. The Millington and Spillco soils are on flood plains. They have no coarse sediments within a depth of 40 inches. The Talcot soils are on outwash plains and are calcareous throughout. Included soils make up 5 to 15 percent of the unit.

Permeability in this Cylinder soil is moderate in the upper part and very rapid in the lower part. Runoff is slow. The available water capacity is moderate. Organic matter content is high. The seasonal high water table is at a depth of 2 to 4 feet.

Most areas of this soil are used as cropland. Corn and soybeans are the most common crops. This soil is well suited to crops. Flooding in the spring sometimes delays tillage. Some crops on this soil are subject to moisture stress late in the growing season. Irrigation improves crop production but is not practical in many areas because they are small. Large open areas with no plant cover are subject to soil blowing. A conservation tillage system that leaves crop residue on the surface helps reduce erosion.

This soil has fair suitability for the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are eastern cottonwood, green ash, hackberry, and Manchurian crabapple. The shrubs that are generally selected are American plum and lilac.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings because of flooding, and contamination of ground water is a hazard in areas used for septic systems.

Roadbeds for local roads and streets should be constructed above the level of flooding. Removing water from ditches minimizes the damage to roads caused by frost action. This soil is a fair source of roadfill material and a probable source of sand.

The land capability classification is IIs.

140—Spicer silty clay loam. This nearly level, poorly drained soil is on slight rises in drainageways. The areas of this unit are irregular in shape and range from 3 to about 80 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is silty clay loam about 9 inches thick. The upper part is black, and the lower part is very dark gray. The subsoil is dark grayish brown, mottled silty clay loam about 18 inches thick. The underlying material to a depth of about 60 inches is olive gray, mottled silty clay loam. In places the surface and subsurface layers are thicker. In some areas the soil has been leached of carbonates.

Included with this soil in mapping are small areas of poorly drained Rushmore and Whitewood soils and somewhat poorly drained Trent soils. The Rushmore and Whitewood soils have been leached of calcium carbonate and are in wet drainageways. The Rushmore soils have glacial till at a depth of 24 to 40 inches. The Trent soils are on foot slopes above the Spicer soil. The Whitewood soils have a thick, dark surface layer. In some areas of Denver Township, this soil has a finer textured subsoil. Included soils make up 10 to 15 percent of the unit.

Permeability in this Spicer soil is mainly moderate, and runoff is slow. In sections 18 and 19 of Denver Township, the permeability of this soil is moderately slow. The available water capacity is high or very high. Organic matter content is high. The seasonal high water table is at a depth of 1 to 3 feet.

Most areas of this soil are used as cropland. Corn, soybeans, small grain, and alfalfa are the most common crops. This soil is well suited to crops, but drainage is necessary for optimum crop production. Because of a high content of lime in this soil, there is a fertility imbalance in some areas. Soybeans, for example, often exhibit iron chlorosis, or "yellowing." Supplemental fertilization helps to overcome this limitation. Fall tillage will help this soil warm up and dry out sooner in the spring, allowing earlier seedbed preparation. Working this soil when it is wet causes compaction and destruction of soil tilth.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Seedling mortality is severe because of the wetness and the high content of lime. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are eastern cottonwood and golden willow. The shrubs that are generally selected are Tatarian honeysuckle and lilac.

This soil is poorly suited to septic tank absorption fields. The seasonal wetness and the restricted permeability are the main limitations. Subsurface drainage helps to remove water from the field, and placing the absorption field in a mound of suitable filtering material will keep the system above the zone of wetness. The restricted permeability generally can be overcome by increasing the size of the absorption field.

This soil is poorly suited as a building site. The seasonal wetness and a shrink-swell potential can be minimized by removing the excess subsurface water with drainage tile or covering the soil with suitable fill material and landscaping the site to keep water from standing on the surface.

The damage to local roads and streets caused by the seasonal wetness, low soil strength, frost action, and the shrink-swell potential can be minimized by constructing the roads on coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches. This soil is a good source of topsoil.

The land capability classification is IIw.

149B—Everly clay loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex ridgetops and plane and convex side slopes. The areas of this unit are irregular in shape and range from 5 to about 300 acres in size.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is dark brown clay loam about 5 inches thick. The subsoil is dark yellowish brown clay loam about 13 inches thick. The underlying material to a depth of about 60 inches is light olive brown clay loam. In places, a mantle of loess over 20 inches thick is on the surface or a thin layer of sandy material is on the surface. A few areas have slopes of more than 6 percent.

Included with this soil in mapping are small areas of well drained Flandreau and Moody soils, poorly drained Rushmore soils, and moderately well drained and somewhat poorly drained Ransom and Wilmonton soils. The Flandreau soils are on side slopes and have sandy underlying material. The Moody soils are on side slopes and contain more silt than this Everly soil. The Rushmore soils are in wet drainageways. The Ransom and Wilmonton soils are on foot slopes and in shallow drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability in this Everly soil is moderately slow, and runoff is medium. The available water capacity is high. Organic matter content is moderate.

Most areas of this soil are used as cropland. Corn, soybeans, small grain, and alfalfa are the most common crops. This soil is well suited to crops. A conservation tillage system that leaves the crop residue on the surface reduces runoff, conserves moisture, and controls erosion.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, hackberry, and green ash. The shrubs that are generally selected are Tatarian honeysuckle and lilac.

This soil is poorly suited as a site for septic tank absorption fields and has fair suitability as a building site. The restricted permeability in this soil can be overcome by enlarging the absorption field. The damage to buildings caused by a shrink-swell potential can be prevented by landscaping the site to keep water from standing on the surface and by backfilling around foundations with suitable coarse material.

The damage to local roads and streets caused by the shrinking and swelling and low strength of this soil can be minimized by using a coarse textured base material. This soil is a fair source of topsoil.

The land capability classification is IIe.

149C—Everly clay loam, 6 to 12 percent slopes. This sloping, well drained soil is on convex ridgetops and side slopes. The areas of this unit are irregular in shape and range from 3 to about 40 acres in size.

Typically, the surface layer is very dark brown clay loam about 7 inches thick. The subsoil is clay loam about 22 inches thick. The upper part is dark brown, and the lower part is dark yellowish brown. The underlying material to a depth of about 60 inches is light olive brown clay loam. In places, a mantle of loess over 20 inches thick is on the surface or a thin mantle of sandy material is on the surface. Some areas have slopes of more than 12 or less than 6 percent.

Included with this soil in mapping are small areas of poorly drained Rushmore and Whitewood soils, moderately well drained and somewhat poorly drained Ransom and Wilmonton soils, and well drained Steinauer soils. The Rushmore and Whitewood soils are in wet drainageways. The Ransom and Wilmonton soils are in shallow drainageways and on foot slopes. The Steinauer soils are on the steeper side slopes and have a surface layer that is thinner than that of this Everly soil. Included soils make up 5 to 15 percent of the unit.

Permeability in this Everly soil is moderately slow, and runoff is medium. The available water capacity is high. Organic matter content is moderate.

Most areas of this soil are used as cropland. Corn, soybeans, small grain, and alfalfa are the most common crops. This soil has fair suitability for cultivated crops. In places water seeps out on hillsides or stands in terrace channels that are not graded. Erosion is a hazard on long slopes. A conservation tillage system that leaves crop residue on the surface reduces runoff and helps prevent erosion. In areas where slopes are smooth and uniform, farming on the contour or terracing helps reduce erosion. On irregular slopes, erosion can be reduced by growing hay crops.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, hackberry, and green ash. The shrubs that are generally selected are Tatarian honeysuckle and lilac.

This soil is poorly suited as a site for septic tank absorption fields and has fair suitability as a building site. The hazard of erosion is severe. Diverting water away from the site before and during construction and revegetating the site as soon as construction is complete will help reduce the erosion hazard. The restricted permeability of this soil can be overcome by enlarging the absorption field. The structural damage to buildings caused by a shrink-swell potential can be prevented by landscaping sites to remove surface water and backfilling around foundations with suitable coarse material.

The damage to local roads and streets caused by the shrinking and swelling and low strength of this soil can be prevented by using coarse textured base material.

The land capability classification is IIIe.

156A—Fairhaven silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is in concave to convex areas on outwash plains. The areas of this unit are irregular in shape and range from 10 to about 400 acres in size.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is very dark grayish brown loam about 5 inches thick. The subsoil is loam about 24 inches thick. The upper part is dark yellowish brown, and the lower part is yellowish brown. The underlying material to a depth of about 60 inches is yellowish brown and brown gravelly sand. Some places are shallower to the underlying material. Some areas have slopes of more than 2 percent. A few places do not have an abrupt textural change between the surface layer and the underlying material.

Included with this soil in mapping are small areas of well drained Dickman soils, moderately well drained Graceville soils, and somewhat poorly drained Cylinder and Spillco soils. The Dickman soils are in landscape positions similar to those of the Fairhaven soil but contain less gravel. The Graceville soils have coarse textured sediments at a depth of more than 45 inches. They are in shallow drainageways. The Cylinder soils are on stream benches. The Spillco soils are on flood plains. Included soils make up 10 to 15 percent of the unit.

Permeability in this Fairhaven soil is moderate in the upper part and rapid in the lower part. Runoff is slow. The available water capacity is moderate or low. Organic matter content is moderate.

Most areas of this soil are used as cropland. Corn, soybeans, and small grain are the most common crops. This soil is well suited to crops, but some crops are subject to moisture stress during the growing season because of the moderate or low amount of moisture held in the soil. Conservation tillage conserves moisture, and irrigation improves crop production. Soil blowing is a hazard on large open areas with no plant cover. Leaving crop residue on the surface or planting windbreaks and grass barriers where practical will help protect these areas from soil blowing.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is moderate. The trees that are generally selected for planting are ponderosa pine, green ash, and Manchurian crabapple. The shrubs that are generally selected are lilac and Tatarian honeysuckle.

This soil is poorly suited as a site for septic tank absorption fields. It does not adequately filter effluent, causing a hazard of ground-water contamination.

This soil is well suited as a site for buildings and for local roads and streets. The lower part of this soil is a good source of roadfill material and is a probable source of sand or gravel.

The land capability classification is IIs.

156B—Fairhaven silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on plane and convex side slopes on the edge of outwash plains and on small knolls on outwash plains. The areas of this unit are irregular in shape or long and narrow and range from 3 to about 40 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsoil is loam about 21 inches thick. The upper part is dark brown, and the lower part is dark yellowish brown. The underlying material to a depth of about 60 inches is yellowish brown and brown loamy coarse sand and gravelly sand. Some places are shallower to the underlying material. Some areas have slopes of less than 2 percent. Some places do not have an abrupt textural change between the surface layer and the underlying material.

Included with this soil in mapping are small areas of well drained Dickman soils, somewhat poorly drained Cylinder soils, and excessively drained Salida soils. The Dickman soils are in landscape positions similar to those of this Fairhaven soil but contain less gravel. The Cylinder soils are on stream benches. The Salida soils are in landscape positions similar to those of this Fairhaven soil but have gravel at or near the surface. Included soils make up 10 to 15 percent of the unit.

Permeability in this Fairhaven soil is moderate in the upper part and rapid in the lower part. Runoff is slow or medium. The available water capacity is moderate or low. Organic matter content is moderate.

Most areas of this soil are used as cropland. Corn, soybeans, and small grain are the most common crops. This soil is well suited to crops, but some crops are subject to moisture stress during the growing season because of the moderate or low amount of moisture held in the soil. A conservation tillage system that leaves crop residue on the surface conserves moisture. Irrigation improves crop production. This soil is on short slopes where erosion can be controlled by conservation tillage and contour farming.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is moderate. The trees that are generally selected for planting are ponderosa pine, green ash, and Manchurian crabapple. The shrubs that are generally selected are Tatarian honeysuckle and lilac.

This soil is poorly suited as a site for septic tank absorption fields. It does not adequately filter effluent, causing a hazard of ground-water contamination.

This soil is well suited as a site for buildings and for local roads and streets. The lower part of this soil is a good source of roadfill material and is a probable source of sand or gravel.

The land capability classification is IIe.

214—Talcot silty clay loam. This nearly level, poorly drained soil is on outwash plains that are subject to occasional flooding. The areas of this unit are irregular in shape or long and narrow and range from 3 to about 350 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam about 14 inches thick. The subsoil is dark grayish brown and olive brown, mottled silty clay loam about 11 inches thick. The underlying material to a depth of about 60 inches is grayish brown, mottled coarse sand. In places the surface and subsurface layers are thicker. In some areas the coarse textured sediments are at a depth of more than 40 inches, and in others the soil is leached.

Included with this soil in mapping are small areas of somewhat poorly drained Cylinder soils and well drained Fairhaven soils. The Cylinder soils are on stream benches. The Fairhaven soils are higher on the landscape than the Talcot soil. Included soils make up 10 to 15 percent of the unit.

Permeability in this Talcot soil is moderate in the upper part and rapid in the lower part. Runoff is slow. The available water capacity is moderate. Organic matter content is high. The seasonal high water table is between the surface and a depth of 1 foot.

Most areas of this soil are used as cropland. Corn and soybeans are the most common crops. If drained, this soil is well suited to crops. Drainage is necessary for optimum crop production, but in some areas adequate outlets for drainage systems are not available. A high content of lime in this soil causes a fertility imbalance. Soybeans, for example, often exhibit iron chlorosis, or "yellowing." Supplemental fertilization will help overcome this limitation. Fall tillage will help this soil warm up and dry out sooner in the spring, allowing earlier seedbed preparation. Tilling when the soil is wet causes compaction and destruction of soil tilth. Some crops on this soil are subject to moisture stress late in the growing season. Irrigation can improve crop production but is not always practical.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Seedling mortality is severe because of the wetness and the high content of lime. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees generally selected for planting are eastern cottonwood and golden willow. The shrub that is generally selected is Tatarian honeysuckle.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings because of the seasonal high water table, the flooding, and a poor filtering capacity.

Local roads and streets built on this soil need drainage to lower the water table and should be above the level of flooding. This soil is a probable source of sand and gravel.

The land capability classification is IIw.

249—Marcus silty clay loam. This nearly level, poorly drained soil is in drainageways. The areas of this unit are long and narrow and range from 3 to about 160 acres in size.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsurface layer is very dark gray silty clay loam about 10 inches thick. The subsoil is dark grayish brown and grayish brown, mottled silty clay loam about 26 inches thick. The underlying material to a depth of about 60 inches is light brownish gray, mottled silt loam. In places strata of coarser material are in the substratum. In some areas, the surface and subsurface layers are thicker or the soil is calcareous.

Included with this soil in mapping are small areas of well drained Ihlen, Moody, and Sac soils; moderately well drained Trent soils; and poorly drained Calco soils. The Ihlen soils have bedrock at a depth of 20 to 40 inches. The Ihlen, Moody, and Sac soils are on side slopes. The Trent soils are in shallow drainageways and on foot slopes. The Calco soils are on flood plains. Included soils make up 10 to 15 percent of the unit.

Permeability in this Marcus soil is moderately slow in the upper part and moderate in the lower part. Runoff is slow. The available water capacity is high or very high. Organic matter content is high. The seasonal high water table is at a depth of 1 to 3 feet.

Most areas of this soil are used as cropland. Corn, soybeans, small grain, and alfalfa are the most common crops. This soil is well suited to crops. It is seasonally wet, and artificial drainage is necessary for optimum crop production. If tilled in fall, the soil warms up and dries out sooner in the spring, allowing earlier seedbed preparation. Working this soil when it is wet causes compaction and destruction of tilth. Grassed waterways will help prevent gullying.

This soil is fairly well suited to the trees and shrubs grown as windbreaks. Seedling mortality is moderate because of the wetness. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are eastern cottonwood, golden willow, green ash, and silver maple. The shrub that is generally selected is Tatarian honeysuckle.

This soil is poorly suited as a site for septic tank absorption fields. The seasonal high water table and the restricted permeability are the main limitations. They can be overcome by using subsurface drainage to lower the water table and enlarging the filter field area or building the absorption field in a mound of suitable filtering material above the zone of wetness.

This soil is poorly suited as a building site. The seasonal wetness and a shrink-swell potential are the main limitations. They can be minimized by using drainage tile to remove excess subsurface water, covering the soil with suitable fill material, and landscaping the site to remove water. Backfilling around foundations with suitable coarse material will provide added protection against the structural damage caused by shrinking and swelling.

The damage to local roads and streets caused by the seasonal wetness, low strength, frost action, and the shrinking and swelling can be minimized by constructing roads above the zone of wetness. The damage caused by frost action also can be minimized by removing water from road ditches. This soil is a good source of topsoil.

The land capability classification is IIw.

269—Millington clay loam, occasionally flooded. This level, poorly drained soil is on flood plains. The areas of this unit are long and broad or narrow and range from 10 to about 500 acres in size.

Typically, the surface layer is black clay loam about 8 inches thick. The subsurface layer is black clay loam about 24 inches thick. The underlying material to a depth of about 60 inches is dark gray, mottled clay loam. In places, there is more silt and less sand or sand and gravel are at a depth of less than 60 inches. In some areas the soil is leached. In other areas it is frequently flooded.

Included with this soil in mapping are small areas of moderately well drained and well drained Alcester soils, somewhat poorly drained Spillco soils, and poorly drained Whitewood soils. The Alcester soils are on upland toe slopes. The Spillco soils are on the slightly higher parts of the flood plains. The Whitewood soils are in upland drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability in this Millington soil is moderate, and runoff is slow. The available water capacity is high or very high. Organic matter content is high. The seasonal high water table is between the surface and a depth of 2 feet.

Most areas of this soil are used as cropland. Corn and soybeans are the most common crops. Some areas are pastured. If drained, this soil is well suited to crops. It is seasonally wet and subject to occasional flooding. Artificial drainage is needed for optimum crop production, but adequate outlets for drainage are not available in all areas. A high content of lime in this soil causes a fertility imbalance. Soybeans, for example, often exhibit iron chlorosis, or "yellowing." Supplemental fertilization will help overcome this limitation. Fall tillage will help this soil warm up and dry out sooner in the spring, allowing earlier seedbed preparation. Tilling when this soil is wet causes compaction and destruction of tilth, and grazing when the soil is wet also can cause compaction.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Seedling mortality is moderate or severe because of the wetness and the high content of lime. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are eastern cottonwood and green ash. The shrub that is generally selected is Tatarian honeysuckle.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings because of the seasonal high water table and the flooding. Local roads and streets on this soil need drainage to lower the water table and should be constructed above the level of flooding. The damage caused by low strength in this soil can be minimized by using coarse textured base material.

The land capability classification is IIw.

291—Ransom silty clay loam. This nearly level, moderately well and somewhat poorly drained soil is on concave foot slopes, on small rises, and in shallow drainageways. The areas of this unit are irregular in shape and range from 3 to about 40 acres in size.

Typically, the surface layer is black silty clay loam about 16 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 4 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown silt loam; the lower part is olive brown and yellowish brown, mottled loam. The underlying material to a depth of about 60 inches is olive brown, mottled clay loam. In places the depth to glacial till is less than 20 inches or more than 40 inches.

Included with this soil in mapping are small areas of well drained Everly and Sac soils and poorly drained Marcus and Rushmore soils. The Everly and Sac soils are on side slopes. The Marcus and Rushmore soils are in wet drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability in this Ransom soil is moderately slow, and runoff is slow. The available water capacity is high or very high. Organic matter content is high. The seasonal high water table is at a depth of 2.5 to 5 feet.

Most areas of this soil are used as cropland. Corn, soybeans, small grain, and alfalfa are the most common crops. This soil is well suited to crops. It is wet early in spring. Artificial drainage removes the excess water and improves crop production. If tilled in fall, this soil warms up and dries out sooner in the spring, allowing for earlier seedbed preparation. Tilling when the soil is wet causes compaction and destruction of tilth.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are Manchurian crabapple, hackberry, and green ash. The shrub that is generally selected is lilac.

This soil is poorly suited as a site for septic tank absorption fields. The seasonal wetness and the restricted permeability are the main limitations. Using subsurface drainage to remove excess water or placing the absorption field in a mound of suitable filtering material above the zone of wetness helps to minimize those limitations. Increasing the size of the absorption field helps to overcome the restricted permeability.

This soil has fair suitability as a building site. The structural damage caused by shrinking and swelling can be prevented by landscaping the site to remove water or building on a layer of suitable fill material. Subsurface drains are helpful in some areas. Backfilling around foundations with suitable coarse material will provide added protection against structural damage.

The damage to local roads and streets caused by low strength and frost action in this soil can be minimized by using coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches. This soil is a fair source of topsoil.

The land capability classification is I.

304—Rushmore silty clay loam. This nearly level, poorly drained soil is in drainageways. The areas are long and narrow and range from 3 to about 80 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is silty clay loam about 9 inches thick. The upper part is black, and the lower part is very dark gray. The subsoil is dark grayish brown, mottled silty clay loam about 9 inches thick. The underlying material to a depth of about 60 inches is grayish brown and light olive brown clay loam. In places, the depth to glacial till is more than 40 inches or the surface and subsurface layers are thicker.

Included with this soil in mapping are small areas of well drained Everly and Sac soils, moderately well drained and somewhat poorly drained Ransom and Wilmonton soils, and poorly drained Spicer soils. The Everly and Sac soils are on side slopes. The Ransom and Wilmonton soils are on foot slopes and in shallow drainageways. The Spicer soils are calcareous and are on slight rises in drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability in this Rushmore soil is moderately slow. Runoff is slow. The available water capacity and organic matter content are high. The seasonal high water table is at a depth of 1 to 3 feet.

Most areas of this soil are used as cropland. Corn, soybeans, small grain, and alfalfa are the most common crops. This soil is well suited to crops. It is seasonally wet, and artificial drainage is necessary for optimum crop production. If tilled in fall, this soil warms up and dries out sooner in the spring, allowing for earlier seedbed preparation. Tilling when the soil is wet causes compaction and destruction of tilth. Grassed waterways help prevent gullying.

This soil has fair suitability for the trees and shrubs grown as windbreaks. Seedling mortality is moderate because of the wetness. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are eastern cottonwood, golden willow, green ash, and silver maple. The shrubs that are generally selected are Tatarian honeysuckle and lilac.

This soil is poorly suited as a site for septic tank absorption fields. The seasonal high water table and the restricted permeability are the main limitations. They can be overcome by using subsurface drainage to lower the water table, enlarging the filter field area, or building the system in a mound of suitable filtering material above the zone of wetness.

This soil is poorly suited to building site development. The high water table and a shrink-swell potential are the major limitations. They can be overcome by using drainage tile to remove the excess subsurface water or covering the soil with suitable fill material and landscaping the site to remove water. Backfilling around foundations with suitable coarse material will provide added protection against structural damage.

The damage to local roads and streets caused by the seasonal wetness, low strength, frost action, and the shrinking and swelling can be overcome by using coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches. This soil is a fair source of topsoil.

The land capability classification is IIw.

306B—Sac silty clay loam, 1 to 5 percent slopes. This gently sloping, well drained soil is on plane and convex summits and side slopes. The areas of this unit are irregular in shape and range from 3 to about 1,000 acres in size.

Typically, the surface layer is very dark brown silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 4 inches thick. The subsoil is dark yellowish brown silty clay loam about 20 inches thick. The underlying material to a depth of about 60 inches is light olive brown clay loam. In places the depth to glacial till is more than 40 inches or less than 20 inches. In some areas slopes are more than 5 percent.

Included with this soil in mapping are small areas of well drained Flandreau soils; poorly drained Marcus, Rushmore, and Whitewood soils; moderately well drained and somewhat poorly drained Ransom soils; and moderately well drained Trent soils. The Flandreau soils are on side slopes and contain more sand than this Sac soil. The Marcus, Rushmore, and Whitewood soils are in wet drainageways. The Ransom and Trent soils are in shallow drainageways and on foot slopes. Included soils make up 5 to 15 percent of the unit.

Permeability in this Sac soil is moderate in the upper part and moderately slow in the lower part. Runoff is slow or medium. The available water capacity is high. Organic matter content is moderate.

Most areas of this soil are used as cropland. Corn, soybeans, small grain, and alfalfa are the most common crops. This soil is well suited to crops. Spring rainfall causes brief periods of wetness and delays fieldwork in some years. A conservation tillage system that leaves crop residue on the surface reduces runoff and conserves moisture. Erosion is a hazard on long slopes. Where slopes are smooth and uniform, farming on the contour will help prevent erosion. Where slopes are short and irregular, conservation tillage will help prevent erosion.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, ponderosa pine, hackberry, and green ash. The shrubs that are generally selected are Tatarian honeysuckle, lilac, and American plum.

This soil is poorly suited as a site for septic tank absorption fields because of the restricted permeability. This limitation can be overcome by enlarging the absorption field area.

This soil has fair suitability as a building site. Landscaping sites to remove water and backfilling around foundations with suitable coarse material will provide protection against the structural damage caused by a shrink-swell potential. The damage to local roads and streets caused by low strength and frost action can be prevented by using coarse textured base material. The damage caused by frost action also can be prevented by removing water from road ditches. This soil is a fair source of topsoil.

The land capability classification is IIe.

306C—Sac silty clay loam, 5 to 10 percent slopes. This sloping, well drained soil is on plain and convex side slopes and summits. The areas of this unit are irregular in shape and range from 3 to about 80 acres in size.

Typically, the surface layer is very dark brown silty clay loam about 8 inches thick. The subsoil is dark brown silty clay loam about 18 inches thick. The underlying material to a depth of about 60 inches is light olive brown clay loam. In places the depth to glacial till is more than 40 inches or less than 20 inches. In some areas slopes are more than 10 percent.

Included with this soil in mapping are small areas of moderately well drained and well drained Alcester soils, moderately well drained Trent soils, and poorly drained Whitewood soils. The Alcester soils are on toe slopes. The Trent soils are in shallow drainageways and on foot slopes. The Whitewood soils are in wet drainageways. Included soils make up 5 to 15 percent of the unit.

Permeability in this Sac soil is moderate in the upper part and moderately slow in the lower part. Runoff is medium. The available water capacity is high. Organic matter content is moderate.

Most areas of this soil are used as cropland. Corn, soybeans, small grain, and alfalfa are the most common crops. This soil has fair suitability for crops. Erosion is a hazard on long slopes. Where slopes are smooth and uniform, farming on the contour or terracing helps reduce runoff and erosion. On short, irregular slopes, a conservation tillage system that leaves crop residue on the surface helps reduce erosion. Planting grasses also helps prevent erosion.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, ponderosa pine, hackberry, and green ash. The shrubs that are generally selected are Tatarian honeysuckle, lilac, and American plum.

This soil is poorly suited as a site for septic tank absorption fields because of the restricted permeability. This limitation can be overcome by enlarging the absorption field area.

This soil has fair suitability as a building site. Landscaping sites to remove surface water and backfilling around foundations with suitable coarse material will provide protection against the structural damage caused by a shrink-swell potential.

The damage to local roads and streets caused by low strength and frost action can be prevented by using coarse textured base material. The damage caused by frost action also can be prevented by removing water from road ditches. This soil is a fair source of topsoil.

The land capability classification is IIIe.

327B—Dickman sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on plane and convex side slopes, crests, and narrow ridges. The areas of this unit are irregular in shape and range from 3 to about 80 acres in size.

Typically, the surface layer is very dark brown sandy loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part of the subsoil is dark brown sandy loam; the lower part is dark yellowish brown sandy loam and loamy sand. The underlying material to a depth of about 60 inches is yellowish brown sand. In places the upper part of the soil contains more silt and clay and less sand. Some areas have slopes of more than 6 percent.

Included with this soil in mapping are small areas of well drained soils with glacial till, glacial drift, or loess within 60 inches of the surface. Also included are small areas of poorly drained Biscay soils and well drained Moody and Sac soils. The Biscay soils are in wet drainageways. The Moody soils are on side slopes and contain more silt than this Dickman soil. The Sac soils are on side slopes, contain more silt than this Dickman soil, and have glacial till within 40 inches of the surface. Included soils make up 5 to 15 percent of the unit.

Permeability in this Dickman soil is moderately rapid in the upper part and rapid in the lower part. Runoff is slow or medium. The available water capacity is low. Organic matter content is moderate.

Most areas of this soil are used as cropland. Corn, soybeans, and small grain are the most common crops. This soil has fair suitability for crops. Crops on this soil are subject to moisture stress during the growing season because of the low available water capacity. Tillage on the contour or a conservation tillage system that leaves a cover of crop residue will help to conserve moisture. Irrigation improves crop production. Erosion is a hazard on long slopes. On large open areas of this soil, soil blowing is a hazard when the ground is bare or when crops are in the early stages of growth. Conservation tillage helps to control erosion.

This soil has fair suitability for the trees and shrubs grown as windbreaks. Seedling mortality is moderate or severe because of the lack of moisture. The most common tree selected for planting is ponderosa pine, and the most common shrub is lilac.

This soil is poorly suited as a site for septic tank absorption fields. It does not adequately filter effluent. Placing the filter field in a mound of suitable material will help overcome this limitation.

This soil is well suited as a site for buildings and local roads and streets. It is a probable source of sand and a good source of roadfill material.

The land capability classification is IIIe.

327C—Dickman sandy loam, 6 to 12 percent slopes. This sloping, well drained soil is on plane and convex side slopes. The areas of this unit are irregular in shape and range from 3 to about 40 acres in size.

Typically, the surface layer is very dark brown sandy loam about 10 inches thick. The subsoil is about 10 inches thick. The upper part of the subsoil is dark brown sandy loam; the lower part is dark yellowish brown sandy loam. The underlying material to a depth of about 60 inches is yellowish brown loamy sand and sand. In places the upper part of the soil contains more silt and clay and less sand. Some areas have slopes of more than 12 percent or less than 6 percent.

Included with this soil in mapping are small areas of well drained soils with glacial till, glacial drift, or loess within 60 inches of the surface. Also included are small areas of moderately well drained and well drained Alcester soils and well drained Moody and Sac soils. The Alcester soils are in shallow drainageways and on toe slopes. The Moody soils contain more silt than this Dickman soil and are on side slopes. The Sac soils are on side slopes, contain more silt than this Dickman soil, and have glacial till within 40 inches of the surface. Included soils make up 5 to 15 percent of the unit.

Permeability in this Dickman soil is moderately rapid in the upper part and rapid in the lower part. Runoff is medium. The available water capacity is low. Organic matter content is moderate.

Most areas of this soil are used as cropland or hayland. The most common crops are corn, soybeans, small grain, and alfalfa. This soil has fair suitability for crops and hay. Crops on this soil are subject to moisture stress because of the low available water capacity. Irrigation improves crop production. Erosion is a management concern. Applying a conservation tillage system that leaves crop residue on the surface, farming on the contour, or planting hay will help reduce erosion. Terraces also help prevent erosion and conserve moisture.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Seedling mortality is severe because of the lack of moisture. The most common tree selected for planting is ponderosa pine. The most common shrub is lilac.

This soil is poorly suited as a site for septic tank absorption fields. It does not adequately filter effluent. Placing the filter field in a layer of suitable material will help overcome this limitation.

This soil has fair suitability as a site for buildings and local roads and streets. Slope is the main limitation, and erosion is a hazard during and after construction. Erosion can be reduced by diverting water away from sites before construction and establishing a plant cover on the sites as soon as construction is completed. This soil is a probable source of sand and a fair source of roadfill material.

The land capability classification is IVe.

345—Wilmonton silty clay loam. This nearly level, somewhat poorly drained and moderately well drained soil is on concave foot slopes, on small rises, and in shallow drainageways. The areas of this unit are irregular in shape and range from 3 to about 25 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 19 inches thick. The upper part of the subsoil is dark brown loam; the lower part is olive brown, mottled clay loam. The underlying material to a depth of about 60 inches is light olive brown and grayish brown, mottled clay loam. In places free carbonates are closer to the surface. In some areas, the depth to glacial till is more than 30 inches or there is more sand in the surface layer.

Included with this soil in mapping are small areas of well drained Everly soils and poorly drained Marcus and Rushmore soils. The Everly soils are on side slopes. The Marcus and Rushmore soils are in wet drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability in this Wilmonton soil is moderately slow, and runoff is slow. The available water capacity is high or very high. Organic matter content is high. The seasonal high water table is at a depth of 2.5 to 5 feet.

Most areas of this soil are used as cropland. Corn, soybeans, small grain, and alfalfa are the most common crops. This soil is well suited to crops. In some years wetness is a limitation early in the spring. Artificial drainage removes excess water and improves crop production. If tilled in fall, this soil will warm up and dry out sooner in the spring, allowing earlier seedbed preparation. Tilling when this soil is wet causes compaction and destruction of tilth.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are ponderosa pine, Manchurian crabapple, hackberry, and green ash. The shrubs that are generally selected are American plum and lilac.

This soil is poorly suited as a site for septic tank absorption fields. The seasonal wetness and the restricted permeability are the main limitations. Using subsurface drainage to remove excess water or placing the absorption field in a mound of suitable filtering material will keep septic systems above the zone of wetness. Increasing the size of the absorption field will help overcome the restricted permeability.

This soil has fair suitability as a building site. Landscaping the site to remove water, building on a layer of suitable fill material, or removing excess water with subsurface drainage will help to prevent the structural damage caused by a shrink-swell potential. Backfilling around foundations with suitable material will provide added protection against structural damage.

The damage to local roads and streets caused by low strength and frost action in this soil can be minimized by using coarse textured base material. The damage caused by frost also can be minimized by removing water from ditches. This soil is a fair source of topsoil.

The land capability classification is I.

362—Millington clay loam, frequently flooded. This level, poorly drained soil is on flood plains. The areas of this unit are irregular in shape or long and narrow and range from 10 to 300 acres in size.

Typically, the surface layer is black clay loam about 10 inches thick. The subsurface layer is black clay loam about 22 inches thick. The underlying material to a depth of about 60 inches is dark gray clay loam. In places this soil contains less sand or has coarse textured sediments within 60 inches of the surface. In some areas, the soil is leached or it is only occasionally flooded.

Included with this soil in mapping are small areas of moderately well drained and well drained Alcester soils, poorly drained Whitewood soils, and somewhat poorly drained Spillco soils. The Alcester soils are on upland toe slopes. The Whitewood soils are in upland drainageways. The Spillco soils are on the slightly higher parts of the flood plains. Included soils make up 10 to 15 percent of the unit.

Permeability in this Millington soil is moderate, and runoff is slow. The available water capacity is high or very high. Organic matter content is high. The seasonal high water table is between the surface and a depth of 2 feet.

Most areas of this soil are used as pasture or are idle. This soil is generally unsuited to crops because of frequent flooding before and during the growing season. Grazing when this soil is wet causes compaction and destruction of the root zone.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Seedling mortality is moderate or severe because of the wetness and a high content of lime. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or by applications of herbicide. The tree generally selected for planting is eastern cottonwood. The shrub generally selected is lilac.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings because of the seasonal high water table and the flooding.

In areas where local roads and streets are built on this soil, the design should include a means of lowering the water table. The roadbed should be constructed above the level of flooding. The damage caused by the low strength of the soil can be minimized by using coarse textured base material.

The land capability classification is Vw.

392—Biscay silty clay loam. This nearly level, poorly drained soil is on outwash plains. The areas of this unit are irregular in shape and range from 3 to about 160 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is black and very dark grayish brown silty clay loam and clay loam about 13 inches thick. The subsoil is dark gray and gray, mottled clay loam about 10 inches thick. The underlying material to a depth of about 60 inches is grayish brown, mottled coarse sand. In places the coarse textured sediments are at a greater depth.

Included with this soil in mapping are small areas of somewhat poorly drained Cylinder soils, well drained Dickman and Flandreau soils, and poorly drained Talcot soils. The Cylinder soils are on stream benches. The Dickman and Flandreau soils are on knolls and convex side slopes. The Talcot soils are calcareous throughout and are occasionally flooded. Included soils make up 5 to 15 percent of the unit.

Permeability in this Biscay soil is moderate in the upper part and rapid in the lower part. Runoff is slow. The available water capacity is moderate. Organic matter content is high. The seasonal high water table is at a depth of 1 to 3 feet.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, and small grain. This soil is well suited to crops. It is seasonally wet, and artificial drainage is necessary for optimum crop production. If tilled in fall, the soil warms up and dries out sooner in the spring, allowing earlier seedbed preparation. Tilling when the soil is wet causes compaction and destruction of tilth. Crops on this soil are subject to moisture stress late in the growing season in years when rainfall is below normal. Irrigation will improve production but is not always practical.

This soil has fair suitability for the trees and shrubs grown as windbreaks. Seedling mortality is moderate because of the wetness. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are eastern cottonwood, golden willow, and green ash. The shrubs that are generally selected are Tatarian honeysuckle and lilac.

This soil is poorly suited as a site for septic tank absorption fields and buildings. Because of the seasonal high water table and a poor filtering capacity, septic systems do not function properly. Placing the system in a mound of suitable filtering material helps to overcome those limitations, but contamination of the ground water is a hazard in some areas used for septic systems.

Where roads and streets are built on this soil, lowering the water table and building the roadbed above the zone of wetness help to prevent the damage caused by frost action. This soil is a probable source of sand and gravel.

The land capability classification is IIw.

443—Ihlen Variant silt loam, 0 to 3 percent slopes. This gently sloping, well drained soil is on concave to convex areas underlain by quartzite bedrock. The areas of this unit are irregular in shape and range from 3 to about 100 acres in size.

Typically, the surface layer is black silt loam about 14 inches thick. It is underlain by red and pale red quartzite bedrock. In places the depth to bedrock is more than 20 inches.

Included with this soil in mapping are small areas where bedrock crops out. These inclusions make up 1 to 15 percent of the unit.

Permeability in the Ihlen Variant soil is moderate, and runoff is slow or medium. The available water capacity is very low. Organic matter content is high.

Most areas of this soil are used as pasture or are idle. This soil is unsuited to cultivated crops. A shallow root zone and the very low available water capacity are the main limitations. Overgrazing of pastured areas causes poor regeneration of plants, but a deferred grazing program will help maintain the pasture plants.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Seedling mortality is severe because of the lack of available moisture. Onsite evaluation is necessary to determine the management needs and the species suitable for planting.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings. The major limitation is the depth to bedrock.

The land capability classification is VIs.

490—Whitewood silty clay loam. This nearly level, poorly drained soil is in drainageways. The areas are long and narrow or irregular in shape and range from 3 to about 200 acres in size.

Typically, the surface layer is black silty clay loam about 8 inches thick. The subsurface layer is silty clay loam about 19 inches thick. The upper part is black, and the lower part is very dark gray. The subsoil is olive gray, mottled silty clay loam about 23 inches thick. The underlying material to a depth of about 60 inches also is olive gray, mottled silty clay loam. In places, the surface layer is calcareous or recent colluvial or local alluvial sediments are on the surface. Some areas have glacial till within 60 inches of the surface. In places the dark surface and subsurface layers are thinner.

Included with this soil in mapping are small areas of moderately well drained and well drained Alcester soils; well drained Moody, Nora, and Sac soils; moderately well drained Trent soils; and poorly drained Spicer soils. The Alcester soils are in shallow drainageways and on toe slopes. The Trent soils are in shallow drainageways and on foot slopes. The Moody, Nora, and Sac soils are on side slopes. The Spicer soils are calcareous and are on slight rises within drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability in this Whitewood soil is moderately slow, and runoff is slow. The available water capacity is high or very high. Organic matter content is high. The seasonal high water table is at a depth of 1 to 3 feet.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, small grain, and alfalfa. This soil is well suited to crops. It is seasonally wet, and artificial drainage is necessary for optimum crop production. If tilled in fall, this soil warms up and dries out sooner in the spring, allowing earlier seedbed preparation. Tilling when the soil is wet causes compaction and destruction of tilth. Grassed waterways prevent gullying.

This soil has fair suitability for the trees and shrubs grown as windbreaks. Seedling mortality is moderate because of the wetness. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are eastern cottonwood, golden willow, and green ash. The shrub generally selected is lilac.

This soil is poorly suited as a site for septic tank absorption fields and buildings. The seasonal high water table and the restricted permeability are the main limitations on sites for septic systems. These can be overcome by using subsurface drainage to lower the water table and building the absorption field in a mound of suitable material. The seasonal wetness and a shrink-swell potential are limitations affecting building site development. They can be overcome by using drainage tile to remove the excess subsurface water or covering the soil with suitable fill material and landscaping to remove surface water. Backfilling with coarse material will provide added protection against structural damage.

The damage to local roads and streets caused by the seasonal wetness, low strength, frost action, and the shrink-swell potential can be minimized by using coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches. This soil is a good source of topsoil.

The land capability classification is IIw.

596E—Steinauer clay loam, 15 to 45 percent slopes. This moderately steep and steep, well drained soil is on plane and convex side slopes adjacent to stream valleys and large alluvial plains. The areas are long and narrow and range from 3 to about 40 acres in size.

Typically, the surface layer is very dark brown clay loam about 5 inches thick. The subsoil is brown clay loam about 4 inches thick. The underlying material to a depth of about 60 inches is light olive brown and grayish brown clay loam.

Included with this soil in mapping are small areas of moderately well drained and well drained Alcester soils and well drained Everly soils. The Alcester soils are on toe slopes. The Everly soils are on side slopes and have a dark colored surface layer and subsurface layer. Included soils make up 10 to 15 percent of the unit.

Permeability in this Steinauer soil is moderately slow, and runoff is rapid. The available water capacity is high. Organic matter content is low or moderately low.

Most areas of this soil are used for pasture or hay. This soil is unsuited to cultivated crops. The low or moderately low content of organic matter, a high content of lime, and the slope are the major limitations. Overgrazing causes poor plant regeneration, and heavy animal traffic can expose the soil surface and cause erosion. Deferred grazing will help reduce these hazards.

This soil is unsuited to the trees and shrubs grown as windbreaks, but it is suitable for other types of plantings. Seedling mortality is severe on south- and west-facing slopes. The slope limits the use of equipment and causes a severe erosion hazard.

This soil is generally unsuitable as a site for buildings and septic tank absorption fields. The major limitation is the slope. The restricted permeability is a limitation on sites for septic tank absorption fields. Erosion is a major concern during road construction. Diverting water away from sites before and during construction and establishing a plant cover as soon as construction is complete will help protect these areas from erosion. Roads should be constructed on coarse textured base material.

The land capability classification is VIe.

610—Calco silty clay loam, frequently flooded. This level, poorly drained soil is on flood plains. The areas of this unit are irregular in shape or long and narrow and range from 10 to about 300 acres in size.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsurface layer also is black silty clay loam. It is about 26 inches thick. The underlying material to a depth of about 60 inches is dark gray and gray silty clay loam. In places coarse textured sediments are within 60 inches of the surface. Some areas contain more sand and less silt, and others are occasionally flooded. In some areas the soil is leached.

Included with this soil in mapping are small areas of moderately well drained Alcester soils, poorly drained Whitewood soils, and somewhat poorly drained Spillco soils. The Alcester soils are on upland toe slopes. The Whitewood soils are in upland drainageways. The Spillco soils are on the higher parts of the flood plains and contain less silt than this Calco soil. Included soils make up 10 to 15 percent of the unit.

Permeability in this Calco soil is moderate, and runoff is slow. The available water capacity is very high or high. Organic matter content is high. The seasonal high water table is at a depth of 1 to 3 feet.

Most areas of this soil are used as pasture or are idle. This soil is generally unsuited to crops because of frequent flooding before and during the growing season. Grazing when the soil is wet causes compaction and destruction of tilth.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Seedling mortality is moderate or severe because of the wetness and a high content of lime. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The tree generally selected for planting is eastern cottonwood. The shrubs that are generally selected are Tatarian honeysuckle and lilac.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings because of the seasonal high water table and the flooding hazard.

In areas where roads and streets are built on this soil, the design should include a means of lowering the water table. The roadbed should be constructed above the level of flooding. The damage caused by low strength can be minimized by using coarse textured base material.

The land capability classification is Vw.

658A—Dempster silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on concave to convex areas on outwash plains. Some areas of this unit are irregular in shape and range from 3 to about 20 acres in size. Some are long and broad and range from 15 to about 500 acres.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 5 inches thick. The subsoil is dark brown silt loam and silty clay loam about 17 inches thick. The underlying material to a depth of about 60 inches is brown gravelly sand. Some places are shallower to the underlying material. Some areas have slopes of more than 2 percent.

Included with this soil in mapping are small areas of somewhat poorly drained Cylinder and Spillco soils and moderately well drained Graceville soils. The Cylinder soils are on stream benches. The Spillco soils are on the higher parts of flood plains. The Graceville soils have coarse textured sediments at a depth of more than 40 inches. They are in drainageways. Included soils make up 5 to 15 percent of the unit.

Permeability in this Dempster soil is moderate in the upper part and rapid in the lower part. Runoff is slow. The available water capacity and organic matter content are moderate.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, and small grain. This soil is well suited to crops. Crops are subject to moisture stress because of the moderate amount of moisture in this soil. A conservation tillage system that leaves a cover of crop residue helps to conserve moisture. Irrigation will improve crop production. Soil blowing is a hazard in large open areas when the ground is bare. Leaving crop residue on the surface or planting windbreaks and grass barriers will help to protect these areas from soil blowing.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is moderate. The trees that are generally selected for planting are ponderosa pine, green ash, honeylocust, and Manchurian crabapple. The shrubs that are generally selected are lilac and Tatarian honeysuckle.

This soil is poorly suited as a site for septic tank absorption fields because it does not adequately filter effluent and there is a hazard of contamination of ground water.

This soil is well suited as a site for buildings and local roads and streets. The lower part of this soil is a good source of roadfill material. It is a probable source of sand or gravel.

The land capability classification is IIs.

658B—Dempster silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on plane and convex side slopes at the edge of outwash plains and on small knolls on outwash plains. The areas of this unit are irregular in shape or long and narrow and range from 3 to about 40 acres in size.

Typically, the surface layer is black silt loam about 7 inches thick. The subsurface layer is very dark brown silt loam about 5 inches thick. The subsoil is very dark grayish brown and dark grayish brown silty clay loam about 15 inches thick. The underlying material to a depth of about 60 inches is dark yellowish brown and yellowish brown gravelly sand. Some areas are shallower to the underlying material, and some have slopes of less than 2 percent.

Included with this soil in mapping are small areas of somewhat poorly drained Cylinder soils and excessively drained Salida soils. The Cylinder soils are on stream benches. The Salida soils are in landscape positions similar to those of the Dempster soil but have gravel at or near the surface. Included soils make up 5 to 10 percent of the unit.

Permeability in this Dempster soil is moderate in the upper part and rapid in the lower part. Runoff is slow or medium. The available water capacity and organic matter content are moderate.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, and small grain. This soil is well suited to crops. Crops on this soil are subject to moisture stress because of the moderate available water capacity. Tillage on the contour or a conservation tillage system that leaves a cover of crop residue helps to conserve moisture and control erosion. Irrigation will improve crop production.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is moderate. The trees that are generally selected for planting are ponderosa pine, green ash, honeylocust, and Manchurian crabapple. The shrubs that are generally selected are Tatarian honeysuckle and lilac.

This soil is poorly suited as a site for septic tank absorption fields because it does not adequately filter effluent, causing a hazard of ground-water contamination.

This soil is well suited as a site for buildings and local roads and streets. The lower part of this soil is a good source of roadfill material and is a probable source of sand or gravel.

The land capability classification is IIe.

659A—Graceville silt loam, 0 to 2 percent slopes. This nearly level, moderately well drained and well drained soil is in concave to convex positions on outwash plains. Some areas of this unit are long and broad and range from 20 to about 200 acres in size. Some are irregular in shape and range from 3 to about 40 acres.

Typically, the surface layer is black silt loam about 8 inches thick. The subsurface layer is very dark grayish brown silt loam about 17 inches thick. The subsoil is dark yellowish brown silt loam about 13 inches thick. The upper part of the underlying material is dark yellowish brown silt loam. The lower part to a depth of about 60 inches is brown gravelly sand. In some places the surface and subsurface layers are thinner. Some areas have slopes of more than 2 percent.

Included with this soil in mapping are small areas of well drained Dempster soils and somewhat poorly drained Spillco soils. The Dempster soils are in positions on the landscape similar to those of the Graceville soil but have coarse textured sediments within 40 inches of the surface. The Spillco soils are on the higher parts of flood plains. Included soils make up 5 to 15 percent of the unit.

Permeability in the Graceville soil is moderate, and runoff is slow. The available water capacity is very high. Organic matter content is high.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, and small grain. This soil is well suited to crops. Crops on this soil are subject to moisture stress late in the growing season in years when rainfall is below normal. Soil blowing is a hazard on large open areas when the ground is bare. Leaving crop residue on the surface or planting windbreaks and grass barriers will protect these areas from soil blowing.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, ponderosa pine, Siberian crabapple, hackberry, and green ash. The shrubs that are generally selected are American plum and lilac.

This soil is generally suitable as a site for septic tank absorption fields. It has fair suitability as a building site. Landscaping to remove water from the surface and backfilling with suitable coarse material will provide protection against the structural damaged caused by a shrink-swell potential.

The damage to local roads and streets caused by low strength and a frost-action potential in this soil can be minimized by using coarse textured base material and removing water from road ditches. This soil is a good source of topsoil. The lower part of this soil is a good source of roadfill material and is a probable source of sand and gravel.

The land capability classification is I.

659B—Graceville silt loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on plane and convex side slopes on outwash plains. The areas of this unit are irregular in shape or long and narrow and range from 3 to about 150 acres in size.

Typically, the surface layer is black silt loam about 13 inches thick. The subsurface layer is very dark brown silt loam about 4 inches thick. The subsoil is dark brown silt loam about 22 inches thick. The underlying material to a depth of about 60 inches is brown silt loam. In places coarse textured sediments are within 60 inches of the surface. In some areas the surface and subsurface layers are thicker. Some areas have slopes of less than 2 percent.

Included with this soil in mapping are small areas of moderately well drained Trent soils and well drained Dempster soils. The Trent soils are on upland foot slopes and in shallow drainageways. The Dempster soils are in landscape positions similar to those of the Graceville soil but have coarse textured sediments within 40 inches of the surface. Included soils make up 5 to 10 percent of the unit.

Permeability in this Graceville soil is moderate, and runoff is slow or medium. The available water capacity is very high. Organic matter content is moderate.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, and small grain. This soil is well suited to crops. Crops on this soil are subject to moisture stress late in the growing season in years when rainfall is below normal. In most areas this soil is on short slopes. Runoff can be controlled by a conservation tillage system that leaves residue on the surface and by farming on the contour.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, ponderosa pine, Siberian crabapple, hackberry, and green ash. The shrubs that are generally selected are American plum and lilac.

This soil is generally suitable as a site for septic tank absorption fields. It has fair suitability for building sites. Landscaping to remove surface water and backfilling with suitable coarse material will provide protection against the structural damage caused by a shrink-swell potential.

The damage to local roads and streets caused by low strength and a frost-action potential in this soil can be minimized by using coarse textured base material and removing water from road ditches. This soil is a good source of topsoil.

The land capability classification is IIe.

661C—Nora silt loam, 4 to 10 percent slopes. This gently sloping and sloping, well drained soil is on convex summits and plane and convex side slopes. The areas of this unit are irregular in shape and range from 3 to about 200 acres in size.

Typically, the surface layer is very dark brown silt loam about 8 inches thick. The subsoil is silt loam about 25 inches thick. The upper part is dark brown and brown, and the lower part is yellowish brown. The underlying material to a depth of about 60 inches is yellowish brown silt loam. In places the depth to free carbonates is more than 30 inches. Some areas have slopes of more than 10 percent.

Included with this soil in mapping are small areas of moderately well drained and well drained Alcester soils, well drained Crofton and Sac soils, moderately well drained Trent soils, and poorly drained Whitewood soils. The Alcester soils are in shallow drainageways and on toe slopes. The Crofton soils are on convex nose slopes and are calcareous throughout. The Sac soils are on side slopes and summits and have glacial till within 40 inches of the surface. The Trent soils are on foot slopes and in shallow drainageways. The Whitewood soils are in wet drainageways. Included soils make up 5 to 15 percent of the unit.

Permeability in this Nora soil is moderate, and runoff is medium. The available water capacity is high or very high. Organic matter content is moderate.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, small grain, and alfalfa. This soil has fair suitability for crops. Erosion is a hazard on long slopes. Where slopes are smooth and uniform, farming on the contour or terracing will help prevent erosion. On other slopes, a conservation tillage system that leaves the crop residue on the surface will reduce runoff, help prevent erosion, and conserve moisture. Planting grasses also will help prevent erosion.

This soil is well suited to the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are blue spruce, ponderosa pine, Russian-olive, and green ash. The shrubs that are generally selected are American plum and lilac.

This soil has fair suitability as a site for buildings. Diverting water away from construction sites and establishing a plant cover on the sites as soon as construction is complete will help prevent erosion. Landscaping sites to remove surface water and backfilling with suitable coarse material will provide protection against the structural damage caused by a shrink-swell potential. The restricted permeability of this soil is a limitation on sites for septic tank absorption fields, but it generally can be overcome by increasing the size of the absorption field.

The damage to local roads and streets caused by low soil strength and a frost-action potential in this soil can be minimized by using coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches. This soil is a good source of topsoil.

The land capability classification is IIIe.

661D2—Nora silt loam, 10 to 18 percent slopes, eroded. This moderately steep, well drained soil is on plane and convex side slopes. The areas of this unit are irregular in shape and range from 3 to about 40 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is silt loam about 24 inches thick. The upper part is dark brown, and the lower part is dark yellowish brown and yellowish brown. The underlying material to a depth of about 60 inches is yellowish brown silt loam. In places the depth to free carbonates is more than 30 inches. Some areas have slopes of less than 10 percent.

Included with this soil in mapping are small areas of moderately well drained and well drained Alcester soils, well drained Crofton soils, and poorly drained Whitewood soils. The Alcester soils are in shallow drainageways and on toe slopes. The Crofton soils are on convex nose slopes and are calcareous throughout. The Whitewood soils are in wet drainageways. Also included are areas with glacial till within 40 inches of the surface. Included soils make up 5 to 15 percent of the unit.

Permeability in this Nora soil is moderate, and runoff is medium or rapid. The available water capacity is high or very high. Organic matter content is moderate.

Most areas of this soil are used as hayland or pasture or as cropland. The most common crops are corn, soybeans, small grain, and alfalfa. Because of a severe erosion hazard, this soil is unsuited to cultivated crops. It has fair suitability for hay and pasture, which help prevent erosion. Overgrazing pastures will cause poor regeneration of plants, and heavy animal traffic exposes the soil surface, increasing the erosion hazard. Deferred grazing will help reduce these hazards.

This soil is poorly suited to the trees and shrubs grown as windbreaks but can be used for other types of plantings. Onsite evaluation is necessary to determine the treatment needs and the species suitable for planting. Seedling mortality is severe on south- and west-facing slopes and moderate elsewhere. The use of equipment is severely limited. The hazard of erosion is severe.

This soil is fairly well suited or poorly suited as a site for buildings. Erosion is a hazard on building sites. Diverting water away from the sites before and during construction and establishing a plant cover as soon as construction is complete will help reduce this hazard. Landscaping sites to remove surface water and backfilling with suitable coarse material will provide protection against the structural damage caused by a shrink-swell potential. The restricted permeability of this soil is a limitation on sites for septic tank absorption fields, but it generally can be overcome by increasing the size of the absorption field.

The damage to local roads and streets caused by low strength and a frost-action potential in this soil can be minimized by using coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches.

The land capability classification is IVe.

662C2—Nora-Crofton silt loams, 6 to 12 percent slopes, eroded. These sloping, well drained soils are on uplands. The Nora soil is on plane and convex side slopes, and the Crofton soil is on convex ridgetops and nose slopes. Individual areas are irregular in shape and range from 20 to about 500 acres in size. They are 30 to 55 percent Nora soil and 15 to 45 percent Crofton soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Nora soil has a surface layer of very dark grayish brown silt loam about 8 inches thick. The subsoil is silt loam about 14 inches thick. The upper part is dark brown, and the lower part is yellowish brown. The underlying material to a depth of about 60 inches is yellowish brown silt loam. In some areas the depth to free carbonates is more than 30 or less than 15 inches. In other areas the slope is more than 12 percent. In places the surface layer is lighter colored.

Typically, the Crofton soil has a surface layer of dark brown silt loam about 8 inches thick. The subsurface layer is dark yellowish brown silt loam about 6 inches thick. The underlying material to a depth of about 60 inches is yellowish brown silt loam. In some places the surface layer is not calcareous. In other places it is thinner. In some areas the slope is more than 12 percent.

Included with these soils in mapping are small areas of moderately well drained and well drained Alcester soils and poorly drained Whitewood soils. The Alcester soils are in shallow drainageways and on toe slopes. The

Whitewood soils are in drainageways. Also included are areas where glacial till is within 40 inches of the surface. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Nora and Crofton soils, and runoff is medium. The available water capacity is high. Organic matter content is low or moderately low in the Crofton soil and moderate in the Nora soil.

Most areas are used as cropland. The most common crops are corn, soybeans, small grain, and alfalfa. These soils are fairly well suited to crops. Erosion is a hazard on the longer slopes. Where slopes are smooth and uniform, farming the contour or terracing helps to prevent excessive erosion. On the shorter, irregular slopes, a system of conservation tillage that leaves crop residue on the surface reduces the hazards of runoff and erosion and conserves moisture. Planting grasses also reduces the hazard of erosion.

These soils are fairly well suited to septic tank absorption fields and building site development. The restricted permeability is a limitation in septic tank absorption fields. It can be overcome by enlarging the absorption field. Diverting water away from the site and revegetating the site as soon as construction is completed help to control erosion during and after construction. A shrink-swell potential is a limitation on sites for buildings. The structural damage caused by shrinking and swelling can be prevented by proper landscaping, which helps to remove surface water, and by backfilling around foundations with suitable coarse textured material.

The damage to local roads and streets caused by low strength and frost action in these soils can be minimized by constructing the roads on coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches.

The land capability classification is IIIe.

662D2—Nora-Crofton silt loams, 12 to 18 percent slopes, eroded. These moderately steep, well drained soils are on uplands. The Nora soil is on plane and convex side slopes, and the Crofton soil is on convex ridgetops and nose slopes. The areas are irregular in shape and range from 10 to about 100 acres in size. They are about 30 to 50 percent Nora soil and 20 to 50 percent Crofton soil. The two soils occur as areas so intricately mixed or so small that it is not practical to map them separately.

Typically, the Nora soil has a surface layer of dark brown silt loam about 8 inches thick. The subsoil is silt loam about 22 inches thick. The upper part is brown, and the lower part is dark yellowish brown and yellowish brown. The underlying material to a depth of about 60 inches is yellowish brown silt loam. In places the depth to free carbonates is less than 15 inches. Some areas have slopes of less than 12 percent, and some have a lighter colored surface layer.

Typically, the Crofton soil has a surface layer of dark brown silt loam about 8 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The underlying material to a depth of about 60 inches is yellowish brown silt loam. In places the surface layer is not calcareous. Some areas have a thicker surface layer, and some have slopes of less than 12 percent.

Included with these soils in mapping are small areas of moderately well drained and well drained Alcester soils and poorly drained Whitewood soils. The Alcester soils are on toe slopes and in shallow drainageways. The Whitewood soils are in wet drainageways. Also included are areas where glacial till is within 40 inches of the surface. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Nora and Crofton soils, and runoff is medium or rapid. The available water capacity is high. Organic matter content is low or moderately low in the Crofton soil and moderate in the Nora soil.

Most areas of this unit are used as hayland or pasture or as cropland. The most common crops are corn, soybeans, small grain, and alfalfa. Because of the erosion hazard, these soils are generally unsuited to cultivated crops. They have fair suitability for hay and pasture, which help prevent erosion. Overgrazing pastured areas will cause poor regeneration of plants. Heavy animal traffic exposes the soil surface and increases the hazard of erosion. Deferred grazing will help reduce these hazards.

This unit has fair suitability as a site for septic tank absorption fields because of restricted permeability and slope. Enlarging the absorption field area will help overcome the restricted permeability. Because of the slope, special care is needed to keep effluent from seeping out at the surface.

This unit is fairly well suited or poorly suited as a site for buildings. Diverting water away from sites before and during construction and establishing a plant cover as soon as construction is complete help to control erosion. Landscaping the sites to remove surface water and backfilling with suitable coarse material will provide protection against the structural damage caused by a shrink-swell potential.

The damage to local roads and streets caused by low strength and a frost-action potential can be minimized by using coarse textured base material. The damage caused by frost action also can be minimized by removing water from road ditches.

The land capability classification is VIe.

663—Spillco silt loam, occasionally flooded. This nearly level, somewhat poorly drained soil is on flood plains. The areas of this unit are irregular in shape or long and broad and range from 3 to about 500 acres in size.

Typically, the surface layer is black silt loam about 10 inches thick. The subsurface layer is about 27 inches thick. The upper part is black silt loam; the lower part is black loam. The subsoil is very dark brown loam about 11 inches thick. The underlying material to a depth of about 60 inches is very dark grayish brown loam. In places free carbonates are throughout the soil. In some areas the soil is leached to a depth of more than 36 inches.

Included with this soil in mapping are small areas of poorly drained Calco and Millington soils, somewhat poorly drained Cylinder soils, well drained Dempster and Fairhaven soils, and moderately well drained and well drained Graceville soils. The Calco and Millington soils are calcareous throughout and are on the lower parts of flood plains. The Cylinder soils have coarse textured sediments within 40 inches of the surface and are on stream benches. The Dempster, Fairhaven, and Graceville soils are on outwash plains. The Dempster and Fairhaven soils have coarse textured sediments within 40 inches of the surface. Included soils make up 10 to 15 percent of the unit.

Permeability in the Spillco soil is moderate, and surface runoff is slow. The available water capacity is high or very high. Organic matter content is high. The seasonal high water table is at a depth of 3 to 5 feet.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, small grain, and alfalfa. Some areas are pastured. This soil is well suited to crops. Floods in the spring sometimes delay tillage. Artificial drainage in areas where adequate outlets are available can improve crop production. If tilled in fall, this soil warms up and dries out sooner in the spring, allowing earlier seedbed preparation. Tilling when this soil is wet causes compaction and destruction of tilth.

This soil has fair suitability for the trees and shrubs grown as windbreaks. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are eastern cottonwood, green ash, and hackberry. The shrubs that are generally selected are American plum and lilac.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings because of the seasonal wetness and the flooding. Those limitations can be overcome on sites for local roads and streets if coarse textured base material is used and the road is built above the level of flooding. Removing water from road ditches reduces the hazard of frost damage. This soil is a good source of topsoil.

The land capability classification is IIw.

939B—Ihlen-Rock outcrop complex, 0 to 4 percent slopes. This map unit consists of a nearly level and gently sloping, well drained Ihlen soil intermingled with bedrock outcrops on uplands underlain by quartzite. Slopes are concave to convex. The areas of this unit are irregular in shape and range from 20 to about 1,000 acres in size. They are about 40 to 80 percent Ihlen soil and 20 to 50 percent Rock outcrop. The two are in areas so intricately mixed or so small that it is not practical to map them separately.

Typically, the Ihlen soil has a surface layer of black silty clay loam about 11 inches thick. The subsoil is silty clay loam about 21 inches thick. The upper part is very dark grayish brown, and the lower part is brown. The subsoil is underlain by red and pale red quartzite. In places the bedrock is closer to the surface. Some areas have slopes of more than 4 percent.

Included with this unit in mapping are small areas of deep, well drained Moody soils and deep, moderately well drained Trent soils. The Moody soils are on side slopes. The Trent soils are in shallow drainageways. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Ihlen soil. The available water capacity is low or moderate. Organic matter content is moderate or high. Runoff is slow.

Most areas of this unit are used as pasture or are idle. The unit is unsuited to row crops because of the bedrock outcrops. The major limitations affecting pasture are a restricted root zone and the low or moderate available water capacity. Deferred grazing improves the growth and survival of pasture plants.

This unit is generally unsuitable as a site for septic tank absorption fields and buildings. The main limitation is the depth to bedrock. Low strength is a limitation on sites for local roads and streets, but it can be overcome by using coarse textured base material.

The land capability classification is VIs.

939C—Ihlen-Rock outcrop complex, 4 to 35 percent slopes. This map unit consists of a gently sloping to steep, well drained Ihlen soil intermingled with bedrock outcrops on loess-covered uplands underlain by quartzite bedrock. Slopes are concave to convex. The areas of this unit are irregular in shape and range from 15 to about 500 acres in size. They are about 30 to 60 percent Ihlen soil and 30 to 60 percent Rock outcrop. The two are in areas so intricately mixed or so small that it is not practical to map them separately.

Typically, the Ihlen soil has a surface layer of black silty clay loam about 10 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 4 inches thick. The subsoil is silty clay loam about 13 inches thick. The upper part is brown, and the lower part is dark yellowish brown. The subsoil is underlain by red and pale red quartzite. In places the bedrock is closer to the surface. Some areas have slopes of less than 4 percent.

Included with this unit in mapping are small areas of deep, moderately well drained and well drained Alcester soils; deep, well drained Moody soils; and deep, moderately well drained Trent soils. The Alcester soils are on toe slopes. The Moody soils are on side slopes.

The Trent soils are in shallow drainageways. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Ihlen soil. The available water capacity is low or moderate. Organic matter content is moderate. Runoff is medium.

Most areas of this unit are pastured or are idle. One area is in Blue Mound State Park. The unit is unsuited to row crops because of the bedrock outcrops. The major limitations affecting pasture are a restricted root zone and the low or moderate available water capacity. Deferred grazing will improve the growth and survival of pasture plants.

This unit is generally unsuitable as a site for septic tank absorption fields and buildings. The main limitations are the bedrock near the surface and the slope.

Low strength is a limitation on sites for local roads and streets, but it can be overcome by using coarse textured base material. The bedrock and the slope hinder road construction. Large machinery and blasting of bedrock are generally required.

The land capability classification is VIIs.

1029—Pits, gravel. This map unit consists of areas from which sand and gravel have been removed for use as fill. These are open pits, some of which are still mined. In partially reclaimed areas, the sidewalls of the pits have been shaped. Most areas are irregular in shape and range from 3 to about 200 acres in size.

This unit is poorly suited to crops, even after reclamation. A thin layer of topsoil, a low organic matter content, and a low available water capacity are the major limitations.

Onsite investigation is needed to determine the suitability of this unit as a site for buildings, septic tank absorption fields, or local roads and streets.

This unit is not assigned a land capability classification.

1839—Marcus Variant silty clay loam. This level, poorly drained soil is on lake plains. The areas of this unit are circular and range from 10 to about 1,800 acres in size.

Typically, the surface layer is black silty clay loam about 11 inches thick. The subsoil is dark grayish brown, mottled clay loam about 12 inches thick. The underlying material to a depth of about 60 inches is olive, mottled clay loam. Some areas have a thinner surface layer, and some have strata of sand in the subsoil.

Included with this soil in mapping are small depressional areas of very poorly drained soils. These soils are acid and have more clay in the subsoil than the Marcus Variant soil. Also included are areas of poorly drained Spicer soils, which are on slight rises and are calcareous throughout. Included soils make up 5 to 15 percent of the unit.

Permeability in the Marcus Variant soil is moderately slow, and runoff is slow or very slow. The available water capacity and organic matter content are moderate. The seasonal high water table is between the surface and a depth of 2 feet.

Most areas of this soil are used as cropland. The most common crops are corn, soybeans, small grain, and alfalfa. This soil has fair suitability for crops. It is seasonally wet, and artificial drainage is necessary for optimum crop production. The landscape is dotted with numerous small depressions in which water ponds following rains. Surface inlets leading to subsurface drainage tile are needed in these depressions. If tilled in fall, this soil warms up and dries out sooner in the spring, allowing earlier seedbed preparation. Ridge planting is also helpful. Working this soil when it is wet causes compaction and destruction of soil tilth.

This soil has fair suitability for the trees and shrubs used as windbreaks. Seedling mortality is moderate. Plant competition is severe, but weeds and grasses can be controlled by shallow cultivation or applications of herbicide. The trees that are generally selected for planting are eastern cottonwood, golden willow, green ash, and silver maple. The shrubs that are generally selected are Tatarian honeysuckle and lilac.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings. The seasonal wetness and the restricted permeability are the main limitations.

Using coarse textured base material for local roads and streets on this soil and removing water from road ditches help prevent the damage caused by low strength and frost action.

The land capability classification is IIIw.

1920—Spillco silt loam, frequently flooded. This nearly level, somewhat poorly drained soil is on flood plains (fig. 7). The areas of this unit are irregular in shape or long and broad and range from a few hundred to thousands of acres in size.

Typically, the surface layer is black silt loam about 15 inches thick. The subsurface layer is black loam about 20 inches thick. The next layer is very dark brown loam about 14 inches thick. The underlying material to a depth of about 60 inches is very dark grayish brown loam. In some places lighter colored overwash is on the surface. In other places strata of coarse textured sediments are throughout the soil. Some areas are occasionally flooded.

Included with this soil in mapping are small areas of poorly drained Calco, Millington, and Talcot soils; somewhat poorly drained Cylinder soils; and well drained Dickman and Fairhaven soils. The Calco, Millington, and Talcot soils are on flood plains in oxbow channels. The Cylinder soils are on stream benches and have coarse textured sediments within 40 inches of the surface. The Dickman and Fairhaven soils are on slight rises. Included soils make up 10 to 15 percent of the unit.

Permeability in the Spillco soil is moderate, and runoff is slow. The available water capacity and organic matter content are high. The seasonal high water table is at a depth of 3 to 5 feet.

Most areas of this soil are used as pasture or are idle (fig. 8). A few areas are used as cropland. The soil is generally unsuited to crops and is poorly suited to pasture. Flooding is frequent in the spring and in some areas after heavy rains. Wetness and flooding limit the types of suitable pasture plants and restrict grazing.

This soil is very poorly suited to the trees and shrubs grown as windbreaks. Seedling mortality and plant competition are severe, and the use of equipment is limited. Onsite evaluation is necessary to determine the treatment needs and the species suitable for planting.

This soil is generally unsuitable as a site for septic tank absorption fields and buildings because of the seasonal wetness and the flooding.

Using coarse textured base material, placing the road above the level of flooding, and removing water from road ditches help to prevent damage to local roads and streets. This soil is a good source of topsoil.

The land capability classification is VIw.

Prime Farmland

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

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

Figure 7.—An aerial view of Spillco silt loam, frequently flooded, along the Rock River, near Luverne.

Figure 8.—Pasture on Spillco silt loam, frequently flooded. Logs were carried in by floodwater.

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

About 250,500 acres in the survey area, or nearly 81 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county. Most of this prime farmland is used for crops. The main crops grown on this land are corn and soybeans.

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

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

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

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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 of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

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

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

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

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

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

Crops and Pasture

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

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

About 220,000 acres in Rock County is used for row crops, mainly corn and soybeans; 20,600 acres for small grain, mainly oats and wheat; 19,500 acres for hay, mainly alfalfa; and 27,000 acres for pasture (*3*). Trends in crop selection over the past 20 years show an increase in the acreage of corn and soybeans, a small decrease in the acreage of hay, and a large decrease in the acreage of small grain. A shift to cash crops, especially soybeans, and to confined livestock systems accounts for this trend.

Although the total number of cattle in the county has not changed significantly in the last 20 years, the number of dairy cattle has declined by 40 percent. Hog production increased by about 40,000 between 1960 and 1979. The number of sheep in the county dropped from 15,000 in 1960 to just over 3,000 in 1979.

The soils in Rock County have good potential for increased crop production. Higher levels of productivity from agricultural land can be realized by using the latest crop production technology. This soil survey can help in the application of this technology.

The major management concerns on most of the soils in Rock County are moisture conservation to increase the amount of available water for crop production, controlling soil blowing and water erosion, removal of excess subsoil moisture from some soils, reducing the hazard of flooding on lowlands, and correcting fertility imbalances.

Rainfall during the growing season is critical to crop production. In order for crops to make maximum use of the rainfall, rainwater must be kept from running off the surface and allowed to infiltrate into the sloping areas of Moody, Sac, and Nora soils. Contour farming, terraces, diversions, sediment- and water-control basins, and conservation tillage systems that leave crop residue on the surface can reduce water runoff and increase infiltration. Conservation tillage systems may include chisel plowing, disking, ridge planting, or no-tillage. Chisel plowing in the spring leaves the surface rough, but the soil may dry out rapidly unless secondary tillage operations are performed in a timely manner. Ridge planting and no-tillage systems leave large amounts of crop residue on the surface, increasing the moisture supply in the surface layer. Terraces on sloping land trap water and hold it until infiltration can occur.

On the sloping soils, such as Nora and Crofton soils, runoff causes erosion. Sedimentation can result in damage to crops and downstream improvements and can lower the water quality. The conservation practices that are used to improve infiltration and the use of grassed waterways can help reduce water erosion.

Conservation tillage systems that utilize chisel plows and disks require management practices similar to those needed where moldboard plows are used. Ridge planting and no-tillage are being applied successfully, but they require some modification of traditional farming methods. Adjustments in fertilizer application are sometimes necessary with these systems, along with a change from preplant incorporated herbicides to preemergent and postemergent herbicides.

Soil blowing occurs on the broad, flat outwash terraces in the Rock River Valley and on some sandy upland soils in the eastern third of the county. On the Dickman soils, soil blowing during winter and early spring can be reduced by leaving crop residue on the surface during those seasons and tilling in the spring. Spring tillage can dry out the surface layer, however, and may cause soil compaction. These soils dry out and warm up early in the spring, providing additional time for planting. These soils are well suited to tillage and planting practices that leave large amounts of crop residue on the surface during the winter and early spring. Cover crops, strip crops, and windbreaks are effective for controlling soil blowing.

Spillco soils are on the flood plains along the larger streams. These soils are wet and subject to spring flooding, and the broad open areas are also subject to soil blowing. Fall tillage is usually practiced to create conditions favorable for spring planting. Heavy amounts of crop residue may slow soil warming and drying. As a result, planting is delayed unless a system of chisel plowing or ridge planting is applied. Field windbreaks will help reduce the hazard of soil blowing.

Many soils in the county, such as the Spicer, Biscay, and Whitewood soils, are wet in the spring and remain wet well into the summer. Artificial drainage removes excess water. This enables farmers to till and plant earlier in the spring. A drainage system also allows these soils to warm up quicker and improves soil aeration, resulting in improved crop growth. Marcus and Whitewood soils are in drainageways, which may need grass to control gully erosion. Tile drainage along these waterways improves the plant cover, providing better erosion control.

Calco, Colo, and Millington soils are not only seasonally wet, but are also subject to flooding. Where outlets are available, surface and subsurface drainage will remove excess water and will shorten the time during which the soil is saturated after flooding.

Maintaining tilth is important because of the need for a desirable seedbed and for water infiltration. Soils that have good tilth are granular and porous. Crop residue, manure, and fall tillage can improve tilth. Cultivating moderately fine textured and fine textured soils when they are wet results in compaction, damages soil structure, and makes seedbed preparation difficult. Spring tillage of these wet soils should be avoided. When fall tillage is used, however, surface roughness and some residue cover are necessary if soil blowing or water erosion is a hazard.

The soils in the county are generally medium or low in content of phosphorus and high in content of potassium. Micronutrients are rarely needed in most soils. The surface layer, subsurface layer, and subsoil of most soils in the county are slightly acid or neutral. Applications of lime generally are not needed. Fertilizer needs depend on the soil type, past and present management, and the kind of crop to be grown. A soil test will provide the information needed in choosing the proper kind and amount of fertilizer.

Calco, Millington, and Spicer soils have natural concentrations of lime in the surface layer. Soybeans can be affected by chlorosis when grown on these soils. Supplemental fertilization coupled with artificial drainage will improve this condition.

Pasture in the county is primarily used for grazing by beef cattle. Most of the pasture is marginal cropland because of steep slopes, wetness, flooding, or depth to bedrock. Production from pastures can be increased by deferred or rotation grazing, fertilization, and weed control. Pasture renovation, which introduces new forage species, may include interseeding legumes in existing grass pastures. Some of the legumes suitable in Rock County are alfalfa, birdsfoot trefoil, and clover. Cool-season grasses suitable in mixtures are smooth bromegrass, orchardgrass, timothy, and intermediate wheatgrass. Reed canarygrass and creeping foxtail can be grown on poorly drained soils. The sandy and gravelly soils, such as Dickman and Fairhaven soils, are well suited to warm-season grasses, such as big bluestem, little bluestem, and sideoats grama. Examples of warm-season grasses that can be grown on fine textured or moderately fine textured soils are big bluestem, indiangrass, and switchgrass.

Further information about the management practices described in this section can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Yields Per Acre

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

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

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

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

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

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*9*). 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 engineering purposes.

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

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

Class I soils have few limitations 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 limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is 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, rangeland, woodland, wildlife habitat, or recreation.

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

Windbreaks and Environmental Plantings

Windbreaks have been planted since the days of the early settlers to protect farmsteads and livestock. In the 1930's, windbreaks were planted to control soil blowing. In recent years field windbreaks have been planted to trap snow and thus increase the moisture supply. Maximum growth and survival rates can be obtained by controlling weeds around new plantings.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

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

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

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The major recreation areas in the county are Blue Mound State Park, just north of Luverne, and the city parks located in several communities. Blue Mound State Park offers facilities for overnight camping, hiking, picnics, and swimming. It also has a nature center and supports a herd of buffalo. The Rock River, which runs north to south through the county, is large enough for canoeing.

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

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 have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but 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

The kinds and numbers of wildlife in Rock County are directly affected by land use. For example, the mixture of open areas and crop fields throughout the county provides good habitat for the Hungarian partridge, and the county has one of the largest populations of that bird in the State. Hungarian partridge require little cover. Their food and cover are provided by corn and soybean fields during summer and fall. Grassed waterways, fence rows, and farmstead and field windbreaks provide food and cover during the winter.

The ring-necked pheasant, on the other hand, requires heavy cover, especially during the winter. The corn and soybean fields provide food and cover during late spring, summer, and fall. During the winter and early spring, cover, food, and nesting sites are provided by wooded areas and undisturbed grassland along the major streams and rivers and by brushy upland draws and drainageways (fig. 9). The population of pheasants becomes somewhat dispersed during the summer. The heaviest concentrations, however, are in areas along the Rock River where wooded flood plains are next to farmland on river terraces and in areas on the Beaver Creek, Springwater Creek, and Four Mile Creek watersheds where brushy drainageways are deeply cut into the uplands. Farmstead windbreaks also provide food and cover for wintering pheasants.

Rock County supports a large deer population. The deer are throughout the county during the spring, summer, and fall. During the winter, they congregate in the same areas used by the ring-necked pheasant. One concentration of deer is in the Kenneth area. This area has numerous abandoned gravel pits along the Champepedan River and other streams which are overgrown with trees and brush. During the winter, a sizable herd is in Blue Mound State Park. The herd leaves the park at dusk to feed in the surrounding crop fields and returns to the park early in the morning.

Raccoons are in low-lying wooded areas. The heaviest population is along the Rock River. Badgers are throughout the county, and jackrabbits and cottontail rabbits are abundant. The heaviest rabbit populations are in wooded areas along the Rock River and around farmsteads and field windbreaks. The size of the fox population in Rock County depends on the amount of available food and the number of denning sites. The quartzite bedrock area in the northern half of the county has uncultivated areas which provide good denning sites. Other suitable sites are along the Rock River and its tributaries and along Beaver Creek and Springwater Creek.

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

In table 9, 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

Figure 9.—A gravel pit overgrown by brush that provides wildlife habitat.

the intensity of management needed for each element of the habitat.

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

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

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

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

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

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, apple, hawthorn, and dogwood. 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, 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, cordgrass, rushes, sedges, and reeds.

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

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

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include Hungarian partridge, pheasant, meadowlark, field sparrow, cottontail, jackrabbit, 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 thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

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

Engineering

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

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

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

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

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

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock 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 to 6 feet are not considered.

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

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock 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 11 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 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock 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 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

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

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

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, 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 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 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. 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. The performance of a system is affected by the depth of the root zone and soil reaction.

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

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

Soil Properties

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

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

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

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

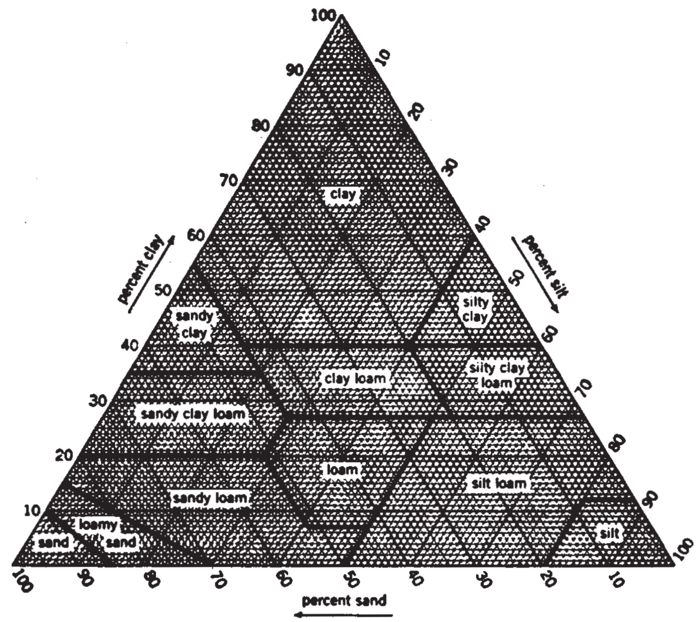

Figure 10.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 10). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

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

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

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

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

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

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

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

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

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

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

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

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

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

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

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

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

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

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, 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 of 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 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

If a soil is assigned to two hydrologic groups in table 16, 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 or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

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

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table, the kind of water table, 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 16. Only saturated zones within a depth of about 6 feet are indicated. An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

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

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

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

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*10*). 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 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that has an aquic moisture regime).

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

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

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material 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* (*8*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*10*). 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."

Alcester Series

The Alcester series consists of deep, moderately well drained and well drained, moderately permeable soils in the uplands. These soils formed in silty colluvium. Slope ranges from 1 to 8 percent.

Typical pedon of Alcester silt loam, 3 to 8 percent slopes, 1,250 feet north and 675 feet east of the southwest corner of sec. 14, T. 102 N., R. 47 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A1—8 to 16 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; neutral; gradual wavy boundary.
A2—16 to 24 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine and very fine subangular blocky structure; friable; neutral; gradual wavy boundary.
A3—24 to 36 inches; black (10YR 2/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; friable; neutral; gradual wavy boundary.
Bw1—36 to 44 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; neutral; gradual wavy boundary.
Bw2—44 to 56 inches; dark grayish brown (10YR 4/2) and dark brown (10YR 4/3) silty clay loam; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; neutral; gradual wavy boundary.
C—56 to 60 inches; dark brown (10YR 4/3) silty clay loam; few fine faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 42 to 60 inches. The solum is silt loam or silty clay loam. The thickness of the mollic epipedon ranges from 30 to 50 inches. Some pedons have a buried A horizon.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 or 3. The C horizon has value of 4 or 5.

Biscay Series

The Biscay series consists of deep, poorly drained soils on outwash plains and in upland drainageways. The soils formed in moderately fine textured sediments overlying calcareous, coarse textured outwash. Permeability is moderate in the upper part of the profile and rapid in the underlying coarse textured sediments. Slope ranges from 0 to 2 percent.

Typical pedon of Biscay silty clay loam, 1,600 feet north and 700 feet west of the southeast corner of sec. 3, T. 103 N., R. 44 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; cloddy; friable; neutral; clear smooth boundary.
A1—8 to 16 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.
A2—16 to 21 inches; black (N 2/0) and very dark grayish brown (2.5Y 3/2) clay loam, dark grayish brown (2.5Y 4/2) dry; weak fine and very fine subangular blocky structure; friable; neutral; gradual smooth boundary.
Bg—21 to 31 inches; dark gray (5Y 4/1) and gray (5Y 5/1) clay loam; common medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; weak fine and very fine subangular blocky structure; friable; neutral; clear smooth boundary.
2Cg—31 to 60 inches; grayish brown (2.5Y 5/2) coarse sand; common medium distinct yellowish brown (10YR 5/6) and common medium faint light olive brown (2.5Y 5/4) mottles; single grain; loose; slight effervescence; about 8 percent coarse fragments; mildly alkaline.

The thickness of the solum and the depth to coarse textured material range from 24 to 40 inches. The depth to free carbonates ranges from 20 to 40 inches. The mollic epipedon ranges from 16 to 24 inches in thickness. The content of coarse fragments is 0 to 4 percent in the upper mantle and 4 to 25 percent in the underlying material.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or is neutral in hue and has value of 2 or 3 and chroma of 0. It is silty clay loam or clay loam. The B horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2 and has few or common mottles. It is dominantly clay loam, but the BC horizon, if it occurs, ranges to sandy clay loam. The 2C horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2. It is dominantly coarse sand, but the range includes loamy sand and gravelly sand.

Calco Series

The Calco series consists of deep, poorly drained, moderately permeable soils on flood plains. The soils formed in moderately fine textured and medium textured, calcareous alluvium. Slope is 0 to 1 percent.

Typical pedon of Calco silty clay loam, occasionally flooded, 150 feet north and 1,800 feet west of the southeast corner of sec. 3, T. 102 N., R. 45 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; slight effervescence; mildly alkaline; clear smooth boundary.
A1—8 to 24 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine and very fine subangular blocky structure; friable; slight effervescence; mildly alkaline; gradual wavy boundary.
A2—24 to 38 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium and

fine subangular blocky structure; friable; slight effervescence; mildly alkaline; gradual wavy boundary.

Bg—38 to 45 inches; very dark gray (5Y 3/1) silty clay loam; weak very fine subangular blocky structure; friable; slight effervescence; mildly alkaline; gradual wavy boundary.

Cg—45 to 60 inches; olive gray (5Y 5/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6) and few fine faint gray (5Y 5/1) mottles; massive; friable; slight effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 38 to 50 inches. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1, or it is neutral in hue and has value of 2. It is dominantly silty clay loam, but the range includes silt loam. The Bg horizon has hue of 10YR, value of 3 or 4, and chroma of 1, or it is neutral in hue and has value of 2 or 3. It either has no mottles or has few or common mottles. It is silty clay loam or silt loam. The Cg horizon has hue of 10YR or 5Y and value of 3 to 5 and has few to many mottles.

Colo Series

The Colo series consists of deep, poorly drained, moderately permeable soils on flood plains. The soils formed in moderately fine textured and medium textured alluvium. Slope is 0 to 1 percent.

Typical pedon of Colo silty clay loam, 80 feet north and 50 feet east of the southwest corner of sec. 19, T. 103 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; cloddy; friable; slightly acid; clear smooth boundary.

A1—8 to 20 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine and very fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

A2—20 to 28 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium and fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

A3—28 to 37 inches; black (10YR 2/1) and very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A4—37 to 44 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Cg1—44 to 46 inches; olive gray (5Y 5/2) silty clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; slight effervescence; mildly alkaline; gradual smooth boundary.

Cg2—46 to 60 inches; olive gray (5Y 5/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum and depth to free carbonates range from 36 to 50 inches. The mollic epipedon is 40 to 50 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or is neutral in hue and has value of 2 or 3 and chroma of 0. It is mainly silty clay loam, but the range includes silt loam. The C horizon has hue of 10YR to 5Y, value of 3 to 5, and chroma of 1 or 2. It is silty clay loam or silt loam.

Comfrey Series

The Comfrey series consists of deep, poorly drained, moderately permeable soils on flood plains. The soils formed in moderately fine textured alluvium. Slope is 0 to 1 percent.

Typical pedon of Comfrey clay loam, 200 feet south and 2,600 feet west of the northeast corner of sec. 20, T. 102 N., R. 44 W.

A1—0 to 14 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; moderate very fine granular structure; friable; neutral; gradual smooth boundary.

A2—14 to 26 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak coarse prismatic structure parting to weak very fine granular; friable; neutral; gradual smooth boundary.

Bg—26 to 35 inches; very dark gray (10YR 3/1) clay loam, dark grayish brown (10YR 4/2) dry; weak coarse prismatic structure parting to weak medium subangular blocky; friable; neutral; gradual wavy boundary.

BCg—35 to 38 inches; dark gray (10YR 4/1) clay loam; common fine distinct yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable; slight effervescence; mildly alkaline; gradual wavy boundary.

Cg—38 to 60 inches; dark gray (5Y 4/1) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; slight effervescence; mildly alkaline.

The mollic epipedon is more than 24 inches thick. The solum is silty clay loam or clay loam. The depth to free carbonates ranges from 20 to 46 inches.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3. The B horizon, if it occurs, has hue of 10YR, 2.5Y, or 5Y, value of 2 to 4, and chroma of 1. It either has no mottles or has few or common mottles. The C horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2 and has few to many mottles.

Crofton Series

The Crofton series consists of deep, well drained, moderately permeable soils on loess-covered uplands. The soils formed in medium textured, calcareous loess. Slope ranges from 6 to 18 percent.

Typical pedon of Crofton silt loam, in an area of Nora-Crofton silt loams, 6 to 12 percent slopes, eroded, 100 feet north and 780 feet west of the southeast corner of sec. 35, T. 103 N., R. 47 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak medium and fine subangular blocky structure; friable; strong effervescence; many accumulations of lime; mildly alkaline; abrupt smooth boundary.

AC—8 to 14 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium and fine subangular blocky structure; friable; strong effervescence; many accumulations of lime; moderately alkaline; clear wavy boundary.

C1—14 to 24 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; strong effervescence; many accumulations of lime; moderately alkaline; clear smooth boundary.

C2—24 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct strong brown (7.5YR 5/8) mottles; massive; friable;; strong effervescence; few accumulations of lime; moderately alkaline.

The thickness of the solum ranges from 7 to 15 inches. The A horizon has chroma of 2 or 3. Some pedons do not have an AC horizon. The C horizon has value of 4 to 6 and chroma of 2 to 4. Lime accumulations occur throughout most pedons.

Cylinder Series

The Cylinder series consists of deep, somewhat poorly drained soils on stream benches. The soils formed in medium textured alluvium over coarse textured outwash. Permeability is moderate in the upper part of the profile and very rapid in the underlying coarse textured sediments. Slope ranges from 0 to 2 percent.

Typical pedon of Cylinder loam, occasionally flooded, 350 feet north and 650 feet west of the southeast corner of sec. 3, T. 103 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A1—8 to 15 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine and very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A2—15 to 22 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw—22 to 32 inches; dark grayish brown (10YR 4/2) loam; weak medium and fine subangular blocky structure; friable; neutral; gradual smooth boundary.

BC—32 to 36 inches; olive brown (2.5Y 4/4) sandy loam; few fine faint dark grayish brown (2.5Y 4/2) mottles; weak medium subangular blocky structure; very friable; slight effervescence; about 3 percent coarse fragments; mildly alkaline; clear smooth boundary.

2C—36 to 60 inches; olive brown (2.5Y 4/4) and dark grayish brown (10YR 4/2) gravelly sand; single grain; loose; slight effervescence; about 20 percent coarse fragments; mildly alkaline.

The thickness of the solum and the depth to sand and gravel range from 24 to 40 inches. The mollic epipedon is 16 to 22 inches thick. The content of coarse fragments ranges from 0 to 4 percent in the BC horizon and from 10 to 25 percent in the C horizon. Strata with up to 40 percent coarse fragments are in some pedons.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. The 2C horizon has hue of 2.5Y or 10YR, value of 3 or 4, chroma of 2 to 4. It is gravelly sand or gravelly coarse sand.

Dempster Series

The Dempster series consists of deep, well drained soils on outwash plains. The soils formed in medium textured and moderately fine textured sediments over coarse textured outwash. Permeability is moderate in the upper part of the profile and rapid in the underlying coarse textured sediments. Slope ranges from 0 to 6 percent.

Typical pedon of Dempster silt loam, 0 to 2 percent slopes, 50 feet south and 1,200 feet west of the northeast corner of sec. 5, T. 103 N., R. 44 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

A—8 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak medium fine and very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw1—13 to 17 inches; dark brown (10YR 4/3) silt loam; very dark grayish brown (10YR 3/2) faces of peds; weak moderate prismatic structure parting to weak fine subangular blocky; friable; neutral; gradual smooth boundary.

Bw2—17 to 30 inches; dark brown (10YR 4/3) silty clay loam; weak medium and fine subangular blocky structure; friable; neutral; clear smooth boundary.

2C—30 to 60 inches; brown (10YR 5/3) gravelly sand; single grain; loose; about 20 percent coarse fragments; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness. It is silt loam or silty clay loam. The depth to sand and gravel ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The coarse textured underlying material has 10 to 30 percent coarse fragments.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y and chroma of 2 to 4. The 2C horizon is gravelly sand or gravelly loamy sand.

Dickman Series

The Dickman series consists of deep, well drained soils on outwash plains and uplands. The soils formed in moderately coarse textured and coarse textured sediments. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Slope ranges from 2 to 12 percent.

Typical pedon of Dickman sandy loam, 2 to 6 percent slopes, 2,300 feet south and 500 feet west of the northeast corner of sec. 12, T. 101 N., R. 45 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

Bw1—8 to 13 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

Bw2—13 to 18 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine prismatic structure parting to moderate fine subangular blocky; very friable; slightly acid; gradual wavy boundary.

BC—18 to 36 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; neutral; gradual wavy boundary.

C—36 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches. The depth to loamy sand or coarser textured material ranges from 12 to 20 inches. The thickness of the mollic epipedon ranges from 10 to 16 inches. The solum contains 0 to 5 percent coarse fragments.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has value of 3 to 5 and chroma of 3 or 4. It is sandy loam, fine sandy loam, or loamy sand. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4.

Everly Series

The Everly series consists of deep, well drained, moderately slowly permeable soils on uplands. The soils formed in a mantle of moderately fine textured and medium textured sediments and in the underlying moderately fine textured and medium textured glacial till. Slope ranges from 2 to 12 percent.

Typical pedon of Everly clay loam, 2 to 6 percent slopes, 75 feet south and 90 feet east of the northwest corner of sec. 6, T. 104 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; moderate fine and very fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

AB—8 to 13 inches; dark brown (10YR 3/3) clay loam; very dark brown (10YR 2/2) faces of peds; dark grayish brown (10YR 4/2) dry; moderate fine and very fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bw1—13 to 22 inches; dark yellowish brown (10YR 4/4) clay loam; dark brown (10YR 4/3) faces of peds; weak fine and very fine subangular blocky structure; friable; neutral; clear wavy boundary.

2Bw2—22 to 26 inches; dark yellowish brown (10YR 4/4) clay loam; weak medium subangular blocky structure; firm; about 3 percent coarse fragments; neutral; gradual wavy boundary.

2C1—26 to 32 inches; light olive brown (2.5Y 5/4) clay loam; few medium faint yellowish brown (10YR 5/6) and few medium distinct strong brown (7.5YR 5/8) mottles; massive; firm; many accumulations of lime; strong effervescence; about 5 percent coarse fragments; moderately alkaline; diffuse wavy boundary.

2C2—32 to 60 inches; light olive brown (2.5Y 5/4) clay loam; few medium faint yellowish brown (10YR 5/6), few medium distinct strong brown (7.5YR 5/6), and few fine faint grayish brown (10YR 5/2) mottles; massive; firm; about 5 percent coarse fragments; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches. The thickness of the sediment overlying the glacial till ranges from 18 to 30 inches. In some pedons a pebble layer is at the contact with the glacial till. The depth to free carbonates is typically the same as the depth to glacial till, although in some pedons the till is leached in the upper few inches. The mollic epipedon is 10 to 16 inches thick. The 2C horizon is 2 to 8 percent coarse fragments.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silty clay loam, loam, or clay loam. The Bw, 2B, C, and 2C horizons are clay loam or loam. The Bw horizon has value of 4 in the upper part and 4 or 5 in the lower part and has chroma of 3 or 4. The C or 2C horizon has hue of 2.5Y or 10YR and value of 4 or 5. It either has no mottles or has few or common mottles. Some pedons have a zone of secondary carbonate concentration in the upper part of the C horizon.

Fairhaven Series

The Fairhaven series consists of deep, well drained soils on outwash plains. The soils formed in medium textured sediments and in the underlying coarse textured outwash. Permeability is moderate in the upper part of the profile and rapid in the underlying coarse textured sediments. Slope ranges from 0 to 6 percent.

Typical pedon of Fairhaven silt loam, 0 to 2 percent slopes, 240 feet south and 150 feet east of the northwest corner of sec. 27, T. 104 N., R. 44 W.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

A1—7 to 12 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw1—12 to 25 inches; dark yellowish brown (10YR 4/4) loam; weak fine and medium subangular blocky structure; friable; neutral; gradual wavy boundary.

Bw2—25 to 36 inches; yellowish brown (10YR 5/4 and 5/6) loam; weak medium and fine subangular blocky structure; friable; neutral; clear smooth boundary.

2C—36 to 60 inches; yellowish brown (10YR 5/4) and brown (10YR 5/3) gravelly sand; single grain; loose; strong effervescence; about 20 percent coarse fragments; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 25 to 45 inches. The thickness of the fine loamy mantle and the depth to coarse textured outwash range from 22 to 40 inches. The mollic epipedon is 10 to 20 inches thick. The upper mantle is 0 to 5 percent coarse fragments. The underlying coarse textured material is 10 to 30 percent coarse fragments.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silt loam or loam. The B horizon has value and chroma of 3 to 5. It is mainly loam, but the range includes silt loam. Some pedons have a 2BC horizon. This horizon has value of 4 or 5. It is loamy sand or sandy loam. The 2C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 to 5. It is sand or gravelly sand.

Flandreau Series

The Flandreau series consists of deep, well drained soils in the uplands. These soils formed in medium textured and coarse textured sediments. Permeability is moderate in the upper part of the profile and rapid in the lower part. Slope ranges from 0 to 6 percent.

The Flandreau soils in Rock County have a more abrupt transition between the loamy and sandy sediments than is characteristic of the Flandreau series. This difference, however, does not alter the usefulness or behavior of the soils.

Typical pedon of Flandreau silt loam, 2 to 6 percent slopes, 1,800 feet south and 500 feet west of the northeast corner of sec. 12, T. 101 N., R. 45 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; cloddy; friable; neutral; clear smooth boundary.

AB—8 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; very dark brown (10YR 2/2) faces of peds; weak fine and very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bw1—15 to 25 inches; dark brown (10YR 4/3) silt loam; very dark grayish brown (10YR 3/2) faces of peds; weak medium prismatic structure parting to weak fine subangular blocky; friable; neutral; gradual smooth boundary.

Bw2—25 to 30 inches; dark yellowish brown (10YR 4/4) loam; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; neutral; gradual smooth boundary.

2BC—30 to 36 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium subangular blocky structure; very friable; neutral; gradual smooth boundary.

2C—36 to 60 inches; yellowish brown (10YR 5/4) loamy sand; few fine faint yellowish brown (10YR 5/6) mottles; single grain; loose; strong effervescence; mildly alkaline.

The thickness of the solum, the depth to sandy material, and the depth to free carbonates range from 25 to 40 inches. The thickness of the mollic epipedon ranges from 12 to 20 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. The B horizon has value and chroma of 3 or 4. It is silt loam or loam in the upper part and grades to loam and sandy loam in the lower part. The 2C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 3 or 4. It either has no mottles or has few or common mottles. It is dominantly loamy sand, but the range includes sandy loam and loamy fine sand.

Graceville Series

The Graceville series consists of deep, well drained and moderately well drained, moderately permeable soils on outwash plains. The soils formed in medium textured and moderately fine textured sediments over coarse textured outwash. Slope ranges from 0 to 6 percent.

Typical pedon of Graceville silt loam, 0 to 2 percent slopes, 625 feet north and 1,975 feet west of the southeast corner of sec. 10, T. 102 N., R. 45 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium and fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.
A—8 to 25 inches; very dark grayish brown (10YR 3/2) silt loam, dark brown (10YR 4/3) dry; weak medium and fine subangular blocky structure; friable; slightly acid; gradual wavy boundary.
Bw—25 to 38 inches; dark yellowish brown (10YR 4/4) silt loam; dark brown (10YR 3/3) faces of peds; weak medium prismatic structure parting to weak medium subangular blocky; friable; slightly acid; gradual wavy boundary.
C1—38 to 58 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; neutral; clear smooth boundary.
2C2—58 to 60 inches; brown (10YR 5/3) gravelly sand; single grain; loose; strong effervescence; about 15 percent coarse fragments; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 36 to 60 inches. The solum is silt loam or silty clay loam. The thickness of the mollic epipedon ranges from 14 to 36 inches. The depth to sand and gravel is more than 45 inches. The underlying material is 10 to 25 percent coarse fragments.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 2 to 4. The C horizon has value of 4 or 5 and chroma of 3 or 4. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 or 4. It is gravelly sand or sand.

Unit 659B is a taxadjunct because the mollic epipedon is thinner than is defined for the series. This difference, however, does not alter the usefulness or behavior of the soil.

Ihlen Series

The Ihlen series consists of moderately deep, well drained, moderately permeable soils on loess-mantled uplands that are underlain by bedrock. The soils formed in medium textured and moderately fine textured loess over Sioux quartzite bedrock. Slope ranges from 0 to 35 percent.

Typical pedon of Ihlen silty clay loam, 2 to 6 percent slopes, 2,575 feet north and 500 feet west of the southeast corner of sec. 22, T. 104 N., R. 46 W.

A1—0 to 10 inches; black (10YR 2/1) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; friable; neutral; clear smooth boundary.
A2—10 to 13 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) faces of peds; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky; friable; neutral; gradual smooth boundary.
Bw1—13 to 18 inches; brown (10YR 4/3) silty clay loam; dark brown (10YR 3/3) faces of peds; weak medium prismatic structure parting to moderate medium and fine subangular blocky; friable; neutral; gradual smooth boundary.
Bw2—18 to 26 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium and fine subangular blocky structure; friable; neutral; abrupt smooth boundary.
2R—26 inches; red and pale red Sioux quartzite.

The thickness of the solum ranges from 20 to 38 inches, and the depth to bedrock ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is mainly silty clay loam, but the range includes silt loam. The B horizon has value and chroma of 3 or 4. It is silty clay loam or silt loam.

Ihlen Variant

The Ihlen Variant consists of shallow, well drained, moderately permeable soils on loess-mantled uplands underlain by bedrock. The soils formed in medium textured and moderately fine textured loess over Sioux quartzite bedrock. Slope ranges from 0 to 3 percent.

Typical pedon of Ihlen Variant silt loam, 0 to 3 percent slopes, 100 feet south and 100 feet east of the northwest corner of sec. 15, T. 104 N., R. 46 W.

A—0 to 14 inches; black (10YR 2/1) silt loam, very dark grayish brown (10YR 3/2) dry; moderate very fine granular structure; friable; neutral; abrupt smooth boundary.
2R—14 inches; red and pale red Sioux quartzite.

The thickness of the solum and the depth to bedrock range from 10 to 20 inches. The mollic epipedon typically is as thick as the solum. The A horizon is mainly silt loam, but in some pedons it is silty clay loam. It has chroma of 1 or 2.

Marcus Series

The Marcus series consists of deep, poorly drained soils on loess-covered uplands. The soils formed in moderately fine textured and medium textured loess. Permeability is moderately slow in the upper part of the profile and moderate in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Marcus silty clay loam, 1,000 feet north and 800 feet east of the southwest corner of sec. 19, T. 104 N., R. 45 W.

A1—0 to 10 inches; black (10YR 2/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine and very fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

A2—10 to 20 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; slightly acid; clear wavy boundary.

Bg—20 to 35 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine distinct brown (10YR 5/3) mottles; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; neutral; gradual wavy boundary.

BCg—35 to 46 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine faint yellowish brown (10YR 5/4 and 5/6) mottles; weak medium subangular blocky structure; friable; slight effervescence; mildly alkaline; gradual wavy boundary.

Cg—46 to 60 inches; light brownish gray (2.5Y 6/2) silt loam; common medium and fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 45 inches. The mollic epipedon is 15 to 20 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or is neutral in hue and has value of 2 and chroma of 0. The B horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2 and has few or common mottles. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 1 or 2 and has common or many mottles. It is silt loam or silty clay loam. In some pedons a 2C horizon is at a depth of more than 45 inches.

Marcus Variant

The Marcus Variant consists of deep, poorly drained, moderately slowly permeable soils on lake plains. The soils formed in moderately fine textured, water-modified glacial till and lacustrine sediments. Slope is 0 to 1 percent.

Typical pedon of Marcus Variant silty clay loam, 2,670 feet north and 280 feet west of the southeast corner of sec. 13, T. 104 N., R. 46 W.

A—0 to 11 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; cloddy; friable; neutral; abrupt smooth boundary.

Bg1—11 to 18 inches; dark grayish brown (2.5Y 4/2) clay loam; common fine distinct light olive brown (2.5Y 5/6) mottles; weak medium and fine subangular blocky structure; firm; neutral; gradual wavy boundary.

Bg2—18 to 23 inches; dark grayish brown (2.5Y 4/2) clay loam; common fine distinct light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure parting to moderate fine and very fine subangular blocky; firm; neutral; clear wavy boundary.

Cg—23 to 60 inches; olive (5Y 5/3) clay loam; common fine faint olive gray (5Y 5/2), common medium faint olive brown (2.5Y 5/6), and common medium distinct olive yellow (2.5Y 6/6) mottles; massive; firm; violent effervescence; many accumulations of lime; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to free carbonates ranges from 12 to 28 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches. The solum contains 0 to 5 percent coarse fragments.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or is neutral in hue and has value of 2 and chroma of 0. It is silty clay loam or clay loam. The B and C horizons also are silty clay loam or clay loam. The B horizon has hue of 2.5Y or 5Y, value of 3 to 5, and chroma of 1 to 4 and has few to many mottles. The C horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 1 to 3 and has common or many mottles. Some pedons have a 2C horizon, which is silty clay.

Millington Series

The Millington series consists of deep, poorly drained, moderately permeable soils on flood plains. The soils formed in moderately fine textured alluvium. Slope is 0 to 1 percent.

Typical pedon of Millington clay loam, occasionally flooded, 2,200 feet south and 75 feet east of the northwest corner of sec. 23, T. 103 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; moderate medium and fine subangular blocky structure; friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

A1—8 to 16 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to moderate fine and very fine subangular blocky; friable; strong effervescence; moderately alkaline; clear wavy boundary.

A2—16 to 32 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; weak fine and very fine subangular blocky structure; friable; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg—32 to 60 inches; dark gray (10YR 4/1) clay loam; common fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak very fine subangular blocky structure; friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 26 to 40 inches. The mollic epipedon is more than 24 inches thick.

The A and C horizons are mainly clay loam, but the range includes silty clay loam. The A horizon has value of 2 or 3. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 or 5; and chroma of 1 or 2.

Moody Series

The Moody series consists of deep, well drained, moderately permeable soils on uplands. The soils formed in moderately fine textured and medium textured loess. Slope ranges from 1 to 9 percent.

Typical pedon of Moody silty clay loam, 1 to 5 percent slopes, 275 feet north and 2,610 feet east of the southwest corner of sec. 31, T. 101 N., R. 44 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak medium granular; friable; slightly acid; abrupt smooth boundary.

Bw1—8 to 14 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; very dark brown (10YR 2/2) faces of peds; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; slightly acid; clear wavy boundary.

Bw2—14 to 20 inches; dark yellowish brown (10YR 3/4) silty clay loam; moderate medium prismatic structure parting to weak medium and fine subangular blocky; friable; neutral; gradual smooth boundary.

Bw3—20 to 37 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak coarse prismatic structure parting to moderate medium and fine subangular blocky; friable; neutral; gradual smooth boundary.

Bk—37 to 50 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; strong effervescence; common accumulations of lime; moderately alkaline; gradual smooth boundary.

C—50 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine faint brown (10YR 5/3) mottles; massive; friable; slight effervescence; mildly alkaline.

The solum ranges from 30 to 55 inches in thickness. It is mainly silty clay loam, but the range includes silt loam. The depth to free carbonates is more than 30 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon has value of 2 or 3. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 to 4. The C horizon has hue of 10YR or 2.5Y and chroma of 3 or 4. It either has no mottles or has few or common mottles. It is mainly silt loam, but the range includes silty clay loam. Accumulations of carbonate are in the lower part of the B horizon or the upper part of the C horizon. Some pedons have glacial till below a depth of 45 inches.

Nora Series

The Nora series consists of deep, well drained, moderately permeable soils on loess-covered uplands. The soils formed in medium textured and moderately fine textured loess. Slope ranges from 4 to 18 percent.

Typical pedon of Nora silt loam, 4 to 10 percent slopes, 2,300 feet north and 225 feet west of the southeast corner of sec. 32, T. 102 N., R. 46 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bw1—8 to 14 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; very dark brown (10YR 2/2) faces of peds; weak coarse prismatic structure parting to weak fine and very fine subangular blocky; friable; neutral; gradual wavy boundary.

Bw2—14 to 24 inches; brown (10YR 4/3) silt loam; weak medium prismatic structure parting to weak fine and very fine subangular blocky; friable; neutral; clear wavy boundary.

Bk—24 to 33 inches; yellowish brown (10YR 5/4) silt loam; weak coarse prismatic structure parting to weak medium fine and very fine subangular blocky; friable; strong effervescence; common accumulations of lime; mildly alkaline; gradual wavy boundary.

C1—33 to 41 inches; yellowish brown (10YR 5/4) silt loam; weak coarse prismatic structure parting to weak medium subangular blocky; friable; strong effervescence; common accumulations of lime; moderately alkaline; gradual wavy boundary.

C2—41 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine faint brownish yellow (10YR 6/8) mottles; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 36 inches. The depth to free carbonates ranges from 15 to 30 inches. The thickness of the mollic epipedon ranges from 8 to 16 inches.

The A and Bw horizons are mainly silt loam, but the range includes silty clay loam. The A horizon has value of 2 or 3. The Bw horizon has hue of 10YR or 2.5Y and value and chroma of 3 or 4. The Bk horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. The C horizon has value of 5 or 6.

Ransom Series

The Ransom series consists of deep, moderately well drained and somewhat poorly drained, moderately slowly permeable soils on loess-mantled uplands. The soils formed in moderately fine textured and medium textured loess and medium textured glacial till. Slope ranges from 1 to 3 percent.

Typical pedon of Ransom silty clay loam, 50 feet south and 30 feet west of the northeast corner of sec. 2, T. 103 N., R. 44 W.

A1—0 to 16 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

A2—16 to 20 inches; very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; friable; neutral; gradual wavy boundary.

Bw—20 to 30 inches; dark brown (10YR 4/3) silt loam; few fine faint dark grayish brown (10YR 4/2) mottles; moderate fine subangular blocky structure; friable; neutral; gradual wavy boundary.

2BC—30 to 48 inches; olive brown (2.5Y 4/4) and yellowish brown (10YR 5/4 and 5/6) loam; few fine faint grayish brown (2.5Y 5/2) mottles; weak medium subangular blocky structure; friable; about 3 percent coarse fragments; slight effervescence; mildly alkaline; clear wavy boundary.

2C—48 to 60 inches; olive brown (2.5Y 4/4) clay loam; few fine distinct grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) mottles; massive; firm; about 5 percent coarse fragments; slight effervescence; mildly alkaline.

The thickness of the loess mantle and the depth to the underlying glacial till range from 24 to 40 inches. The thickness of the solum ranges from 22 to 40 inches. The depth to free carbonates typically is the same as the depth to glacial till. In some pedons a gravelly layer above the till contains carbonates. The thickness of the mollic epipedon ranges from 14 to 22 inches. The underlying glacial till contains 2 to 8 percent coarse fragments.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is mainly silty clay loam, but the range includes silt loam. The B horizon has value of 3 or 4 and chroma of 2 to 4. It is silty clay loam or silt loam. Some pedons have a 2B horizon. The 2C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 to 5 and has few or common mottles. It is clay loam or loam.

Rushmore Series

The Rushmore series consists of deep, poorly drained soils on loess-mantled uplands. The soils formed in moderately fine textured loess and in the underlying glacial till. Permeability is moderately slow. Slope ranges from 0 to 2 percent.

Typical pedon of Rushmore silty clay loam, 75 feet north and 1,280 feet west of the southeast corner of sec. 10, T. 103 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; cloddy; friable; slightly acid; abrupt smooth boundary.

A1—8 to 13 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine and very fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

A2—13 to 17 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak medium and fine subangular blocky structure; friable; neutral; gradual smooth boundary.

Bg—17 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay loam; few fine distinct light olive brown (2.5Y 5/4) mottles; weak fine and very fine subangular blocky structure; friable; slight effervescence; mildly alkaline; clear smooth boundary.

2Cg1—26 to 35 inches; grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) clay loam; massive; friable; strong effervescence; few accumulations of lime; about 5 percent coarse fragments; moderately alkaline; gradual smooth boundary.

2Cg2—35 to 60 inches; light olive brown (2.5Y 5/4) and grayish brown (2.5Y 5/2) clay loam; massive; firm; strong effervescence; about 5 percent coarse fragments; moderately alkaline.

The thickness of the loess mantle and the depth to glacial till range from 24 to 40 inches. The thickness of the solum and the depth to free carbonates range from 15 to 30 inches. The thickness of the mollic epipedon ranges from 14 to 24 inches. The underlying glacial till contains 2 to 8 percent coarse fragments.

The A horizon has hue of 10YR, value of 2 or 3, chroma of 1 or is neutral in hue and has value of 2 or 3 and chroma of 0. The B horizon has value of 4 or 5 and chroma of 2 to 4 and has few to many mottles. It is mainly silty clay loam, but the range includes silt loam. The 2C horizon has hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 2 to 4 and either has no mottles or has few to many mottles.

Sac Series

The Sac series consists of deep, well drained soils on loess-mantled uplands. The soils formed in moderately fine textured loess over glacial till. Permeability is moderate in the upper part of the profile and moderately slow in the lower part. Slope ranges from 1 to 10 percent.

Typical pedon of Sac silty clay loam, 1 to 5 percent slopes, 250 feet north and 1,200 feet east of the southwest corner of sec. 35, T. 101 N., R. 45 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; slightly acid; clear smooth boundary.

AB—8 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 4/3) dry; very dark brown (10YR 2/2) faces of peds; weak fine and very fine subangular blocky structure; friable; slightly acid; gradual wavy boundary.

Bw—12 to 20 inches; dark yellowish brown (10YR 4/4) silty clay loam; dark brown (10YR 3/3) faces of peds; weak medium and fine subangular blocky structure; friable; neutral; gradual smooth boundary.

BC—20 to 32 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium and fine subangular blocky structure; friable; neutral; gradual smooth boundary.

2C1—32 to 45 inches; light olive brown (2.5Y 5/4) clay loam; massive; friable; about 3 percent coarse fragments; slight effervescence; mildly alkaline; gradual wavy boundary.

2C2—45 to 60 inches; light olive brown (2.5Y 5/4 and 5/6) clay loam; massive; firm; about 5 percent coarse fragments; slight effervescence; mildly alkaline.

The thickness of the loess mantle and the depth to glacial till or to a gravelly lag layer range from 20 to 40 inches. The depth to free carbonates typically is the same as the depth to till. The thickness of the solum ranges from 30 to 48 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The underlying glacial till contains 2 to 8 percent coarse fragments.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. The 2C horizon has value of 4 or 5 and chroma of 4 to 6. It either has no mottles or has few or common mottles. It is clay loam or loam. Some pedons have secondary lime accumulations in the upper part of the 2C horizon. Some pedons have a coarse textured gravelly layer between the loess mantle and underlying glacial till.

Salida Series

The Salida series consists of deep, excessively drained, very rapidly permeable soils on outwash plains. The soils formed in coarse textured and moderately coarse textured outwash. Slope ranges from 2 to 35 percent.

Typical pedon of Salida gravelly sandy loam, 6 to 35 percent slopes, 1,500 feet south and 175 feet west of the northeast corner of sec. 21, T. 103 N., R. 44 W.

A—0 to 9 inches; black (10YR 2/1) gravelly sandy loam, dark grayish brown (10YR 4/2) dry; weak coarse prismatic structure; friable; slight effervescence; about 15 percent coarse fragments; mildly alkaline; clear smooth boundary.

Bw—9 to 12 inches; dark brown (10YR 3/3) gravelly loamy sand, brown (10YR 5/3) dry; single grain; loose; slight effervescence; about 15 percent coarse fragments; mildly alkaline; gradual smooth boundary.

C1—12 to 30 inches; grayish brown (10YR 5/2) very gravelly sand; single grain; loose; strong effervescence; about 45 percent coarse fragments; mildly alkaline; gradual smooth boundary.

C2—30 to 60 inches; brown (10YR 5/3) and dark yellowish brown (10YR 4/4) very gravelly sand; single grain; loose; strong effervescence; about 55 percent coarse fragments; mildly alkaline.

The thickness of the solum ranges from 7 to 15 inches. Free carbonates are within a depth of 12 inches. The thickness of the mollic epipedon ranges from 7 to 12 inches. The surface layer contains 5 to 15 percent coarse fragments. The underlying material contains 35 to 60 percent coarse fragments.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is sandy loam, gravelly sandy loam, or gravelly loamy sand. The B horizon has value and chroma of 3 or 4. It is gravelly loamy sand to gravelly coarse sand. The C horizon has value of 4 to 6 and chroma of 2 to 4.

Spicer Series

The Spicer series consists of deep, poorly drained, moderately permeable soils on loess-covered uplands. The soils formed in moderately fine textured and medium textured loess. Slope ranges from 0 to 2 percent.

Typical pedon of Spicer silty clay loam, 2,000 feet south and 1,200 feet east of the northwest corner of sec. 32, T. 102 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, gray (10YR 5/1) dry; weak fine subangular blocky; friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A—8 to 13 inches; black (10YR 2/1) silty clay loam, grayish brown (10YR 5/2) dry; weak fine and very fine subangular blocky structure; friable; strong effervescence; mildly alkaline; gradual smooth boundary.

AB—13 to 17 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; weak fine and very fine subangular blocky structure; friable; strong effervescence; mildly alkaline; gradual smooth boundary.

Bg1—17 to 27 inches; dark grayish brown (2.5Y 4/2) silty clay loam; dark gray (10YR 4/1) faces of peds; few fine distinct yellowish brown (10YR 5/4) mottles;

weak fine subangular blocky structure; friable; strong effervescence; mildly alkaline; gradual smooth boundary.

Bg2—27 to 35 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; strong effervescence; mildly alkaline; gradual smooth boundary.

Cg—35 to 60 inches; olive gray (5Y 5/2) silty clay loam; many fine distinct yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) mottles; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 46 inches. The mollic epipedon ranges from 14 to 24 inches in thickness.

The A horizon has value of 2 or 3. The B horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2 and has few or common mottles. It is mainly silty clay loam, but the range includes silt loam. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6, and chroma of 1 or 2 and has few to many mottles. It is mainly silty clay loam, but the range includes silt loam. Some pedons have a 2C horizon of clay loam below a depth of 45 inches.

Spillco Series

The Spillco series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. The soils formed in medium textured alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Spillco silt loam, occasionally flooded, 1,200 feet north and 2,500 feet east of the southwest corner of sec. 13, T. 101 N., R. 45 W.

A1—0 to 10 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; neutral; clear smooth boundary.

A2—10 to 22 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine and very fine subangular blocky structure; friable; neutral; clear smooth boundary.

A3—22 to 37 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; weak fine and very fine subangular blocky structure; friable; slight effervescence; mildly alkaline; gradual smooth boundary.

Bw—37 to 48 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) faces of peds; weak fine subangular blocky structure; friable; slight effervescence; mildly alkaline; gradual wavy boundary.

C—48 to 60 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 34 to 50 inches. The depth to free carbonates ranges from 15 to 34 inches. The mollic epipedon is more than 40 inches thick.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is mainly silt loam, but the range includes loam. The B horizon has value of 2 or 3 and chroma of 1 or 2. In some pedons it is mottled below a depth of 36 inches. It is mainly loam, but the range includes silt loam. The C horizon has hue of 10YR or 2.5Y and chroma of 2 or 3. It either has no mottles or has few or common mottles.

Steinauer Series

The Steinauer series consists of deep, well drained, moderately slowly permeable soils on uplands. The soils formed in moderately fine textured and medium textured, calcareous glacial till. Slope ranges from 15 to 45 percent.

Typical pedon of Steinauer clay loam, 15 to 45 percent slopes, 290 feet north and 1,425 feet west of the southeast corner of sec. 7, T. 101 N., R. 44 W.

A—0 to 5 inches; very dark brown (10YR 2/2) clay loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; slight effervescence; about 2 percent coarse fragments; mildly alkaline; clear smooth boundary.

AC—5 to 9 inches; brown (10YR 4/3) clay loam; very dark grayish brown (10YR 3/2) faces of peds; weak fine subangular blocky structure; friable; strong effervescence; about 2 percent coarse fragments; moderately alkaline; clear wavy boundary.

C1—9 to 25 inches; light olive brown (2.5Y 5/4) clay loam; common fine distinct gray (10YR 6/1) and yellowish brown (10YR 5/8) mottles; massive with weak vertical cleavage; firm; strong effervescence; about 5 percent coarse fragments; moderately alkaline; gradual wavy boundary.

C2—25 to 60 inches; light olive brown (2.5Y 5/4) and grayish brown (2.5Y 5/2) clay loam; common fine distinct brownish yellow (10YR 6/8) mottles; massive; firm; strong effervescence; common accumulations of lime; about 5 percent coarse fragments; moderately alkaline.

The thickness of the solum ranges from 6 to 15 inches. The depth to free carbonates ranges from 0 to 10 inches. The solum contains 2 to 8 percent coarse fragments.

The A horizon has value of 2 to 4. It is mainly clay loam, but the range includes loam. The AC horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. The C horizon has value of 5 or 6 and chroma of 2 to 4 and has few to many mottles.

Talcot Series

The Talcot series consists of deep, poorly drained soils on outwash plains. The soils formed in moderately fine textured and medium textured sediments over coarse textured outwash. Permeability is moderate in the upper part of the profile and rapid in the underlying coarse textured sediments. Slope ranges from 0 to 2 percent.

Typical pedon of Talcot silty clay loam, 75 feet south and 1,925 feet west of the northeast corner of sec. 24, T. 103 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; cloddy; friable; strong effervescence; mildly alkaline; clear smooth boundary.

A1—8 to 15 inches; black (10YR 2/1) and very dark grayish brown (2.5Y 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; strong effervescence; mildly alkaline; gradual smooth boundary.

A2—15 to 22 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine and very fine subangular blocky structure; friable; strong effervescence; mildly alkaline; gradual smooth boundary.

Bg—22 to 33 inches; dark grayish brown (2.5Y 4/2) and olive brown (2.5Y 4/4) silty clay loam; common fine distinct light olive brown (2.5Y 5/6) and gray (5Y 5/1) mottles; weak medium and fine subangular blocky structure; friable; strong effervescence; mildly alkaline; clear smooth boundary.

2Cg—33 to 60 inches; grayish brown (2.5Y 5/2) coarse sand; common fine distinct strong brown (7.5YR 5/6) mottles; single grain; loose; slight effervescence; about 10 percent coarse fragments; mildly alkaline.

The thickness of the solum and the depth to 2C material range from 24 to 40 inches. The thickness of the mollic epipedon ranges from 14 to 24 inches. The A horizon contains 0 to 5 percent coarse fragments. The underlying material contains 10 to 25 percent coarse fragments.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2 or is neutral in hue and has value of 2 and chroma of 0. The B horizon has hue of 2.5Y or 5Y and value of 4 or 5 and has few or common mottles. It is mainly silty clay loam, but the range includes loam. The 2C horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 2 to 4 and has common or many mottles. It is mainly loamy sand, but the range includes coarse sand and gravelly sand.

Trent Series

The Trent series consists of deep, moderately well drained, moderately permeable soils on loess-covered uplands. The soils formed in moderately fine textured and medium textured loess. Slope ranges from 1 to 3 percent.

Typical pedon of Trent silty clay loam, 675 feet south and 650 feet west of the northeast corner of sec. 31, T. 102 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine and very fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

A1—8 to 16 inches; very dark brown (10YR 2/2) silty clay loam, dark gray (10YR 4/1) dry; moderate fine and very fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

A2—16 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark brown (10YR 4/3) dry; weak medium prismatic structure parting to moderate fine and very fine subangular blocky; friable; neutral; gradual wavy boundary.

Bw—22 to 33 inches; brown (10YR 4/3) silty clay loam; dark brown (10YR 3/3) faces of peds; weak medium prismatic structure parting to weak fine and very fine subangular blocky; friable; neutral; gradual smooth boundary.

BCk—33 to 40 inches; light yellowish brown (10YR 6/4) silty clay loam; few fine faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; weak medium and fine subangular blocky structure; friable; strong effervescence; common accumulations of lime; moderately alkaline; gradual smooth boundary.

C—40 to 60 inches; pale brown (10YR 6/3) silt loam; common fine faint light brownish gray (10YR 6/2) and common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; strong effervescence; few accumulations of lime; mildly alkaline.

The solum ranges from 35 to 50 inches in thickness. It is mainly silty clay loam, but the range includes silt loam. The depth to free carbonates ranges from 30 to 45 inches. The mollic epipedon is more than 20 inches thick.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 3 or 4. It is mottled below a depth of 24 inches. The C horizon has hue of 10YR or 2.5Y and value of 5 or 6 and has few to many mottles. It is mainly silt loam, but the range includes silty clay loam. Some pedons have glacial till at a depth of more than 45 inches.

Whitewood Series

The Whitewood series consists of deep, poorly drained, moderately slowly permeable soils in loess-covered swales and drainageways on uplands. The soils formed in moderately fine textured and medium textured local alluvial sediments and loess. Slope ranges from 0 to 2 percent.

Typical pedon of Whitewood silty clay loam, 95 feet north and 1,350 feet east of the southwest corner of sec. 34, T. 102 N., R. 44 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine and very fine subangular blocky structure; friable; slightly acid; abrupt smooth boundary.

A1—8 to 22 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium and fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

A2—22 to 27 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium prismatic structure parting to weak fine and very fine subangular blocky; friable; neutral; clear wavy boundary.

Bg—27 to 39 inches; olive gray (5Y 5/2) silty clay loam; common fine distinct light olive brown (2.5Y 5/6) mottles; weak medium prismatic structure parting to weak medium and fine subangular blocky; friable; neutral; gradual wavy boundary.

BCg—39 to 50 inches; olive gray (5Y 5/2) silty clay loam; many fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.

Cg—50 to 60 inches; olive gray (5Y 5/2) silty clay loam; many fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; massive; friable; strong effervescence; few accumulations of lime; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to 52 inches. The mollic epipedon is more than 24 inches thick.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or is neutral in hue and has value of 2 or 3 and chroma of 0. It is mainly silty clay loam, but silt loam is within the range. The B horizon has hue of 10YR, 2.5Y or 5Y and value of 3 to 5 and has few to many mottles. The C horizon has hue of 2.5Y or 5Y and value of 5 or 6 and has common or many mottles. Some pedons have glacial till below a depth of 45 inches

Wilmonton Series

The Wilmonton series consists of deep, somewhat poorly drained and moderately well drained, moderately slowly permeable soils on uplands. The soils formed in a mantle of moderately fine textured and medium textured sediments and in the underlying glacial till. Slope ranges from 1 to 3 percent.

Typical pedon of Wilmonton silty clay loam, 700 feet north and 1,800 feet east of the southwest corner of sec. 23, T. 103 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure parting to weak fine granular; friable; neutral; abrupt smooth boundary.

A—8 to 16 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; black (10YR 2/1) faces of peds; moderate fine and very fine subangular blocky structure; friable; neutral; gradual irregular boundary.

Bw—16 to 23 inches; dark brown (10YR 4/3) loam; few medium distinct grayish brown (2.5Y 5/2) mottles; very dark grayish brown (10YR 3/2) faces of peds; moderate fine and very fine subangular blocky structure; friable; neutral; gradual wavy boundary.

2BC—23 to 35 inches; olive brown (2.5Y 4/4) clay loam; few fine distinct grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/6) mottles; weak coarse and medium subangular blocky structure; friable; slight effervescence; about 3 percent coarse fragments; mildly alkaline; gradual smooth boundary.

2C1—35 to 52 inches; light olive brown (2.5Y 5/4) clay loam; common fine distinct strong brown (7.5YR 5/8) and yellowish brown (10YR 5/6) and common fine faint grayish brown (2.5Y 5/2) mottles; massive; firm; about 5 percent coarse fragments; strong effervescence; many accumulations of lime; moderately alkaline; gradual smooth boundary.

2C2—52 to 60 inches; grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) clay loam; common fine faint yellowish brown (10YR 5/6) and common medium distinct strong brown (7.5YR 5/8) mottles; massive; firm; strong effervescence; about 5 percent coarse fragments; moderately alkaline.

The thickness of the solum and the depth to free carbonates range from 20 to 40 inches. The depth to glacial till or a gravelly layer is less than 24 inches. The thickness of the mollic epipedon ranges from 14 to 24 inches. The surface mantle contains 0 to 5 percent coarse fragments. The underlying glacial till contains 2 to 8 percent coarse fragments.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is loam, clay loam, or silty clay loam. The B and 2C horizons are loam or clay loam. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 3 or 4. The lower part of this horizon either has no mottles or has few or common mottles. Some pedons have a coarser textured 2B horizon just above the glacial till. The 2C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4 and has few to many mottles.

Formation of the Soils

The characteristics of the soil are determined by the interaction of five factors. Those factors and their effects on the soils in this survey area are described in this section.

Parent Material

The physical medium within which the soil develops is the parent material. The most common parent material in the survey area is loess, or wind-deposited silty material. Loess was blown into the area from the west 15,000 to 25,000 years ago, creating a silt blanket over the county. The loess blanket is thickest, 15 to 20 feet, in the west-central part of the county, north of the city of Beaver Creek. It is thinnest in the northeast corner of the county, where it has been mixed with the underlying material during farming, so that it is now barely noticeable.

Beneath the loess blanket is another parent material, glacial till. It was deposited by ice as an unsorted mixture of clay, silt, sand, pebbles, and rocks. The glacial till in this survey area was deposited more than 40,000 years ago.

Another parent material is the Sioux quartzite residuum. It is material weathered from metamorphosed sandstone bedrock believed to be about 1.5 billion years old (*6*). Although this bedrock underlies the entire survey area, it is at or close to the surface in only a few areas.

During the period when the glacier was melting, enormous amounts of water flowed through Rock County. This meltwater carried tons of soil and material and, as the volume of water decreased, the material settled. This material, mainly sand and gravel, is another parent material. Soils formed in outwash are along ancient glacial rivers and streams. Some of these soils are distant from present-day watercourses.

The present-day rivers in the county still carry some material as they constantly cut and dig at streambanks (*5*). This material, alluvium, is deposited on flood plains as the water volume decreases. Alluvium is generally finer textured than outwash and in most cases is much younger.

A circular depression in the north-central part of Rock County contains a parent material known as water-modified glacial till and lacustrine sediments. This shallow glacial lake basin is of uncertain origin.

Plants and Animals

The soil formation process begins as plants begin to grow on the freshly deposited parent material. Plant roots loosen soil and release minerals in the underlying material. Decay of the plants returns organic matter and plant nutrients to the soil.

Earthworms eat decomposed plant matter, and their burrows help channel air and water through the soil. Horizons in many soils contain wormcasts of soil material in the surface layer and the subsoil. Burrowing animals mix soil material from various horizons and bring fresh parent material to the surface.

Man also influences soil formation. Farming has increased the action of some soil-forming processes. In fields where the soil is exposed to the air and wind, the oxidation of organic matter has accelerated. Erosion of the surface layer has been accelerated on some steeply sloping soils, and areas below these slopes have received deposits of eroded material. Artificial drainage and the lowering of water tables in wet soils, measures that improve fertility, and changes in the kinds of vegetation also affect soil formation.

Climate

Climatic changes have been responsible for the formation and melting of glaciers, deposition of loess, evolution of topography, and growth cycles of plants and animals. The present climate has been relatively constant for the past few thousand years. It is a continental climate that is characterized by long, cold winters and hot summers. Freezing of the soil during the winter slows the soil-forming processes. Alternate freezing and thawing, however, especially in the spring, play a part in the development of soil structure. Freezing and thawing also help to disintegrate parent materials, and frost heaving helps mix soil material.

Rainfall affects the leaching of lime. The solum thickness of a soil is often determined by the depth to which free lime has been leached. Climate determines the growth of the prairie vegetation. As a result of the grass cover, most soils in the survey area have a dark surface layer. A prairie vegetation and cool temperatures promote the accumulation of organic matter.

Climate is essentially uniform over the survey area, but there are local variations in climate caused by differences in relief and aspect. South- and west-facing slopes tend to be slightly drier and warmer than north- and east-facing slopes.

Topography

Each type of topographic position—crest, side slope, foot slope, toe slope, or drainageway—affects development of the soil. At different locations on the landscape, the forces of soil formation differ and different soils will develop.

In areas with more relief, much of the rainfall runs off the hillsides and plant growth is less than in areas where the rain soaks into the ground. The lack of water movement through the soil also limits the leaching of carbonates and the translocation of clay particles.

Soils on sloping areas tend to have less distinct horizons than soils on more level areas. Steinauer and Crofton soils, for example, are weakly developed. Runoff does infiltrate at the base of these less developed sloping soils, and in those areas the soils tend to be more developed.

In steeply sloping areas, erosional sediments are carried downslope by runoff. These sediments affect not only those soils from which they have been removed, but also those areas where the sediment is deposited. Alcester soils formed in colluvial sediments over the original soil material.

Topographic position affects soil drainage. The Marcus and Whitwood soils in concave drainageways are poorly drained and have a high water table. They usually are wet throughout the year. In contrast, Moody and Nora soils are on convex side slopes. They are well drained, are drier, and have a water table at much greater depths.

Time

Time is required for the effects of climate and biological activity on the parent materials. In areas that are stable and not subject to frequent changes in parent material, conditions are favorable for soil development and mature profiles have developed. Mature soils, such as Trent soils, have a well developed surface layer, subsurface layer, and subsoil. In unstable areas where conditions for soil development are less favorable, the soils are weakly developed and have only a thin surface layer over the parent material. Crofton soils have this kind of profile.

Soils formed in alluvium along streams are also immature or weakly developed because the parent material is geologically young. Fresh deposits of alluvium are added almost annually. This recurring deposition prevents the formation of distinct horizons and mature profiles. Millington soils have this kind of development.

The soils in Rock County are geologically old compared to the rest of southern and southwestern Minnesota. The last glaciation in Minnesota did not reach as far south as Rock County. As a result, there has been more time for the soils to develop and the county has a mature topography with a well defined drainage pattern.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures 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.

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.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

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.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

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.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

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.

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.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration 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

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

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.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

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.

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.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

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.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. 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).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area 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.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1958-80 at Luverne, Minnesota]

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----	21.6	0.9	11.3	47	-28	0	0.59	0.18	0.91	2	8.2
February---	28.3	7.0	17.7	55	-27	0	.87	.38	1.29	3	8.3
March------	41.0	20.5	30.8	75	-12	36	1.67	.63	2.54	4	10.3
April------	59.1	34.2	46.7	89	14	64	2.42	1.14	3.51	6	.8
May--------	72.1	44.6	58.4	92	23	272	3.40	1.60	4.94	7	.0
June-------	81.6	55.7	68.7	98	37	561	3.59	1.93	5.05	7	.0
July-------	86.0	60.0	73.0	99	42	713	3.55	1.60	5.21	6	.0
August-----	83.9	57.1	70.5	98	39	636	3.46	1.31	5.25	5	.0
September--	74.6	47.7	61.2	95	28	344	3.29	1.54	4.80	6	.0
October----	63.2	36.4	49.8	86	14	96	2.17	.49	3.49	4	.5
November---	43.5	22.3	32.9	70	-7	0	1.06	.20	1.72	3	3.9
December---	28.9	9.2	19.1	55	-24	0	.76	.22	1.20	2	8.9
Yearly:											
Average--	57.0	33.0	45.0	---	---	---	---	---	---	---	---
Extreme--	---	---	---	100	-31	---	---	---	---	---	---
Total----	---	---	---	---	---	2,722	26.83	20.53	33.41	55	40.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1958-80 at Luverne, Minnesota]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 10	May 16	May 26
2 years in 10 later than--	May 4	May 11	May 21
5 years in 10 later than--	Apr. 20	May 1	May 10
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 1	Sept. 21	Sept. 13
2 years in 10 earlier than--	Oct. 7	Sept. 26	Sept. 17
5 years in 10 earlier than--	Oct. 17	Oct. 6	Sept. 26

TABLE 3.--GROWING SEASON

[Recorded in the period 1958-80 at Luverne, Minnesota]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	153	137	118
8 years in 10	162	143	125
5 years in 10	179	157	138
2 years in 10	196	170	152
1 year in 10	205	176	159

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
18	Comfrey clay loam	2,260	0.7
28A	Alcester silty clay loam, 1 to 3 percent slopes	2,870	0.9
28B	Alcester silt loam, 3 to 8 percent slopes	2,220	0.7
42B	Salida gravelly sandy loam, 2 to 6 percent slopes	610	0.2
42D	Salida gravelly sandy loam, 6 to 35 percent slopes	1,160	0.4
54A	Ihlen silty clay loam, 0 to 2 percent slopes	3,765	1.2
54B	Ihlen silty clay loam, 2 to 6 percent slopes	4,110	1.3
85	Calco silty clay loam, occasionally flooded	5,210	1.7
90B	Moody silty clay loam, 1 to 5 percent slopes	37,765	12.2
90C	Moody silty clay loam, 5 to 9 percent slopes	4,775	1.5
92A	Flandreau silt loam, 0 to 2 percent slopes	1,550	0.5
92B	Flandreau silt loam, 2 to 6 percent slopes	6,250	2.0
97	Trent silty clay loam	39,800	12.8
98	Colo silty clay loam	1,805	0.6
129	Cylinder loam, occasionally flooded	1,290	0.4
140	Spicer silty clay loam	1,045	0.3
149B	Everly clay loam, 2 to 6 percent slopes	4,875	1.6
149C	Everly clay loam, 6 to 12 percent slopes	1,035	0.3
156A	Fairhaven silt loam, 0 to 2 percent slopes	4,340	1.4
156B	Fairhaven silt loam, 2 to 6 percent slopes	2,050	0.7
214	Talcot silty clay loam	2,175	0.7
249	Marcus silty clay loam	19,360	6.2
269	Millington clay loam, occasionally flooded	3,430	1.1
291	Ransom silty clay loam	2,360	0.8
304	Rushmore silty clay loam	2,175	0.7
306B	Sac silty clay loam, 1 to 5 percent slopes	41,445	13.3
306C	Sac silty clay loam, 5 to 10 percent slopes	3,750	1.2
327B	Dickman sandy loam, 2 to 6 percent slopes	2,070	0.7
327C	Dickman sandy loam, 6 to 12 percent slopes	1,515	0.5
345	Wilmonton silty clay loam	610	0.2
362	Millington clay loam, frequently flooded	5,645	1.8
392	Biscay silty clay loam	895	0.3
443	Ihlen Variant silt loam, 0 to 3 percent slopes	520	0.2
490	Whitewood silty clay loam	30,310	9.8
596E	Steinauer clay loam, 15 to 45 percent slopes	1,000	0.3
610	Calco silty clay loam, frequently flooded	6,625	2.1
658A	Dempster silt loam, 0 to 2 percent slopes	2,890	0.9
658B	Dempster silt loam, 2 to 6 percent slopes	1,135	0.4
659A	Graceville silt loam, 0 to 2 percent slopes	11,250	3.6
659B	Graceville silt loam, 2 to 6 percent slopes	2,480	0.8
661C	Nora silt loam, 4 to 10 percent slopes	7,440	2.4
661D2	Nora silt loam, 10 to 18 percent slopes, eroded	510	0.2
662C2	Nora-Crofton silt loams, 6 to 12 percent slopes, eroded	7,115	2.3
662D2	Nora-Crofton silt loams, 12 to 18 percent slopes, eroded	565	0.2
663	Spillco silt loam, occasionally flooded	8,850	2.9
939B	Ihlen-Rock outcrop complex, 0 to 4 percent slopes	4,255	1.4
939C	Ihlen-Rock outcrop complex, 4 to 35 percent slopes	2,160	0.7
1029	Pits, gravel	1,050	0.3
1839	Marcus Variant silty clay loam	1,960	0.6
1920	Spillco silt loam, frequently flooded	6,070	2.0
	Total	310,400	100.0

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
18	Comfrey clay loam (where drained)
28A	Alcester silty clay loam, 1 to 3 percent slopes
28B	Alcester silt loam, 3 to 8 percent slopes
54A	Ihlen silty clay loam, 0 to 2 percent slopes
54B	Ihlen silty clay loam, 2 to 6 percent slopes
85	Calco silty clay loam, occasionally flooded (where drained)
90B	Moody silty clay loam, 1 to 5 percent slopes
92A	Flandreau silt loam, 0 to 2 percent slopes
92B	Flandreau silt loam, 2 to 6 percent slopes
97	Trent silty clay loam
98	Colo silty clay loam (where drained)
129	Cylinder loam, occasionally flooded
140	Spicer silty clay loam (where drained)
149B	Everly clay loam, 2 to 6 percent slopes
156A	Fairhaven silt loam, 0 to 2 percent slopes
156B	Fairhaven silt loam, 2 to 6 percent slopes
214	Talcot silty clay loam (where drained)
249	Marcus silty clay loam (where drained)
269	Millington clay loam, occasionally flooded (where drained)
291	Ransom silty clay loam
304	Rushmore silty clay loam (where drained)
306B	Sac silty clay loam, 1 to 5 percent slopes
345	Wilmonton silty clay loam
392	Biscay silty clay loam (where drained)
490	Whitewood silty clay loam (where drained)
658A	Dempster silt loam, 0 to 2 percent slopes
658B	Dempster silt loam, 2 to 6 percent slopes
659A	Graceville silt loam, 0 to 2 percent slopes
659B	Graceville silt loam, 2 to 6 percent slopes
663	Spillco silt loam, occasionally flooded

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Alfalfa hay	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*
18----- Comfrey	IIw	100	36	75	3.5	---
28A----- Alcester	I	135	45	90	---	---
28B----- Alcester	IIe	125	41	80	---	6.5
42B----- Salida	IVs	35	15	30	2.4	3.7
42D----- Salida	VIs	---	---	---	2.0	3.0
54A----- Ihlen	IIs	115	40	70	3.5	5.8
54B----- Ihlen	IIe	105	36	70	3.3	5.5
85----- Calco	IIw	100	35	84	3.9	7.0
90B----- Moody	IIe	125	42	77	---	6.5
90C----- Moody	IIIe	120	37	67	---	6.0
92A----- Flandreau	IIs	100	35	75	---	5.0
92B----- Flandreau	IIe	90	32	67	---	4.7
97----- Trent	I	140	47	---	---	---
98----- Colo	IIw	100	36	---	4.2	---
129----- Cylinder	IIs	95	34	70	3.8	---
140----- Spicer	IIw	118	36	80	4.0	6.0
149B----- Everly	IIe	120	39	75	3.4	5.6
149C----- Everly	IIIe	115	35	64	2.8	4.6
156A----- Fairhaven	IIs	85	31	75	3.5	4.8

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Alfalfa hay	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*
156B----------------------- Fairhaven	IIe	75	26	72	3.2	4.5
214----------------------- Talcot	IIw	95	36	76	4.0	5.0
249----------------------- Marcus	IIw	120	41	84	3.8	6.3
269----------------------- Millington	IIw	100	35	68	4.6	---
291----------------------- Ransom	I	140	47	80	4.5	---
304----------------------- Rushmore	IIw	118	40	85	4.5	---
306B----------------------- Sac	IIe	125	42	85	4.2	---
306C----------------------- Sac	IIIe	120	37	80	3.8	---
327B----------------------- Dickman	IIIe	80	26	45	2.6	3.9
327C----------------------- Dickman	IVe	70	22	40	2.2	3.4
345----------------------- Wilmonton	I	130	44	80	4.5	---
362----------------------- Millington	Vw	---	---	---	---	---
392----------------------- Biscay	IIw	95	33	65	3.5	5.2
443----------------------- Ihlen Variant	VIs	---	---	---	3.0	4.5
490----------------------- Whitewood	IIw	120	41	84	3.8	6.3
596E----------------------- Steinauer	VIe	---	---	---	---	---
610----------------------- Calco	Vw	---	---	---	---	---
658A----------------------- Dempster	IIs	85	30	78	---	4.2
658B----------------------- Dempster	IIe	75	26	74	---	4.0
659A----------------------- Graceville	I	115	38	77	---	6.3
659B----------------------- Graceville	IIe	110	35	77	---	6.3

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Alfalfa hay	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*
661C----------------------- Nora	IIIe	120	37	61	---	5.2
661D2---------------------- Nora	IVe	49	17	47	---	4.5
662C2---------------------- Nora-Crofton	IIIe	115	33	43	---	4.0
662D2---------------------- Nora-Crofton	VIe	---	---	---	---	---
663------------------------ Spillco	IIw	125	43	72	3.5	5.8
939B**--------------------- Ihlen-Rock outcrop	VIs	---	---	---	---	---
939C**--------------------- Ihlen-Rock outcrop	VIIs	---	---	---	---	---
1029**. Pits						
1839----------------------- Marcus Variant	IIIw	95	30	58	3.2	---
1920----------------------- Spillco	VIw	---	---	---	---	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--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
18---------------- Comfrey	---	American plum, redosier dogwood.	Hackberry, tall purple willow, northern white-cedar, white spruce, Amur maple.	Golden willow, green ash.	Eastern cottonwood, silver maple.
28A--------------- Alcester	---	Eastern redcedar, American plum, lilac.	Blue spruce, hackberry, Siberian crabapple.	Green ash, golden willow, ponderosa pine.	Eastern cottonwood, Siberian elm.
28B--------------- Alcester	---	Siberian peashrub, American plum, lilac.	Bur oak, blue spruce, hackberry, Russian-olive, eastern redcedar.	Honeylocust, ponderosa pine, green ash.	---
42B, 42D. Salida					
54A, 54B---------- Ihlen	Lilac, Peking cotoneaster.	Eastern redcedar, Siberian peashrub, Russian-olive, Manchurian crabapple, common chokecherry.	Green ash, ponderosa pine, honeylocust.	Siberian elm------	---
85---------------- Calco	Lilac-------------	Siberian peashrub	Hackberry, ponderosa pine, eastern redcedar, Russian-olive.	Green ash, honeylocust, green ash, golden willow.	Eastern cottonwood.
90B, 90C---------- Moody	---	Siberian peashrub, American plum, lilac.	Blue spruce, hackberry, Russian-olive, bur oak, eastern redcedar.	Ponderosa pine, green ash, honeylocust.	---
92A, 92B---------- Flandreau	Siberian peashrub, Peking cotoneaster, lilac.	Manchurian crabapple, eastern redcedar, hackberry.	Siberian elm, ponderosa pine, green ash, honeylocust, Russian-olive.	---	---
97---------------- Trent	---	American plum, lilac.	Blue spruce, eastern redcedar, Siberian crabapple, bur oak.	Hackberry, ponderosa pine, green ash, golden willow.	Eastern cottonwood, Siberian elm.

TABLE 7.--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
98. Colo	Lilac	Siberian peashrub	Eastern redcedar, blue spruce, hackberry, ponderosa pine.	Silver maple, golden willow, honeylocust, green ash.	Eastern cottonwood.
129. Cylinder	---	Redosier dogwood, lilac.	Blue spruce, northern white-cedar, Amur maple, white spruce.	Austrian pine, eastern white pine, green ash, hackberry.	Silver maple.
140. Spicer	Lilac	Siberian peashrub	Hackberry, ponderosa pine, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, golden willow, green ash.	Eastern cottonwood.
149B, 149C. Everly	---	American plum, lilac, Siberian peashrub.	Russian-olive, eastern redcedar, blue spruce, hackberry, bur oak.	Green ash, ponderosa pine, honeylocust.	---
156A, 156B. Fairhaven	Lilac, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, hackberry, Manchurian crabapple.	Ponderosa pine, green ash, Siberian elm, honeylocust, Russian-olive.	---	---
214. Talcot	---	---	---	Golden willow	Eastern cottonwood.
249. Marcus	Lilac	Siberian peashrub	Eastern redcedar, blue spruce, ponderosa pine, hackberry.	Green ash, honeylocust, golden willow, silver maple.	Eastern cottonwood.
269. Millington	---	Northern white-cedar, lilac, Siberian peashrub.	Hackberry, white spruce, eastern redcedar.	Honeylocust, silver maple, green ash, red maple, white ash.	Eastern cottonwood.
291. Ransom	Peking cotoneaster	American plum, lilac, Siberian peashrub.	Eastern redcedar, ponderosa pine, Manchurian crabapple.	Hackberry, honeylocust, green ash, golden willow.	Eastern cottonwood.
304. Rushmore	Lilac	Siberian peashrub	Blue spruce, ponderosa pine, hackberry, eastern redcedar.	Golden willow, green ash, honeylocust, silver maple.	Eastern cottonwood.
306B, 306C. Sac	---	Siberian peashrub, American plum, lilac.	Eastern redcedar, blue spruce, bur oak, hackberry, Russian-olive.	Ponderosa pine, honeylocust, green ash.	---
327B, 327C. Dickman	Lilac	Rocky Mountain juniper, eastern redcedar, Russian-olive, ponderosa pine.	Siberian elm	---	---

TABLE 7.--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
345 Wilmonton	Peking cotoneaster	Siberian peashrub, lilac, American plum.	Eastern redcedar, Manchurian crabapple, ponderosa pine.	Golden willow, honeylocust, green ash, hackberry.	Eastern cottonwood.
362 Millington	---	Northern white-cedar, lilac, Siberian peashrub.	Hackberry, white spruce, eastern redcedar.	Honeylocust, silver maple, green ash, red maple, white ash.	Eastern cottonwood.
392 Biscay	Lilac	Siberian peashrub	Hackberry, ponderosa pine, blue spruce, eastern redcedar.	Golden willow, silver maple, honeylocust, green ash.	Eastern cottonwood.
443. Ihlen Variant					
490 Whitewood	---	Silver buffaloberry, lilac.	Blue spruce, ponderosa pine, bur oak, Siberian crabapple, hackberry, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood, Siberian elm.
596E Steinauer	Silver buffaloberry, American plum.	Eastern redcedar, Russian-olive, Siberian peashrub, Rocky Mountain juniper, hackberry.	Siberian elm, ponderosa pine, honeylocust, green ash.	---	---
610 Calco	Lilac	Siberian peashrub	Hackberry, ponderosa pine, eastern redcedar, Russian-olive.	Green ash, honeylocust, green ash, golden willow.	Eastern cottonwood.
658A, 658B Dempster	Siberian peashrub, Peking cotoneaster, lilac.	Manchurian crabapple, hackberry, eastern redcedar.	Siberian elm, ponderosa pine, green ash, Russian-olive, honeylocust.	---	---
659A, 659B Graceville	---	Siberian peashrub, American plum, lilac.	Bur oak, Russian-olive, hackberry, blue spruce, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
661C, 661D2 Nora	---	Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---

TABLE 7.--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
662C2*:					
Nora	---	Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Crofton	Silver buffaloberry, American plum.	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Russian-olive, hackberry.	Ponderosa pine, honeylocust, Siberian elm, green ash.	---	---
662D2*:					
Nora	---	Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Crofton.					
663 Spillco	Peking cotoneaster	American plum, lilac, Siberian peashrub.	Eastern redcedar, Manchurian crabapple, ponderosa pine.	Hackberry, green ash, honeylocust, golden willow.	Eastern cottonwood.
939B*, 939C*:					
Ihlen	Lilac, Peking cotoneaster.	Eastern redcedar, Siberian peashrub, Russian-olive, Manchurian crabapple, common chokecherry.	Green ash, ponderosa pine, honeylocust.	Siberian elm	---
Rock outcrop.					
1029*. Pits					
1839 Marcus Variant	Lilac	Siberian peashrub	Eastern redcedar, blue spruce, ponderosa pine, hackberry.	Green ash, honeylocust, golden willow, silver maple.	Eastern cottonwood.
1920 Spillco	Peking cotoneaster	American plum, lilac, Siberian peashrub.	Eastern redcedar, Manchurian crabapple, ponderosa pine.	Hackberry, green ash, honeylocust, golden willow.	Eastern cottonwood.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--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
18 Comfrey	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
28A Alcester	Slight	Slight	Slight	Slight	Slight.
28B Alcester	Slight	Slight	Moderate: slope.	Slight	Slight.
42B Salida	Slight	Slight	Severe: small stones.	Slight	Severe: droughty.
42D Salida	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate	Severe: droughty, slope.
54A Ihlen	Slight	Slight	Slight	Slight	Moderate: depth to rock.
54B Ihlen	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
85 Calco	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
90B Moody	Slight	Slight	Moderate: slope.	Slight	Slight.
90C Moody	Slight	Slight	Severe: slope.	Slight	Slight.
92A Flandreau	Slight	Slight	Slight	Slight	Slight.
92B Flandreau	Slight	Slight	Moderate: slope.	Slight	Slight.
97 Trent	Slight	Slight	Slight	Slight	Slight.
98 Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
129 Cylinder	Severe: flooding.	Moderate: wetness, flooding.	Moderate: wetness, flooding.	Slight	Moderate: flooding.
140 Spicer	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
149B Everly	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
149C------------------ Everly	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
156A------------------ Fairhaven	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
156B------------------ Fairhaven	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
214------------------- Talcot	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
249------------------- Marcus	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
269------------------- Millington	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
291------------------- Ransom	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Severe: excess humus.	Slight.
304------------------- Rushmore	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
306B------------------ Sac	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
306C------------------ Sac	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight----------	Slight.
327B------------------ Dickman	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty.
327C------------------ Dickman	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: droughty, slope.
345------------------- Wilmonton	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
362------------------- Millington	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
392------------------- Biscay	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
443------------------- Ihlen Variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Severe: depth to rock.
490------------------- Whitewood	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
596E------------------ Steinauer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
610 Calco	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
658A Dempster	Slight	Slight	Slight	Slight	Slight.
658B Dempster	Slight	Slight	Moderate: slope.	Slight	Slight.
659A, 659B Graceville	Slight	Slight	Slight	Slight	Slight.
661C Nora	Slight	Slight	Severe: slope.	Slight	Slight.
661D2 Nora	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
662C2*:					
Nora	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Crofton	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
662D2*:					
Nora	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Crofton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
663 Spillco	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
939B*:					
Ihlen	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
Rock outcrop.					
939C*:					
Ihlen	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, depth to rock.
Rock outcrop.					
1029*. Pits					
1839 Marcus Variant	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1920 Spillco	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--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
18 Comfrey	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
28A Alcester	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
28B Alcester	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.
42B Salida	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
42D Salida	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
54A, 54B Ihlen	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
85 Calco	Good	Fair	Good	Poor	Very poor.	Good	Good	Fair	Poor	Fair.
90B Moody	Good	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.
90C Moody	Fair	Good	Good	Fair	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
92A Flandreau	Good	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
92B Flandreau	Fair	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
97 Trent	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Very poor.	Very poor.
98 Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
129 Cylinder	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
140 Spicer	Good	Good	Fair	Fair	Poor	Good	Good	Good	Fair	Good.
149B Everly	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
149C Everly	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
156A, 156B Fairhaven	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
214 Talcot	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
249---------------- Marcus	Good	Good	Good	Fair	Poor	Good	Fair	Good	Fair	Fair.
269---------------- Millington	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Poor.
291---------------- Ransom	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
304---------------- Rushmore	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
306B--------------- Sac	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
306C--------------- Sac	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
327B, 327C--------- Dickman	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
345---------------- Wilmonton	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
362---------------- Millington	Good	Good	Good	Good	Fair	Good	Good	Good	Good	Poor.
392---------------- Biscay	Good	Good	Good	Good	Fair	Good	Good	Good	Fair	Good.
443---------------- Ihlen Variant	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Poor.
490---------------- Whitewood	Good	Good	Fair	Fair	Poor	Fair	Fair	Good	Poor	Fair.
596E--------------- Steinauer	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
610---------------- Calco	Good	Fair	Good	Poor	Very poor.	Good	Good	Fair	Poor	Fair.
658A--------------- Dempster	Good	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Fair	---	Very poor.
658B--------------- Dempster	Fair	Fair	Good	Poor	Very poor.	Very poor.	Very poor.	Fair	---	Very poor.
659A, 659B--------- Graceville	Good	Good	Good	---	---	Very poor.	Very poor.	Good	---	Very poor.
661C--------------- Nora	Poor	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Very poor.
661D2-------------- Nora	Poor	Good	Good	Good	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
662C2*: Nora---------------	Poor	Good	Good	Good	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
662C2*:										
Crofton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
662D2*:										
Nora	Poor	Good	Good	Good	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.
Crofton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
663 Spillco	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
939B*:										
Ihlen	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Rock outcrop.										
939C*:										
Ihlen	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Rock outcrop.										
1029*. Pits										
1839 Marcus Variant	Fair	Fair	Fair	Poor	Poor	Good	Good	Good	Poor	Good.
1920 Spillco	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Fair	Poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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
18----------------- Comfrey	Severe: wetness, excess humus.	Severe: flooding, wetness, low strength.	Severe: flooding, wetness.	Severe: flooding, wetness, low strength.	Severe: low strength, wetness, flooding.	Severe: wetness.
28A---------------- Alcester	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
28B---------------- Alcester	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
42B---------------- Salida	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Severe: droughty.
42D---------------- Salida	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
54A---------------- Ihlen	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength, frost action.	Moderate: depth to rock.
54B---------------- Ihlen	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength, frost action.	Moderate: depth to rock.
85----------------- Calco	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
90B---------------- Moody	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
90C---------------- Moody	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
92A---------------- Flandreau	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
92B---------------- Flandreau	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Severe: low strength.	Slight.
97----------------- Trent	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
98----------------- Colo	Severe: wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.

TABLE 10.--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
129: Cylinder	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
140: Spicer	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
149B: Everly	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
149C: Everly	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
156A: Fairhaven	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
156B: Fairhaven	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
214: Talcot	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
249: Marcus	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
269: Millington	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
291: Ransom	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
304: Rushmore	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
306B: Sac	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
306C: Sac	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
327B: Dickman	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
327C: Dickman	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
345: Wilmonton	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.

TABLE 10.--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
362----------------Millington	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
392----------------Biscay	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
443----------------Ihlen Variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, low strength.	Severe: depth to rock.
490----------------Whitewood	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
596E---------------Steinauer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
610----------------Calco	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, flooding, frost action.	Severe: flooding.
658A---------------Dempster	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
658B---------------Dempster	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
659A, 659B---------Graceville	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
661C---------------Nora	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
661D2--------------Nora	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
662C2*:						
Nora----------------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
Crofton-------------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
662D2*:						
Nora----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
Crofton-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

See footnote at end of table.

TABLE 10.--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
663---------------- Spillco	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Moderate: flooding.
939B*:						
Ihlen-------------	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength, frost action.	Moderate: depth to rock.
Rock outcrop.						
939C*:						
Ihlen-------------	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope, depth to rock.
Rock outcrop.						
1029*. Pits						
1839--------------- Marcus Variant	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, frost action.	Severe: wetness.
1920--------------- Spillco	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Severe: flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--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
18----------------- Comfrey	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
28A---------------- Alcester	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
28B---------------- Alcester	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
42B---------------- Salida	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
42D---------------- Salida	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
54A, 54B----------- Ihlen	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
85----------------- Calco	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
90B---------------- Moody	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
90C---------------- Moody	Moderate: percs slowly.	Severe: slope.	Slight-----------	Slight-----------	Good.
92A, 92B----------- Flandreau	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
97----------------- Trent	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
98----------------- Colo	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Poor: wetness, hard to pack.
129---------------- Cylinder	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
140---------------- Spicer	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
149B--------------- Everly	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.

TABLE 11.--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
149C: Everly	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
156A, 156B: Fairhaven	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
214: Talcot	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
249: Marcus	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness, hard to pack.
269: Millington	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
291: Ransom	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
304: Rushmore	Severe: wetness, percs slowly.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
306B: Sac	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
306C: Sac	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
327B: Dickman	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
327C: Dickman	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
345: Wilmonton	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
362: Millington	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
392: Biscay	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
443: Ihlen Variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.

TABLE 11.--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
490: Whitewood	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
596E: Steinauer	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
610: Calco	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
658A, 658B: Dempster	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
659A, 659B: Graceville	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey, thin layer.
661C: Nora	Slight	Severe: slope.	Slight	Slight	Good.
661D2: Nora	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
662C2*:					
Nora	Slight	Severe: slope.	Slight	Slight	Good.
Crofton	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
662D2*:					
Nora	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Crofton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
663: Spillco	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness.	Fair: wetness.
939B*:					
Ihlen	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
Rock outcrop.					
939C*:					
Ihlen	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
Rock outcrop.					
1029*. Pits					

See footnote at end of table.

TABLE 11.--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
1839----------------- Marcus Variant	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
1920----------------- Spillco	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness.	Fair: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--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
18 Comfrey	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
28A, 28B Alcester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
42B Salida	Good	Probable	Probable	Poor: small stones, area reclaim.
42D Salida	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim.
54A, 54B Ihlen	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey.
85 Calco	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
90B, 90C Moody	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
92A, 92B Flandreau	Good	Probable	Improbable: too sandy.	Good.
97 Trent	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
98 Colo	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
129 Cylinder	Fair: wetness.	Probable	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
140 Spicer	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
149B Everly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
149C Everly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
156A, 156B Fairhaven	Good	Probable	Probable	Poor: area reclaim, small stones.
214 Talcot	Poor: wetness.	Probable	Probable	Poor: wetness.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
249 Marcus	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
269 Millington	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
291 Ransom	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
304 Rushmore	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
306B, 306C Sac	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
327B, 327C Dickman	Good	Probable	Improbable: too sandy.	Poor: thin layer.
345 Wilmonton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
362 Millington	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
392 Biscay	Fair: wetness.	Probable	Probable	Fair: area reclaim, thin layer.
443 Ihlen Variant	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
490 Whitewood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
596E Steinauer	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
610 Calco	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
658A, 658B Dempster	Good	Probable	Probable	Poor: area reclaim.
659A, 659B Graceville	Good	Probable	Probable	Good.
661C Nora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
661D2 Nora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
662C2*:				
Nora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Crofton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
662D2*:				
Nora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Crofton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
663 Spillco	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
939B*:				
Ihlen	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey.
Rock outcrop.				
939C*:				
Ihlen	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey.
Rock outcrop.				
1029*. Pits				
1839 Marcus Variant	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1920 Spillco	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--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-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
18: Comfrey	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
28A: Alcester	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Favorable	Favorable	Favorable.
28B: Alcester	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
42B: Salida	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy	Droughty.
42D: Salida	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
54A: Ihlen	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Depth to rock	Depth to rock, erodes easily.	Erodes easily, depth to rock.
54B: Ihlen	Moderate: seepage, depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
85: Calco	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
90B, 90C: Moody	Moderate: seepage, slope.	Moderate: thin layer, piping, hard to pack.	Deep to water	Slope	Erodes easily	Erodes easily.
92A: Flandreau	Severe: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
92B: Flandreau	Severe: seepage.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
97: Trent	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Favorable	Erodes easily	Erodes easily.
98: Colo	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Flooding, wetness.	Wetness	Wetness.
129: Cylinder	Severe: seepage.	Severe: seepage, piping.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Favorable.
140: Spicer	Moderate: seepage.	Severe: wetness.	Frost action	Wetness	Wetness, erodes easily.	Wetness, erodes easily.
149B: Everly	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
149C Everly	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope	Slope.
156A Fairhaven	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable	Erodes easily, too sandy.	Erodes easily.
156B Fairhaven	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope	Erodes easily, too sandy.	Erodes easily.
214 Talcot	Severe: seepage.	Severe: seepage, wetness.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Wetness.
249 Marcus	Moderate: seepage.	Severe: hard to pack, wetness.	Frost action	Wetness	Wetness, erodes easily.	Wetness, erodes easily.
269 Millington	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
291 Ransom	Moderate: seepage.	Severe: piping.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
304 Rushmore	Moderate: seepage.	Severe: wetness.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.
306B, 306C Sac	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Rooting depth, slope.	Erodes easily	Erodes easily, rooting depth.
327B Dickman	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
327C Dickman	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
345 Wilmonton	Slight	Moderate: piping, wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
362 Millington	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
392 Biscay	Severe: seepage.	Severe: seepage, wetness.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Wetness.
443 Ihlen Variant	Severe: depth to rock.	Severe: thin layer.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
490 Whitewood	Moderate: seepage.	Severe: wetness.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.
596E Steinauer	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope	Slope.
610 Calco	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
658A: Dempster	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
658B: Dempster	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
659A, 659B: Graceville	Severe: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Favorable	Favorable.
661C: Nora	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
661D2: Nora	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
662C2*:						
Nora	Severe: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Crofton	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
662D2*:						
Nora	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Crofton	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
663: Spillco	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Flooding	Favorable	Favorable.
939B*:						
Ihlen	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Depth to rock	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Rock outcrop.						
939C*:						
Ihlen	Severe: slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Rock outcrop.						
1029*. Pits						
1839: Marcus Variant	Slight	Severe: hard to pack, wetness.	Frost action	Wetness	Wetness	Wetness.
1920: Spillco	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Flooding	Favorable	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
18 Comfrey	0-14	Clay loam	ML, CL, CH	A-7	0	100	100	90-100	65-95	40-55	15-25
	14-38	Clay loam, loam	CL, MH, ML	A-7	0	100	100	85-100	65-85	45-60	12-25
	38-60	Clay loam, loam	CL	A-7, A-6	0	100	100	80-100	60-85	35-50	12-25
28A Alcester	0-10	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	10-43	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	43-60	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	85-100	30-50	10-20
28B Alcester	0-16	Silt loam	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	85-100	25-40	6-20
	16-36	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	36-60	Silty clay loam, silt loam.	ML, CL	A-6, A-7	0	100	95-100	95-100	85-100	30-50	10-20
42B, 42D Salida	0-9	Gravelly sandy loam.	SM, SP-SM	A-2, A-1	0-5	85-95	60-75	30-60	12-20	---	NP
	9-12	Gravelly loamy sand, gravelly coarse sand, gravelly loamy coarse sand.	SP, SW, GP, GP-GM	A-1	0-5	85-95	60-75	10-30	0-5	---	NP
	12-60	Very gravelly coarse sand, very gravelly sand.	SP, SW, GP, GP-GM	A-1	0-5	20-70	10-60	5-30	0-5	---	NP
54A, 54B Ihlen	0-13	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	85-95	34-50	10-25
	13-26	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-98	35-50	15-25
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
85 Calco	0-45	Silty clay loam	CH, CL	A-7	0	100	100	95-100	85-100	40-60	15-30
	45-60	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
90B, 90C Moody	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	13-25
	8-37	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	32-55	11-33
	37-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-45	3-20
92A, 92B Flandreau	0-8	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-100	25-40	5-20
	8-30	Silt loam, loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-100	65-95	30-45	5-20
	30-60	Loamy sand, loamy fine sand, fine sand.	SM, SM-SC, SW-SM, SP-SM	A-2	0	100	100	50-75	10-30	<25	NP-5
97 Trent	0-22	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	95-100	35-50	11-25
	22-40	Silty clay loam	CL, ML	A-6, A-7	0	100	100	90-100	85-100	35-50	11-25
	40-60	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	100	100	90-100	70-100	35-50	11-25
98 Colo	0-37	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	37-60	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
129-------------	0-15	Loam------------	CL, ML	A-6, A-4	0	100	95-100	90-100	55-85	30-40	5-14
Cylinder	15-32	Loam, clay loam	CL, SC	A-6	0	95-100	80-100	80-95	45-70	30-40	10-20
	32-60	Gravelly sand, gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0-5	75-95	60-90	20-55	5-25	---	NP
140-------------	0-13	Silty clay loam	ML	A-7, A-6	0	100	100	95-100	90-100	35-50	10-20
Spicer	13-35	Silt loam, silty clay loam.	ML	A-7, A-6	0	100	100	95-100	85-100	35-50	10-20
	35-60	Silt loam, silty clay loam.	ML	A-4, A-6	0	100	100	95-100	85-100	30-40	5-12
149B, 149C-------	0-13	Clay loam--------	CL	A-6, A-7	0	100	95-100	85-95	65-80	30-45	10-20
Everly	13-22	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-95	70-90	35-50	15-25
	22-60	Loam, clay loam	CL	A-6	0-5	90-100	85-95	75-85	60-80	30-40	10-20
156A, 156B-------	0-12	Silt loam, loam	ML, CL	A-4, A-6	0	95-100	95-100	80-95	60-85	25-40	NP-15
Fairhaven	12-36	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6	0	95-100	95-100	80-95	60-85	25-40	2-15
	36-60	Stratified gravelly coarse sand to sand.	SP, SP-SM, GP, GP-GM	A-1	0-5	50-100	35-100	20-50	1-10	---	NP
214-------------	0-15	Silty clay loam	CL	A-7	0	100	95-100	80-90	65-85	45-50	20-25
Talcot	15-33	Silty clay loam	CL	A-7	0	100	95-100	80-90	65-85	45-50	20-25
	33-60	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, SW	A-1	0	60-90	50-85	20-50	2-10	---	NP
249-------------	0-20	Silty clay loam	MH, CH	A-7	0	100	100	95-100	90-100	50-65	20-35
Marcus	20-46	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	95-100	90-100	50-65	20-35
	46-60	Silt loam, silty clay loam.	CL	A-7	0	100	100	95-100	85-95	40-50	20-30
269-------------	0-32	Clay loam--------	CL, ML	A-7, A-6	0	100	90-100	90-100	90-100	35-50	11-20
Millington	32-60	Loam, silty clay loam, clay loam.	CL	A-7, A-6	0	95-100	90-100	80-100	70-95	28-50	10-22
291-------------	0-16	Silty clay loam	OL, ML	A-7	0	100	100	95-100	80-95	40-50	10-20
Ransom	16-30	Silty clay loam, silt loam.	ML	A-6, A-7	0	95-100	90-100	85-100	75-95	35-50	10-20
	30-60	Silt loam, loam, clay loam.	ML, CL	A-4, A-6	0-5	95-100	85-100	75-95	55-80	30-40	5-15
304-------------	0-13	Silty clay loam	OL, ML, CL	A-7, A-6	0	100	95-100	90-100	85-95	35-50	10-25
Rushmore	13-26	Silty clay loam	CL	A-7, A-6	0	100	95-100	85-100	85-95	25-45	10-25
	26-60	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	85-95	80-95	55-80	25-45	10-20
306B, 306C-------	0-12	Silty clay loam	CL, ML, MH, CH	A-7	0	100	100	95-100	90-100	40-55	15-25
Sac	12-32	Silty clay loam	CL, ML, MH, CH	A-7	0	100	100	95-100	90-100	40-55	15-25
	32-60	Clay loam--------	CL	A-6	2-5	95-100	90-100	75-95	65-80	30-40	11-20
327B, 327C-------	0-8	Sandy loam-------	SM, SM-SC, SC	A-2, A-4	0	95-100	95-100	55-95	25-40	20-30	2-8
Dickman	8-18	Sandy loam, fine sandy loam.	SM, SM-SC, SC	A-2, A-4	0	95-100	85-100	55-95	25-45	15-25	2-8
	18-60	Stratified loamy sand to coarse sand.	SP-SM	A-3, A-2	0	95-100	75-100	50-80	5-10	---	NP

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
345--------------- Wilmonton	0-16	Silty clay loam	CL	A-6, A-7	0	100	92-100	85-95	60-90	30-50	12-25
	16-23	Clay loam, loam	CL	A-6, A-7	0-5	95-100	85-100	80-90	60-80	30-50	15-25
	23-60	Clay loam, loam	CL	A-6	0-5	95-100	85-95	75-85	55-75	25-40	10-25
362--------------- Millington	0-38	Silty clay loam	CL, ML	A-7, A-6	0	100	90-100	90-100	90-100	35-50	11-20
	38-60	Loam, silty clay loam, clay loam.	CL	A-7, A-6	0	95-100	90-100	80-100	70-95	28-50	10-22
392--------------- Biscay	0-16	Silty clay loam	CL, ML	A-7, A-6	0	95-100	95-100	70-95	50-80	35-50	10-25
	16-31	Loam, clay loam, sandy clay loam.	CL, ML	A-6, A-7	0	95-100	90-100	70-90	50-75	30-50	10-20
	31-60	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0-5	45-95	35-95	20-45	2-10	---	NP
443--------------- Ihlen Variant	0-14	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	85-95	30-50	10-25
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
490--------------- Whitewood	0-22	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	80-95	35-55	15-30
	22-50	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	80-95	35-55	15-30
	50-60	Silty clay loam	CL, CH	A-6, A-7	0	100	95-100	90-100	75-95	35-55	15-30
596E-------------- Steinauer	0-5	Clay loam--------	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-90	30-50	15-25
	5-9	Clay loam--------	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	70-90	30-55	12-30
	9-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	90-100	60-75	20-45	10-26
610--------------- Calco	0-36	Silty clay loam	CH, CL	A-7	0	100	100	95-100	85-100	40-60	15-30
	36-60	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
658A, 658B-------- Dempster	0-13	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-90	25-40	6-15
	13-30	Silty clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	100	90-100	75-95	30-45	7-20
	30-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SW, SW-SM, GP-GM	A-2, A-1, A-3	0	55-90	30-75	20-60	3-30	<25	NP-5
659A-------------- Graceville	0-25	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	30-40	5-15
	25-58	Silty clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	90-100	70-90	30-45	8-20
	58-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, GW-GM, SW-SM, GM	A-1, A-2	0	40-80	30-75	20-50	5-30	<25	NP-4
659B-------------- Graceville	0-13	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	30-40	5-15
	13-45	Silty clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	90-100	70-90	30-45	8-20
	45-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, GW-GM, SW-SM, GM	A-1, A-2	0	40-80	30-75	20-50	5-30	<25	NP-4
661C, 661D2------- Nora	0-8	Silt loam--------	CL, ML	A-6, A-7, A-4	0	100	100	95-100	85-100	30-46	7-23
	8-24	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	95-100	85-100	35-50	11-20
	24-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	95-100	95-100	95-100	85-100	27-50	6-20

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
662C2*, 662D2*:											
Nora------------	0-8	Silt loam--------	CL, ML	A-6, A-7, A-4	0	100	100	95-100	85-100	30-46	7-23
	8-23	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	95-100	85-100	35-50	11-20
	23-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	95-100	95-100	95-100	85-100	27-50	6-20
Crofton---------	0-8	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	8-60	Silt loam--------	CL	A-6, A-7	0	100	95-100	95-100	95-100	32-50	10-25
663-------------- Spillco	0-22	Silt loam--------	CL-ML	A-6, A-7	0	100	95-100	85-95	55-80	25-40	11-20
	22-60	Stratified sandy loam to clay loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	0	95-100	90-100	70-85	35-75	15-30	5-15
939B*, 939C*:											
Ihlen-----------	0-10	Silty clay loam	CL, ML	A-7, A-6	0	100	100	95-100	85-95	34-50	10-25
	10-30	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-98	35-50	15-25
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
1029*. Pits											
1839------------- Marcus Variant	0-11	Silty clay loam	ML, CL	A-6, A-7	0	100	100	95-100	75-85	40-50	15-25
	11-23	Silty clay loam, clay loam.	CL, CH, MH	A-6, A-7	0	100	100	95-100	75-85	40-55	20-30
	23-60	Silty clay loam, clay loam.	CL, CH, MH	A-6, A-7	0	100	100	95-100	75-85	40-55	20-30
1920------------- Spillco	0-60	Silt loam, loam	CL	A-6	0	100	95-100	85-95	55-80	25-40	11-20

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--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 K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
18---------------	0-14	28-35	1.20-1.40	0.6-2.0	0.18-0.22	6.6-7.8	Moderate-----	0.28	5	6	4-8
Comfrey	14-38	18-35	1.20-1.40	0.6-2.0	0.16-0.20	6.6-7.8	Moderate-----	0.28			
	38-60	18-35	1.30-1.50	0.6-2.0	0.15-0.19	6.6-8.4	Moderate-----	0.28			
28A--------------	0-10	27-32	1.20-1.35	0.6-2.0	0.19-0.22	5.6-7.8	Moderate-----	0.28	5	7	4-8
Alcester	10-43	20-32	1.20-1.35	0.6-2.0	0.19-0.22	6.1-7.8	Moderate-----	0.28			
	43-60	20-32	1.20-1.45	0.6-2.0	0.17-0.22	6.6-8.4	Moderate-----	0.43			
28B--------------	0-16	20-26	1.20-1.35	0.6-2.0	0.19-0.22	5.6-7.8	Moderate-----	0.28	5	6	4-8
Alcester	16-36	20-32	1.20-1.35	0.6-2.0	0.19-0.22	6.1-7.8	Moderate-----	0.28			
	36-60	20-32	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	Moderate-----	0.43			
42B, 42D---------	0-9	5-15	1.35-1.45	2.0-6.0	0.10-0.12	6.1-8.4	Low----------	0.10	3	8	5-1
Salida	9-12	2-8	1.50-1.65	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
	12-60	0-5	1.50-1.65	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
54A, 54B---------	0-13	27-35	1.20-1.30	0.6-2.0	0.18-0.22	6.1-7.3	Moderate-----	0.32	4	7	2-4
Ihlen	13-26	27-35	1.20-1.30	0.6-2.0	0.16-0.19	6.1-7.3	Moderate-----	0.32			
	26	---	---	---	---	---	-------------	----			
85---------------	0-45	28-33	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High---------	0.28	5	7	5-7
Calco	45-60	30-35	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High---------	0.28			
90B, 90C---------	0-8	27-35	1.25-1.30	0.2-2.0	0.19-0.22	5.6-7.3	Moderate-----	0.32	5	7	2-4
Moody	8-37	24-35	1.20-1.30	0.6-2.0	0.17-0.20	6.1-7.8	Moderate-----	0.43			
	37-60	20-30	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	Moderate-----	0.43			
92A, 92B---------	0-8	20-26	1.20-1.30	0.6-2.0	0.18-0.22	5.6-7.3	Low----------	0.28	4	6	2-4
Flandreau	8-30	20-30	1.20-1.35	0.6-2.0	0.16-0.22	6.1-7.3	Low----------	0.28			
	30-60	3-10	1.50-1.70	6.0-20	0.06-0.10	6.6-8.4	Low----------	0.10			
97---------------	0-22	27-35	1.20-1.30	0.6-2.0	0.19-0.22	6.1-7.3	Moderate-----	0.28	5	7	4-6
Trent	22-40	27-35	1.20-1.35	0.6-2.0	0.17-0.20	6.1-8.4	Moderate-----	0.43			
	40-60	25-35	1.20-1.40	0.6-2.0	0.17-0.20	6.6-8.4	Moderate-----	0.43			
98---------------	0-37	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	High---------	0.28	5	7	5-7
Colo	37-60	30-35	1.25-1.35	0.6-2.0	0.18-0.20	6.1-7.8	High---------	0.28			
129--------------	0-15	22-27	1.45-1.60	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.24	5	6	4-6
Cylinder	15-32	22-30	1.45-1.60	0.6-2.0	0.17-0.19	6.1-7.3	Moderate-----	0.24			
	32-60	2-12	1.60-1.70	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
140--------------	0-13	27-35	1.20-1.30	0.6-2.0	0.18-0.24	7.4-8.4	Moderate-----	0.28	5	4L	4-8
Spicer	13-35	18-35	1.25-1.35	0.6-2.0	0.16-0.22	7.4-8.4	Moderate-----	0.37			
	35-60	18-35	1.25-1.35	0.6-2.0	0.16-0.22	7.4-8.4	Low----------	0.37			
149B, 149C-------	0-13	27-30	1.40-1.45	0.6-2.0	0.17-0.19	5.6-7.3	Moderate-----	0.24	5-4	6	3-4
Everly	13-22	25-35	1.45-1.55	0.6-2.0	0.15-0.17	6.1-7.3	Moderate-----	0.32			
	22-60	25-35	1.65-1.80	0.2-0.6	0.17-0.19	6.6-8.4	Moderate-----	0.32			
156A, 156B-------	0-12	18-27	1.25-1.40	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	4	6	3-4
Fairhaven	12-36	18-30	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.43			
	36-60	0-5	1.55-1.65	6.0-20	0.02-0.04	6.1-8.4	Low----------	0.10			

TABLE 15.--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
214-------------- Talcot	0-15	27-35	1.20-1.30	0.6-2.0	0.19-0.22	7.4-8.4	Moderate-----	0.28	4	7	4-8
	15-33	27-35	1.25-1.35	0.6-2.0	0.18-0.22	7.4-8.4	Moderate-----	0.28			
	33-60	2-7	1.55-1.65	6.0-20	0.02-0.04	7.4-8.4	Low----------	0.15			
249-------------- Marcus	0-20	30-40	1.30-1.35	0.2-0.6	0.21-0.23	6.1-7.8	High---------	0.28	5	4	6-7
	20-46	30-35	1.35-1.40	0.2-0.6	0.18-0.20	6.1-8.4	High---------	0.43			
	46-60	22-30	1.35-1.45	0.6-2.0	0.20-0.22	7.4-8.4	Moderate-----	0.43			
269-------------- Millington	0-32	27-35	1.40-1.60	0.6-2.0	0.17-0.23	7.4-8.4	Moderate-----	0.28	5	6	4-6
	32-60	18-35	1.40-1.60	0.6-2.0	0.17-0.20	7.4-8.4	Moderate-----	0.28			
291-------------- Ransom	0-16	27-38	1.20-1.30	0.6-2.0	0.18-0.22	6.6-7.3	Moderate-----	0.32	5	7	4-8
	16-30	24-38	1.25-1.35	0.6-2.0	0.16-0.19	6.6-7.8	Moderate-----	0.43			
	30-60	18-30	1.40-1.70	0.2-0.6	0.20-0.22	7.4-8.4	Low----------	0.43			
304-------------- Rushmore	0-13	28-38	1.20-1.30	0.6-2.0	0.18-0.22	6.1-7.8	Moderate-----	0.28	5	7	4-8
	13-26	28-38	1.25-1.35	0.6-2.0	0.16-0.19	6.6-8.4	Moderate-----	0.37			
	26-60	18-30	1.40-1.70	0.2-0.6	0.14-0.16	7.4-8.4	Moderate-----	0.37			
306B, 306C------- Sac	0-12	27-35	1.20-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	4	3-4
	12-32	27-35	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.43			
	32-60	27-35	1.60-1.80	0.2-0.6	0.14-0.16	6.6-8.4	Moderate-----	0.32			
327B, 327C------- Dickman	0-8	6-18	1.30-1.40	2.0-6.0	0.13-0.15	5.6-6.5	Low----------	0.20	3	3	2-4
	8-18	6-18	1.35-1.50	2.0-6.0	0.12-0.14	5.6-7.3	Low----------	0.20			
	18-60	1-10	1.50-1.60	6.0-20	0.02-0.07	5.6-7.8	Low----------	0.15			
345-------------- Wilmonton	0-16	27-35	1.25-1.35	0.6-2.0	0.20-0.26	6.1-7.3	Moderate-----	0.28	5	6	4-8
	16-23	25-32	1.30-1.45	0.2-0.6	0.15-0.19	6.1-7.8	Moderate-----	0.28			
	23-60	22-32	1.45-1.70	0.2-0.6	0.14-0.19	7.4-8.4	Moderate-----	0.37			
362-------------- Millington	0-38	27-35	1.40-1.60	0.6-2.0	0.17-0.23	7.4-8.4	Moderate-----	0.28	5	6	4-6
	38-60	18-35	1.40-1.60	0.6-2.0	0.17-0.20	7.4-8.4	Moderate-----	0.28			
392-------------- Biscay	0-16	27-30	1.20-1.30	0.6-2.0	0.20-0.22	6.1-7.8	Moderate-----	0.28	4	6	4-8
	16-31	18-30	1.25-1.35	0.6-2.0	0.17-0.19	6.6-7.8	Moderate-----	0.28			
	31-60	1-6	1.55-1.65	6.0-20	0.02-0.04	7.4-8.4	Low----------	0.10			
443-------------- Ihlen Variant	0-14	18-27	1.20-1.30	0.6-2.0	0.18-0.22	6.1-7.3	Moderate-----	0.32	4	6	4-6
	14	---	---	---	---	---	-------------	----			
490-------------- Whitewood	0-22	27-35	1.20-1.30	0.2-2.0	0.19-0.22	6.1-7.8	Moderate-----	0.28	5	7	4-8
	22-50	27-35	1.20-1.30	0.2-0.6	0.17-0.20	6.6-7.8	Moderate-----	0.43			
	50-60	27-35	1.20-1.40	0.2-0.6	0.17-0.20	7.4-8.4	Moderate-----	0.43			
596E------------- Steinauer	0-5	27-32	1.30-1.60	0.2-0.6	0.17-0.19	7.4-8.4	Moderate-----	0.32	5	4L	.5-2
	5-9	27-32	1.30-1.60	0.2-0.6	0.15-0.17	7.9-8.4	Moderate-----	0.32			
	9-60	18-30	1.30-1.60	0.2-0.6	0.14-0.19	7.9-8.4	Moderate-----	0.32			
610-------------- Calco	0-36	28-33	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High---------	0.28	5	7	5-7
	36-60	30-35	1.25-1.30	0.6-2.0	0.21-0.23	7.4-8.4	High---------	0.28			
658A, 658B------- Dempster	0-13	20-26	1.10-1.25	0.6-2.0	0.19-0.22	5.6-7.3	Moderate-----	0.32	4	6	3-4
	13-30	24-30	1.20-1.35	0.6-2.0	0.17-0.20	6.1-7.3	Moderate-----	0.32			
	30-60	1-5	1.55-1.70	2.0-20	0.03-0.06	7.4-8.4	Low----------	0.10			
659A------------- Graceville	0-25	20-26	1.10-1.25	0.6-2.0	0.19-0.22	5.6-7.3	Moderate-----	0.32	5	6	2-4
	25-58	25-34	1.20-1.35	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.32			
	58-60	2-10	1.50-1.70	6.0-20	0.03-0.06	6.1-7.8	Low----------	0.10			

TABLE 15.--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
659B------------- Graceville	0-13	20-26	1.10-1.25	0.6-2.0	0.19-0.22	5.6-7.3	Moderate-----	0.32	5	6	4-8
	13-45	25-34	1.20-1.35	0.6-2.0	0.17-0.22	5.6-7.3	Moderate-----	0.32			
	45-60	2-10	1.50-1.70	6.0-20	0.03-0.06	6.1-7.8	Low----------	0.10			
661C, 661D2------ Nora	0-8	20-27	1.20-1.30	0.6-2.0	0.19-0.22	6.1-7.3	Moderate-----	0.32	5	6	2-4
	8-24	20-35	1.25-1.35	0.6-2.0	0.17-0.20	6.1-7.8	Moderate-----	0.43			
	24-60	18-30	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	Moderate-----	0.43			
662C2*, 662D2*:											
Nora-----------	0-8	20-27	1.20-1.30	0.6-2.0	0.19-0.22	6.1-7.3	Moderate-----	0.32	5	6	2-4
	8-23	20-35	1.25-1.35	0.6-2.0	0.17-0.20	6.1-7.8	Moderate-----	0.43			
	23-60	18-30	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	Moderate-----	0.43			
Crofton---------	0-8	20-27	1.20-1.30	0.6-2.0	0.21-0.24	7.4-8.4	Low----------	0.43	5	4L	.5-2
	8-60	15-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	Low----------	0.43			
663-------------- Spillco	0-22	18-26	1.45-1.55	0.6-2.0	0.19-0.21	6.6-8.4	Low----------	0.24	5	6	4-5
	22-60	14-28	1.55-1.70	2.0-6.0	0.14-0.19	7.9-8.4	Low----------	0.24			
939B*, 939C*:											
Ihlen-----------	0-10	27-35	1.20-1.30	0.6-2.0	0.18-0.22	6.1-7.3	Moderate-----	0.32	4	7	2-4
	10-30	27-35	1.20-1.30	0.6-2.0	0.16-0.19	6.1-7.3	Moderate-----	0.32			
	30	---	---	---	---	---	-------------	----			
Rock outcrop.											
1029*. Pits											
1839------------- Marcus Variant	0-11	32-40	1.30-1.35	0.2-0.6	0.21-0.23	6.1-7.3	High---------	0.28	5	4	2-4
	11-23	35-40	1.35-1.40	0.2-0.6	0.18-0.20	6.1-7.3	High---------	0.28			
	23-60	35-40	1.35-1.40	0.2-0.6	0.18-0.20	7.4-8.4	High---------	0.28			
1920------------- Spillco	0-60	18-26	1.45-1.55	0.6-2.0	0.19-0.21	6.6-8.4	Low----------	0.24	5	6	4-5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," and "apparent" 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	Hard-ness		Uncoated steel	Concrete
					Ft			In				
18---------------- Comfrey	B/D	Occasional	Brief to long.	Feb-Nov	0-3.0	Apparent	Apr-Jul	>60	---	High-----	High-----	Low.
28A--------------- Alcester	B	None--------	---	---	3.0-6.0	Apparent	Mar-Jun	>60	---	High-----	Moderate	Low.
28B--------------- Alcester	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Low.
42B, 42D---------- Salida	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
54A, 54B---------- Ihlen	B	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	High-----	Low.
85---------------- Calco	B/D	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
90B, 90C---------- Moody	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Low.
92A, 92B---------- Flandreau	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
97---------------- Trent	B	None--------	---	---	3.0-6.0	Apparent	Mar-Jun	>60	---	High-----	Moderate	Low.
98---------------- Colo	B/D	Occasional	Very brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
129--------------- Cylinder	B	Occasional	Brief-----	Feb-Nov	2.0-4.0	Apparent	Nov-Jul	>60	---	High-----	Moderate	Low.
140--------------- Spicer	B/D	None--------	---	---	1.0-3.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
149B, 149C------ Everly	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
156A, 156B------ Fairhaven	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
214------------- Talcot	B/D	Occasional	Brief-----	Feb-Nov	0-1.0	Apparent	Apr-Jun	>60	---	High-----	High-----	Low.
249------------- Marcus	B/D	None--------	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
269------------- Millington	B/D	Occasional	Brief-----	Feb-Nov	0-2.0	Apparent	Mar-Jul	>60	---	High-----	High-----	Low.
291------------- Ransom	B	None--------	---	---	2.5-5.0	Apparent	Apr-Jun	>60	---	High-----	High-----	Low.
304------------- Rushmore	B/D	Rare--------	---	---	1.0-3.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
306B, 306C------ Sac	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Low.
327B, 327C------ Dickman	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
345------------- Wilmonton	B	None--------	---	---	2.5-5.0	Apparent	Mar-Jun	>60	---	High-----	Moderate	Low.
362------------- Millington	B/D	Frequent----	Brief-----	Feb-Nov	0-2.0	Apparent	Mar-Jul	>60	---	High-----	High-----	Low.
392------------- Biscay	B/D	None--------	---	---	1.0-3.0	Apparent	Nov-Jun	>60	---	High-----	Moderate	Low.
443------------- Ihlen Variant	B	None--------	---	---	>6.0	---	---	10-20	Hard	High-----	High-----	Low.
490------------- Whitewood	B/D	None--------	---	---	1.0-3.0	Apparent	Mar-Jul	>60	---	High-----	High-----	Low.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
596E------------ Steinauer	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
610------------- Calco	B/D	Frequent----	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Low.
658A, 658B------ Dempster	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Low.
659A, 659B------ Graceville	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Low.
661C, 661D2----- Nora	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Low.
662C2*, 662D2*:												
Nora-----------	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Low.
Crofton--------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
663------------- Spillco	B	Occasional	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	High-----	Moderate	Low.
939B*, 939C*:												
Ihlen----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	High-----	Low.
Rock outcrop.												
1029*. Pits												
1839------------ Marcus Variant	B/D	None--------	---	---	0-2.0	Apparent	Mar-Jun	>60	---	High-----	High-----	Low.
1920------------ Spillco	B	Frequent----	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	High-----	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--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
Alcester	Fine-silty, mixed, mesic Cumulic Haplustolls
Biscay	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Calco	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Comfrey	Fine-loamy, mixed, mesic Cumulic Haplaquolls
Crofton	Fine-silty, mixed (calcareous), mesic Typic Ustorthents
Cylinder	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquic Hapludolls
Dempster	Fine-silty over sandy or sandy-skeletal, mixed, mesic Udic Haplustolls
Dickman	Sandy, mixed, mesic Typic Hapludolls
Everly	Fine-loamy, mixed, mesic Typic Hapludolls
Fairhaven	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
*Flandreau	Fine-loamy, mixed, mesic Udic Haplustolls
Graceville	Fine-silty, mixed, mesic Pachic Haplustolls
Ihlen	Fine-silty, mixed, mesic Udic Haplustolls
Ihlen Variant	Fine-silty, mixed, mesic Lithic Haplustolls
Marcus	Fine-silty, mixed, mesic Typic Haplaquolls
Marcus Variant	Fine, montmorillonitic, mesic Typic Haplaquolls
Millington	Fine-loamy, mixed (calcareous), mesic Cumulic Haplaquolls
Moody	Fine-silty, mixed, mesic Udic Haplustolls
Nora	Fine-silty, mixed, mesic Udic Haplustolls
Ransom	Fine-silty, mixed, mesic Aquic Hapludolls
Rushmore	Fine-silty, mixed, mesic Typic Haplaquolls
Sac	Fine-silty, mixed, mesic Typic Hapludolls
Salida	Sandy-skeletal, mixed, mesic Entic Hapludolls
Spicer	Fine-silty, mixed (calcareous), mesic Typic Haplaquolls
Spillco	Fine-loamy, mixed, mesic Cumulic Hapludolls
Steinauer	Fine-loamy, mixed (calcareous), mesic Typic Udorthents
Talcot	Fine-loamy over sandy or sandy-skeletal, mixed (calcareous), mesic Typic Haplaquolls
Trent	Fine-silty, mixed, mesic Pachic Haplustolls
Whitewood	Fine-silty, mixed, mesic Cumulic Haplaquolls
Wilmonton	Fine-loamy, mixed, mesic Aquic Hapludolls

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