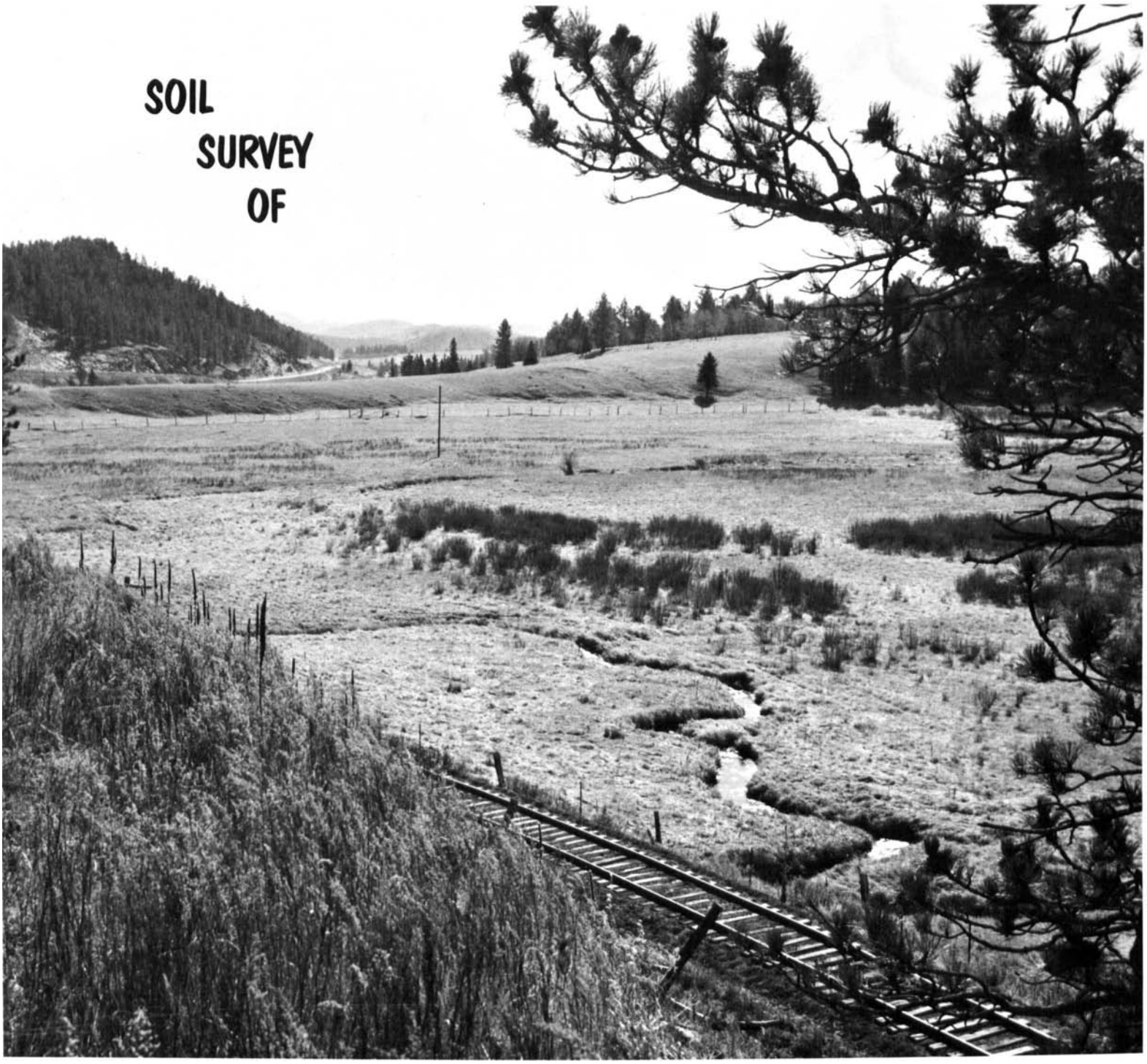
SOIL
SURVEY
OF

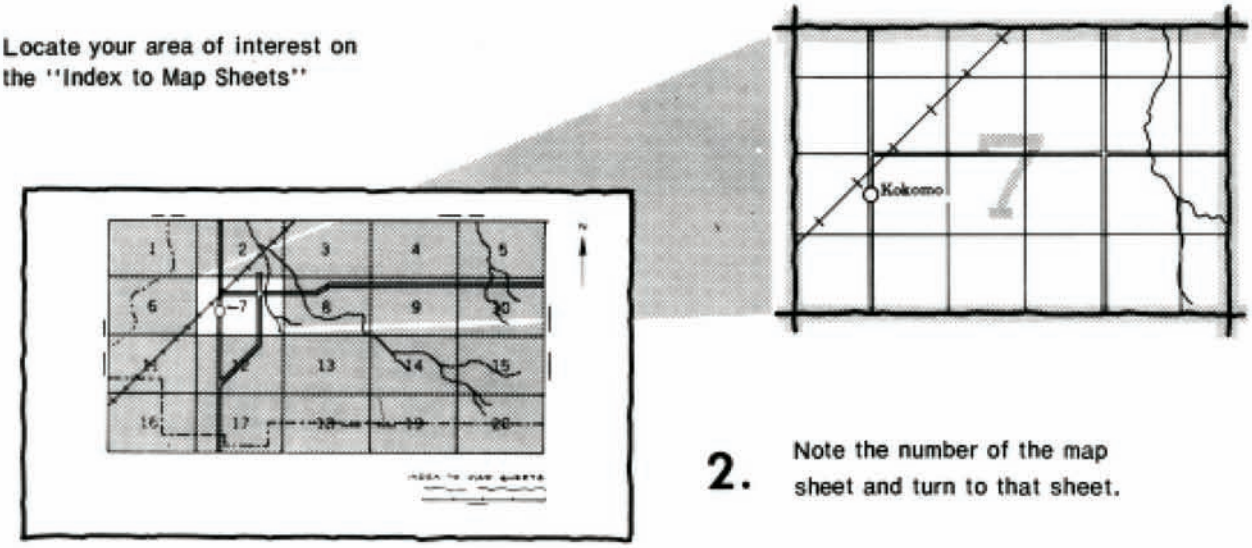


LAWRENCE COUNTY, SOUTH DAKOTA

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
IN COOPERATION WITH THE
FOREST SERVICE AND THE
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

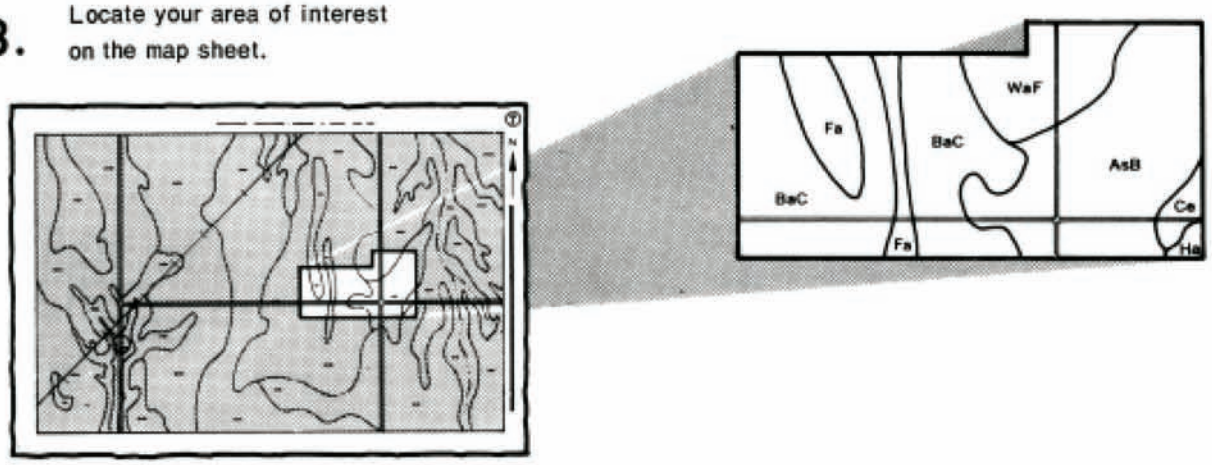
HOW TO USE

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

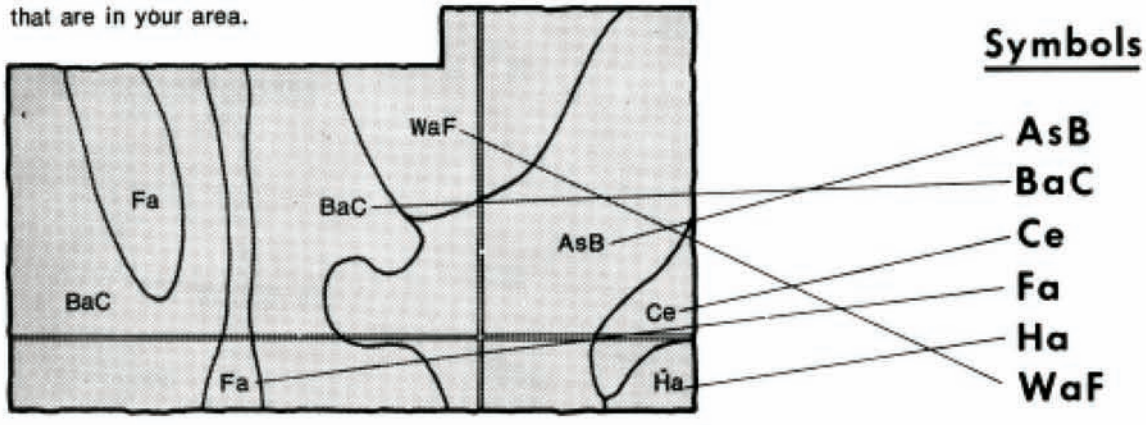


2. Note the number of the map sheet and turn to that sheet.

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

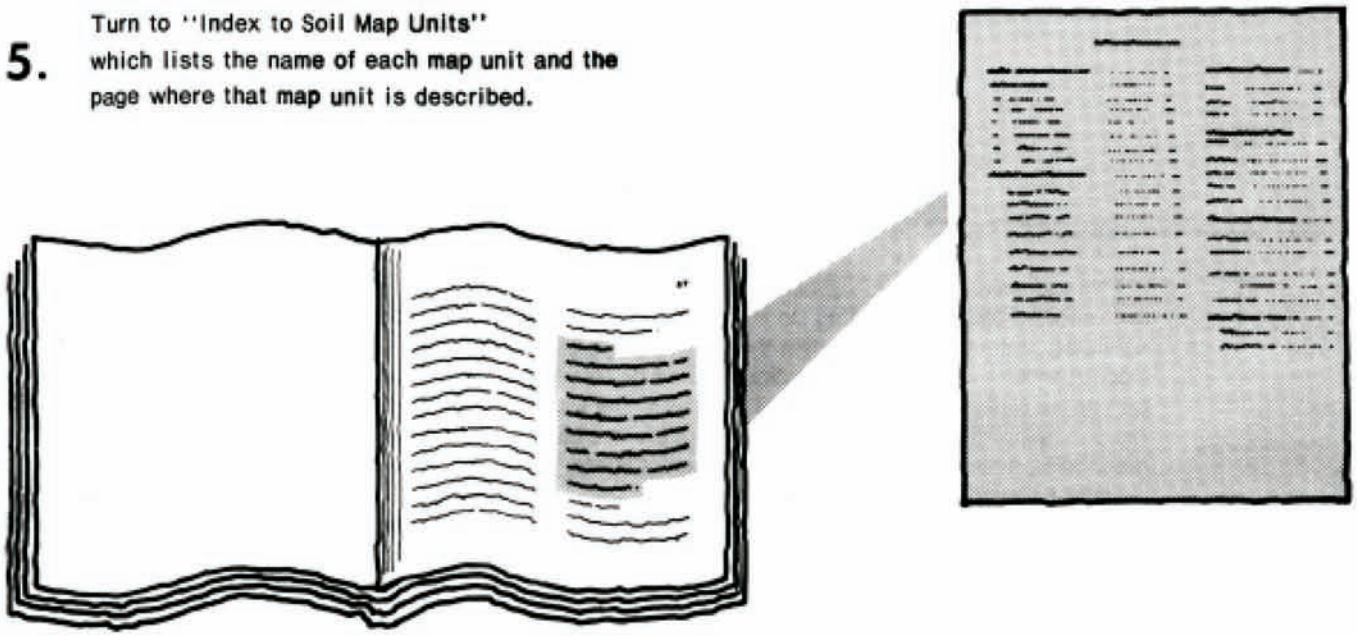


4. List the map unit symbols that are in your area.

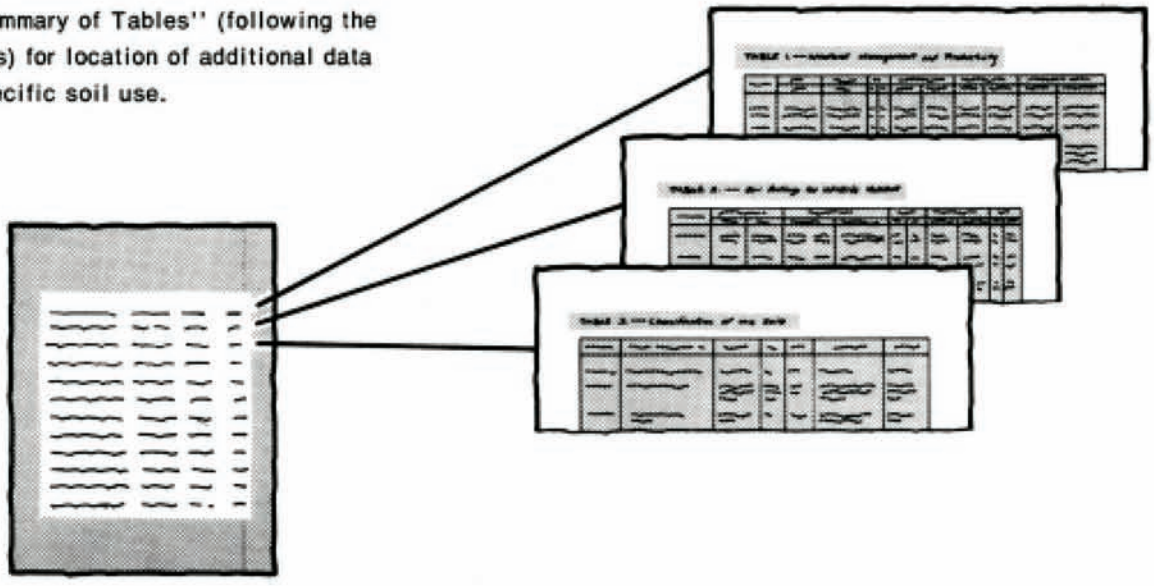


THIS SOIL SURVEY

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; to specialists in wildlife management, waste disposal, or pollution control.

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

Major fieldwork for this soil survey was completed in the period 1970-75. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Lawrence Conservation District.

Cover: Valley of Marshdale-Maitland association, sloping.

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Issued August 1979

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Summary of tables

Foreword

The Soil Survey of Lawrence County, South Dakota contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

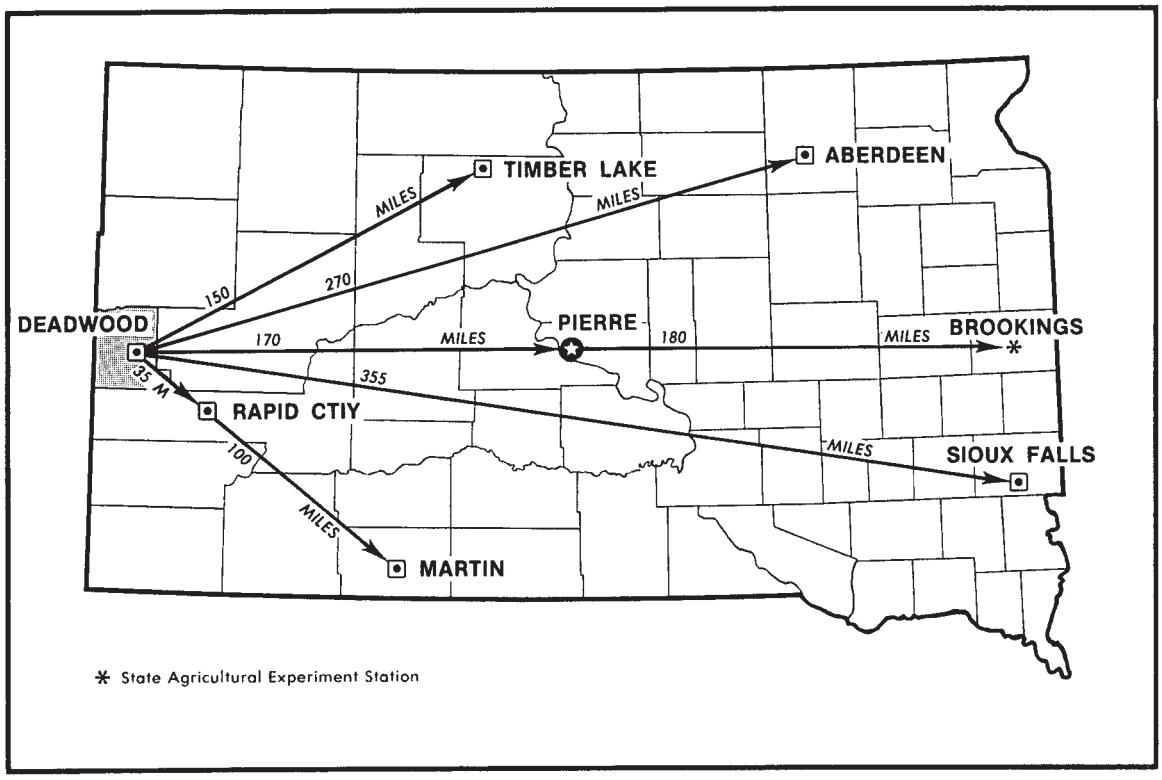
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers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

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

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

R. D. Swenson
State Conservationist
Soil Conservation Service



Location of Lawrence County in South Dakota.

SOIL SURVEY OF LAWRENCE COUNTY, SOUTH DAKOTA

By Arvid C. Meland, Soil Conservation Service

Soil surveyed by Arvid C. Meland and T. J. Ollila, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Forest Service and the South Dakota Agricultural Experiment Station

LAWRENCE COUNTY is in the extreme west-central part of South Dakota (see map on facing page). It has an area of about 512,000 acres. Except for the northern part, the county is made up of the Black Hills. Deadwood, the county seat, is in the east-central part of the county. Its population was 2,409 in 1970. Other towns and villages are Lead, Nemo, Spearfish, St. Onge, and Whitewood.

Livestock farming and ranching are the main farm enterprises. Irrigation is important in the northern part of the county along the main creeks and the Redwater River. About 33 percent of the county is used for farming and grazing, and about 67 percent is in forest.

General nature of the county

This section gives general information concerning the county. It discusses climate, physiography and relief, settlement, farming, and natural resources and industry.

Climate

Climatic data in this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

In summer, Lawrence County usually is warm, and hot days occur frequently. In winter, periods of very cold weather are caused by Artic air moving in from the north or northwest. These cold periods alternate with milder periods that occur often when westerly winds are warmed as they move downslope. Most precipitation falls as rain during the warmer part of the year and is normally heaviest late in spring and early in summer. Winter snowfalls are frequent, but snow cover usually disappears during mild periods, except at higher elevations.

Tables 1 and 2 give data on temperature and precipitation for the survey area, as recorded at Lead and Spearfish for the period 1951 to 1974. Tables 3 and 4 show probable dates of the first freeze in fall and the last freeze in spring. Tables 5 and 6 provide data on length of the growing season.

In winter, the average temperature is 27 degrees F, and the average daily minimum temperature is 16 degrees. The lowest temperature on record, which occurred on December 30, 1968, is -30 degrees. In summer the average temperature is 65 degrees, and the average daily maximum temperature is near 80 degrees. The highest recorded temperature, which occurred on July 9, 1954, is 106 degrees.

Growing degree days, shown in tables 5 and 6, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 17 inches, or 70 percent, usually falls in April through September, which includes the growing season for most crops. 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 5.65 inches on March 14, 1973. Thunderstorms occur on about 42 days each year, and occur mostly in the summer.

Average seasonal snowfall is 155 inches. The greatest snow depth at any one time during the period of record was 48 inches. On the average, 50 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The percentage of possible sunshine is 68 in summer and 56 in winter. The prevailing wind is from the north-northwest. Average windspeed is highest, 13 miles per hour, in April.

Several times each winter storms with snow and high wind bring blizzard conditions to the county. Hail during summer thunderstorms occurs in small scattered areas.

Physiography and relief

Lawrence County is in the northern part of the Black Hills. Spearfish and Whitewood Creeks and their tributaries drain the northern part of Lawrence County. They flow into the Belle Fourche and Redwater Rivers. Numerous small drainageways that eventually enter Rapid Creek drain the southern part of the county. These drainage systems flow easterly to the Cheyenne River.

The southern part of Lawrence County consists of moderately sloping to very steep mountains. A ridge, locally called the Hogback, is 1 mile to 2 miles outside the Black Hills. The plain beyond the Black Hills, in the northern part of the county, is moderately dissected by streams and entrenched drainageways.

Settlement of the county

Lawrence County was created in 1875 by an act of the Dakota Territory Legislature. The county was named in honor of Colonel John Lawrence, an early territorial legislator.

In the fall of 1875, gold was discovered by John B. Pearson in Deadwood Gulch. The following spring most of the gold seekers from the Custer area moved to the Deadwood area and staked claims around Deadwood, Gold Run, and Whitetail Gulches.

The summer of 1876 was a time of turmoil and growth. Among the many people who came to the area with the goldrush were Calamity Jane, Wild Bill Hickock, Potato Creek Johnny, and Preacher Smith. Fred and Moses Manuel staked a claim which was purchased in the spring of 1877 by a group of mining men and incorporated as the Homestake Mining Company. This area is known today as the Open Cut.

In 1910, the population of Lawrence County reached the alltime high of 19,694. The population in 1970, according to the U. S. Census, was 17,453 (*11*). Lead, the site of the Homestake Gold Mine, is the largest city in Lawrence County and has a population of 5,420.

Farming

Livestock farming and ranching is the main agricultural enterprise in Lawrence County. About 87 percent of the total cash farm income is from the sale of livestock and livestock products (*6*). In 1969, Lawrence County had 257 farms and 233,745 acres of farmland. The average farm was 909 acres in size.

About 9 percent of the cash farm income is from cultivated crops. Hay is the main crop and accounts for 67 percent of the total value of all crops. Other crops are alfalfa hay, oats, winter wheat, spring wheat, and wild hay. The main irrigated crops in Lawrence County are alfalfa hay and corn.

Natural resources and industry

Timber is the largest natural resource in Lawrence County. Three large sawmills and many small mills produce posts, poles, and dimensional lumber. Logs for making paper and wood chips for making chipboard are shipped out of the county by rail.

In most parts of the Black Hills in Lawrence County, water is adequate for domestic use and for watering livestock. On the prairie outside the Black Hills, small dams are used to supply livestock with water. Along Spearfish Creek and the Redwater River, areas of soil are irrigated.

The Homestake Gold Mine is the largest producer of gold in the Western Hemipshere. It is the largest single employer in Lawrence County.

Recreation is an important source of income in Lawrence County. In summer, the Black Hills are used by many tourists for hiking, fishing, camping, and sightseeing. In fall and winter, they are used for hunting, snowmobiling, and skiing.

How this survey was made

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

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

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

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil,

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

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

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

General soil map for broad land-use planning

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

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

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The units on the general soil map of this county have been grouped for broad interpretative purposes. The 4 broad groups and the 10 map units are described on the pages that follow. The names of the map units do not coincide exactly with those in the recently published surveys of adjacent Butte and Meade Counties. This is because of differences in detail of the general soil map and also because of changes in the soil classification system.

Areas dominated by well drained to excessively drained, nearly level to very steep soils

The map units in this group are on uplands on high terraces and along drainage divides. The relief is dominantly gently sloping and moderately sloping, but it is steeper on some of the ridges and drainageways. The soils are loamy, silty, and clayey and are dominantly moderately deep and deep over sandstone, siltstone, and shale.

About 40 percent of the acreage of this group of units is in cultivated crops. Much of the cropland in Lawrence County is in this group. Wheat is an important cash crop, and feed and forage crops are also grown. Some of the soils are irrigated. The map units in this group make up about 18 percent of the county.

1. Nevee-Vale-Tilford

Deep, well drained, nearly level to strongly sloping silty soils; on uplands

This map unit consists of upland plains and high terraces. It is in a valley between a sandstone ridge and the Black Hills. Slopes generally are long and are mostly nearly level to moderately sloping but are steeper on the sides of some ridges and along entrenched drainageways (fig. 1).

This map unit makes up about 9 percent of the county. It is about 35 percent Nevee soils, 30 percent Vale soils, 20 percent Tilford soils, and 15 percent minor soils.

Nevee soils are on smooth sides of low upland ridges. Slopes generally are less than 15 percent. Nevee soils have a surface layer of reddish brown silt loam. The underlying material is very friable, calcareous silt loam.

Vale soils are on terraces and lower side slopes. Slopes are long and smooth and generally are less than 9 percent. Vale soils have a surface layer of dark brown silt loam and a subsoil of firm silty clay loam and loam. The underlying material is calcareous loam.

Tilford soils are on rises above the lower side slopes on uplands. Slopes generally are less than 9 percent. Tilford soils have a surface layer of brown silt loam and a subsoil of friable, calcareous silt loam. The underlying material is calcareous silt loam.

Nevee soils are low in fertility, and Vale and Tilford soils are medium in fertility. These soils have moderate permeability and high available water capacity.

Minor soils in this unit are Gypnevee and Rekop soils that contain gypsum and are intermingled with outcrops of gypsum, on some of the higher ridges, and very poorly drained Higgins soils that have more gypsum than those soils, on bottom lands. Also included are Savo and Weber soils that have more sand and gravel in the underlying material than the major soils, on terraces and alluvial fans on the lower parts of the landscape, and gravelly Nihill soils, on terrace fronts above the shallow Spearfish soils which are on steep upper valley side slopes.

About 60 percent of the acreage of this unit is used for cultivated crops. Wheat is grown as a cash crop. Because cattle ranching and general livestock farming are the main farm enterprises, much of the cropland is used for feed and forage crops for livestock. The steeper and more rolling parts of the unit are in native grass and are used for grazing. Runoff is slow or medium on most soils. Conserving moisture and controlling erosion are the main concerns of management. Soil blowing is an additional concern on the Nevee soil.

The major soils in this unit have fair or good potential for cultivated crops, rangeland, and environmental plantings. These soils generally have good potential for building sites and fair potential for local roads and streets and most sanitary facilities. The limitations of these soils generally are easy to overcome.

2. Butche-Satanta-Boneek

Shallow and deep, well drained to excessively drained, nearly level to very steep loamy and silty soils; on uplands

This map unit consists of upland ridges and terraces. It makes up the high ridges and outer side slopes of a sandstone ridge just outside the Black Hills. Slopes are mostly nearly level to moderately sloping but are steeper on the upper edges of ridges and on the side slopes along drainageways (fig. 2).

This map unit makes up about 6 percent of the county. It is about 35 percent Butche soils, 20 percent Satanta soils, 15 percent Boneek soils, and 30 percent minor soils.

Butche soils are on upland divides and valley side slopes. Slopes generally are 8 to 50 percent. Butche soils have a surface layer of brown, stony loam. The underlying material is very friable, stony loam. Indurated sandstone is at a depth of 13 inches.

Satanta soils are on smooth uplands. Slopes generally are 0 to 9 percent. Satanta soils have a surface layer of brown loam and a subsoil of friable and very friable clay loam and sandy clay loam. The underlying material is calcareous sandy clay loam.

Boneek soils are on terraces and lower side slopes of uplands. Slopes generally are 0 to 9 percent. Boneek soils have a surface layer of dark grayish brown silt loam and a subsoil of friable silty clay loam and silt loam. The underlying material is calcareous silt loam.

Butche soils are low in fertility, and Satanta and Boneek soils are medium in fertility. Butche soils have very low available water capacity, and Satanta and Boneek soils have high available water capacity. All of these soils have moderate permeability.

Minor soils in this unit are Canyon and Bridget soils that have lime nearer the surface and more very fine sand than the major soils, on side slopes below the ridges, and Midway and Razor soils that have more clay than those soils, on the lower side slopes and along some drainageways.

About 20 percent of the acreage of this unit is used for cultivated crops. Most crops are grown on the Boneek and Satanta soils. Wheat is grown as a cash crop. Because cattle ranching is the main farm enterprise, much of the cropland is used for feed and forage crops for livestock. The steeper and more rolling parts of the unit are in native grass and are used for grazing. Runoff is medium or rapid on most soils. Controlling erosion is the main concern of management.

Butche soils have fair potential for rangeland and poor potential for cultivated crops, windbreaks and environmental plantings, building sites, and sanitary facilities. The shallow depth to bedrock and steep slopes are severe limitations which are difficult to overcome. Most of the Boneek and Satanta soils have good potential for rangeland, cultivated crops, windbreaks and environmental plantings, local roads and streets, most building sites, and most sanitary facilities. The limitations of these soils generally are easy to overcome.

3. Nunn-Kyle-Pierre

Deep and moderately deep, well drained, nearly level to moderately steep loamy and clayey soils; on uplands

This map unit is on sedimentary uplands and alluvial terraces and is dissected by narrow drainageways. Slopes are mostly nearly level to moderately sloping but are steeper on the sides of entrenched drainageways. The drainage pattern is well defined and consists of many small drainageways that join to form main drainageways that flow out of the area.

This map unit makes up about 3 percent of the county. It is about 25 percent Nunn soils, 20 percent Kyle soils, 20 percent Pierre soils, and 35 percent minor soils.

Nunn soils are on upland terraces. Slopes are less than 9 percent. Nunn soils have a surface layer of grayish brown clay loam and a subsoil of firm clay loam. The underlying material is calcareous clay loam.

Kyle soils are on uplands and alluvial fans. Slopes generally are less than 6 percent. Kyle soils have a surface layer of grayish brown clay and a subsoil of very firm clay. The underlying material is clay.

Pierre soils are on uplands. Slopes generally are less than 25 percent. Pierre soils have a surface layer of clay

and a subsoil of firm clay. The underlying material is clay. Shale is at a depth of 29 inches.

Nunn, Kyle, and Pierre soils are medium in fertility. Nunn soils have high available water capacity and moderately slow permeability. They have high shrink-swell potential in the subsoil. Kyle soils have low or moderate available water capacity, and Pierre soils have very low or low available water capacity. Kyle and Pierre soils have very slow permeability and high shrink-swell potential.

Minor soils in this unit are Hisle soils that have claypans, on lower side slopes, and shallow Enning and moderately deep Minnequa soils that are calcareous, on higher ridges of uplands.

About 20 percent of the acreage of this unit is used for cultivated crops. Most of the cropland is on the Nunn soils. Wheat is the main cash crop. Because cattle ranching and general livestock farming are the main farm enterprises, much of the cropland is used for feed and forage crops for livestock. The steeper parts of the unit are in native grass and are used for grazing. Runoff is slow or medium on the Nunn and Kyle soils and medium or rapid on the Pierre soils. Controlling erosion and conserving moisture are the main concerns of management.

The major soils in this unit have fair or good potential for cultivated crops, rangeland, and environmental plantings. They have poor or fair potential for most sanitary facilities, building sites, and local roads and streets. Most of the minor soils have poor potential for these uses. The limitations are easy to overcome in the Nunn soils and difficult to overcome in the Kyle and Pierre soils.

Areas dominated by well drained, nearly level soils

This map unit is on low terraces and bottom lands along the main streams. The relief is nearly level, and deep stream channels meander through some areas. The soils formed in stratified alluvium and are loamy or silty and deep.

About 70 percent of the acreage of this unit is in cultivated crops. Small grain and grasses and legumes for hay and pasture are important crops, and forage crops for livestock are also grown. Some of the soils are irrigated. This unit makes up about 3 percent of the county.

4. Barnum-Swint-St. Onge

Deep, well drained, nearly level loamy and silty soils; on bottom lands and terraces

This map unit consists of low terraces and bottom lands along the main streams. The soils are subject to common or occasional flooding for brief periods. Slopes generally are long and smooth and are mostly nearly level.

This map unit makes up about 3 percent of the county. It is about 35 percent Barnum soils, 30 percent Swint soils, 20 percent St. Onge soils, and 15 percent minor soils.

Barnum soils are on bottom lands. Some areas are dissected by deep stream channels. Barnum soils have a surface layer of brown silt loam that is underlain by very friable, brown loam.

Swint soils are on low terraces above the bottom lands. They have a surface layer of dark reddish gray silt loam that is underlain by very friable silt loam and very fine sandy loam.

St. Onge soils are on low terraces and bottom lands. They have a surface layer of dark grayish brown loam that is underlain by friable and very friable, stratified loam, silt loam, and fine sandy loam.

Barnum soils are low in fertility, and St. Onge and Swint soils are high in fertility. These soils have moderate permeability and high available water capacity.

Minor soils in this unit are Alice soils that have gravelly loamy sand in the underlying material, generally on steeper slopes on the upper parts of terraces, and Glenberg Variant soils that have fine sandy loam surface layers, on bottom lands. Also included are very poorly drained Higgins soils that contain gypsum, in concave parts of lower terraces, and Vale soils that have more clay in the subsoil than all of these soils, generally on slopes on the upper parts of terraces.

About 70 percent of the acreage of this unit is used for cultivated crops. Some of these soils are irrigated. Most of the cropland is used for small grain and grasses and legumes for hay and pasture. Some forage crops are grown for livestock. Because areas of this map unit are long and narrow, they make up only part of a ranch or farm. Runoff is slow. Some flooding occurs in spring during snowmelt or after heavy rains. Conserving moisture is the main concern of management.

The major soils in this unit have good potential for dryland and irrigated crops, rangeland, and environmental plantings. They have poor potential for building sites, local roads and streets, and sanitary facilities. Protection from flooding is needed if buildings or local roads and streets are constructed on these soils.

Areas dominated by well drained, gently sloping to very steep soils

This map unit is on uplands and along drainage divides. The relief is dominantly gently sloping to very steep. The soils are clayey and are shallow and deep over shale. Some rock crops out.

Nearly all of the acreage of this unit is in native rangeland. The unit makes up about 3 percent of the county.

5. Grummit-Snomo-Rock outcrop

Shallow and deep, well drained, gently sloping to very steep, clayey soils and Rock outcrop; on uplands

This map unit consists of rolling uplands and side slopes. Slopes generally are long and smooth and are mostly gently sloping to very steep. The very steep slopes are on the sides of entrenched drainageways and on the upper sides of prominent ridges. The drainage pattern is well defined and is made up of many small drainageways that join to form larger drainageways that flow out of the area.

This map unit makes up about 3 percent of the county. It is about 35 percent Grummit soils, 35 percent Snomo soils, 25 percent Rock outcrop, and 5 percent minor soils.

Grummit soils are on smooth sides of uplands. Slopes generally are less than 40 percent. Grummit soils have a surface layer of gray clay that is underlain by friable, shaly clay. Shale is at a depth of 13 inches.

Snomo soils are on the tops of the hills. Slopes generally are less than 20 percent. Snomo soils have a surface layer of grayish brown clay and a subsoil of friable clay. The underlying material is clay. Shale is at a depth of 49 inches.

Rock outcrop is an extremely acid, barren shale intermingled with Grummit and Snomo soils on the gently sloping to very steep uplands.

Grummit and Snomo soils are low in fertility. Grummit soils have very low available water capacity, and Snomo soils have low available water capacity. Both soils have moderate permeability.

The minor soils in this unit are Stetter Variant soils that are not so clayey as Grummit and Snomo soils. They are on bottom lands along drainageways.

Nearly all of the acreage of this unit is in native rangeland and is used for grazing. Runoff is rapid. Controlling erosion is the main concern of management.

The soils in this unit have fair or good potential for rangeland. They have poor potential for cultivated crops, windbreaks and environmental plantings, building sites, local roads and streets, and sanitary facilities. Limitations are difficult to overcome.

Areas dominated by well drained and somewhat excessively drained, gently sloping to very steep soils in the Black Hills

The map units in this group are on mountains that make up the Black Hills. The relief is dominantly steep and very steep, but it is gently sloping on some of the high plateaus. The soils are loamy or silty and are dominantly deep over limestone, sandstone, and schist. Shallow and moderately deep soils, however, occur in places.

Most of the acreage in these units is used for woodland grazing and for commercial production of timber products. A few cleared meadows are used for hayland. Deer hunting late in fall and early in winter and winter sports are popular activities in this area. The map units in this group make up about 76 percent of the county.

6. Paunsaugunt-Rock outcrop

Shallow, well drained or somewhat excessively drained, moderately sloping to very steep soils and Rock outcrop; on uplands

This map unit consists of side slopes on the outer edge of the Black Hills. Slopes generally are long and smooth, and main drainages from the Black Hills are entrenched into the limestone bedrock.

This map unit makes up about 3 percent of the county. It is about 50 percent Paunsaugunt soils, 40 percent Rock outcrop, and 10 percent minor soils.

Paunsaugunt soils are on smooth sides of valleys. Slopes generally are less than 50 percent. Paunsaugunt soils have a surface layer of dark grayish brown, gravelly silt loam and a subsurface layer of very friable, channery loam. The underlying material is channery loam. Limestone bedrock is at a depth of 17 inches.

Rock outcrop is intermingled with the Paunsaugunt soils. It consists of fractured limestone bedrock.

Paunsaugunt soils are medium in fertility. They have very low available water capacity and moderately rapid permeability.

Minor soils in this unit are Tilford and Vale soils that are more than 40 inches deep to bedrock and have fewer coarse fragments than Paunsaugunt soils. They are on the concave parts of the landscape.

This map unit is used for woodland grazing and wildlife habitat. Maintaining adequate ground cover to conserve moisture is the main concern of management.

The soils in this unit have fair potential for rangeland, woodland grazing, and woodland wildlife habitat. They have poor potential for cultivated crops, windbreaks and environmental plantings, building sites, local roads and streets, and sanitary facilities. Limitations are difficult to overcome because of the steep slopes and shallow depth to bedrock. Homesites should be placed on the minor soils in this unit.

7. Lakoa-Maitland

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

This map unit consists of upland divides and sides of valleys and drainageways. Slopes generally are long and are mostly moderately steep to very steep. The steeper slopes are on the valley sides along the main drainageways. The drainage pattern is well defined and is made up of many small drainageways that join to form larger drainageways that flow out of the area.

This map unit makes up about 2 percent of the county. It is about 50 percent Lakoa soils, 40 percent Maitland soils, and 10 percent minor soils.

Lakoa soils are on high ridges. Slopes generally are less than 50 percent. The Lakoa soils have a surface layer of gray silt loam and a subsurface layer of yellowish brown loam. The subsoil is firm clay loam that is underlain by sandy loam. Sandstone is at a depth of 42 inches.

Maitland soils are on smooth concave sides of valleys. Slopes generally are less than 40 percent. Maitland soils have a surface layer of gray loam and a subsurface layer of light brownish gray very fine sandy loam. The subsoil is friable clay loam that is underlain by fine sandy loam and loam.

Lakoa soils are low in fertility and moderate in available water capacity. Maitland soils are high in fertility. Both of these soils have moderate permeability.

Minor soils in this unit are shallow Butche soils and Canyon soils on some ridges and on steeper side slopes below the ridges, and gently sloping and sloping Boneek soils that have a dark surface layer and are on the lower parts of the landscape.

This map unit is used for woodland, woodland grazing, and wildlife habitat. Maintaining adequate ground cover to control erosion and conserving moisture are the main concerns of management.

The soils in this unit have good potential for woodland grazing and woodland wildlife habitat. They have fair potential for limited timber production and recreational uses. The soils have poor potential for cultivated crops, windbreaks and environmental plantings, building sites, local roads and streets, and sanitary facilities. Limitations are difficult to overcome because of the steep slopes.

8. Citadel-Vanocker-Grizzly

Deep, well drained, moderately sloping to very steep loamy soils; on uplands

This map unit is in mountains in the Black Hills. The soils are underlain by limestone and sandstone, but many of the high ridges and peaks are intrusions of igneous and metamorphic rocks, which were thrust upward by the Black Hills uplift. Slopes generally are long and are mostly moderately steep and steep, but very steep slopes are on the sides of entrenched drainageways and on the upper sides of prominent ridges and peaks. The drainage pattern is well defined and consists of many small drainageways that join to form larger drainageways that flow out of the area. Elevation ranges from 4,000 to 6,200 feet, and local relief varies as much as 400 feet (fig. 3).

This map unit makes up about 45 percent of the county. It is about 35 percent Citadel soils, 20 percent Vanocker soils, 20 percent Grizzly soils, and 25 percent minor soils.

Citadel soils are on smooth upland divides and on the sides of mountain valleys and drainageways. Slopes generally are less than 40 percent. Citadel soils have a surface layer of very dark gray loam and a subsurface layer of light brown fine sandy loam. The subsoil is loam, clay, and gravelly clay loam. It is underlain by cobbly loam.

Vanocker soils are on very steep slopes along the edges of ridges and sides of mountain valleys. Slopes generally are less than 60 percent. Vanocker soils have a surface layer of dark grayish brown loam and a subsoil of firm channery clay loam. The underlying material is very channery clay loam.

Grizzly soils are on convex ridgetops and upper valley side slopes. Slopes generally are less than 65 percent. Grizzly soils have a surface layer of dark gray, very gravelly silt loam. The subsoil is friable, gravelly clay loam and firm, gravelly clay loam.

Citadel, Vanocker, and Grizzly soils are low in fertility. Citadel and Grizzly soils have high available water capacity and high shrink-swell potential. Vanocker soils have moderate available water capacity. Citadel and Grizzly soils have moderately slow permeability, and Vanocker soils have moderate permeability.

Minor soils in this unit are Virkula soils that do not have carbonates, on some of the higher concave valley side slopes. Also included are Maitland soils that have more organic matter to a greater depth than the major soils, on concave side slopes along some drainageways, and poorly drained Marshdale soils, on bottom lands.

This map unit is used for timber production, woodland grazing, and wildlife habitat. Some of the smoother slopes along drainageways have been cleared of timber, and the acreage is used for hay. Maintaining adequate ground cover to control erosion and conserving moisture are the main concerns of management.

The soils in this unit have good potential for woodland grazing and woodland wildlife habitat. They have fair potential for commercial timber production on slopes of less than 25 percent and poor potential on slopes that are steeper. They have poor potential for cultivated crops, building sites, local roads and streets, and sanitary facilities, and fair or poor potential for most recreational uses. Limitations are difficult to overcome because of the steep slopes.

9. Stovho-Trebor-Rock outcrop

Deep and moderately deep, well drained, gently rolling to very steep silty soils; on uplands

This map unit consists of high plateaus in the Black Hills that are dissected by many valleys and drainageways. Slopes generally are long and are mostly gently rolling to hilly, but steeper slopes are on valley sides along the main drainageways and on edges of rock outcrops. The drainage pattern is well defined and is made up of many small drainageways that join to form

larger drainageways that flow out of the area. Elevation ranges from 6,200 to 7,500 feet, and local relief varies as much as 600 feet.

This map unit makes up about 15 percent of the county. It is about 60 percent Stovho soils, 25 percent Trebor soils, 5 percent Rock outcrop, and 10 percent minor soils.

Stovho soils are on smooth upland divides and on the less sloping sides of mountain valleys and drainageways. Slopes generally are less than 40 percent. The Stovho soils have a surface layer of dark grayish brown and light brownish gray silt loam. The subsoil is firm silty clay that is underlain by cobbly silt loam.

Trebor soils are on rounded ridges on the plateaus and on the sides of valleys and drainageways. Slopes generally are less than 30 percent. The Trebor soils have a surface layer of pinkish gray silt loam and a subsoil of firm, channery silty clay that is underlain by channery silt loam. Limestone bedrock is at a depth of 30 inches.

The Rock outcrop is along the edges of plateaus and on the upper parts of some of the steeper slopes.

Stovho and Trebor soils are low in fertility. Stovho soils have high available water capacity, and Trebor soils have low available water capacity. Stovho and Trebor soils have moderately slow permeability and high shrink-swell potential.

Minor soils in this unit are dark Maitland soils, on concave side slopes along some drainageways, and Vanocker soils, on steep warmer side slopes. Also included are poorly drained Marshdale soils, on bottom lands.

This map unit is used for timber production, woodland grazing, and wildlife habitat. Some of the smoother slopes along drainageways have been cleared of timber, and the acreage is used for hay. Maintaining adequate ground cover to conserve moisture and controlling erosion are the main concerns of management.

The soils in this unit have good potential for woodland grazing and woodland wildlife habitat, fair potential for commercial timber production, and poor potential for buildings, local roads and streets, and sanitary facilities.

10. Pactola-Buska-Hisega

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

This map unit is in mountains in the Black Hills. The soils of the area are underlain by metamorphic rock, dominantly schist and slate containing mica. Slopes generally are long and are mostly steep, but moderate slopes are on the lower part of the landscape and very steep slopes are on the sides of entrenched drainageways and on the upper sides of prominent ridges and peaks. The drainage pattern is well defined and consists of many small drainageways that join to form larger drainageways that flow out of the area. Elevation ranges from 5,000 to 6,300 feet, and local relief varies as much as 600 feet.

This map unit makes up about 11 percent of the county. It is about 35 percent Pactola soils, 25 percent Buska soils, 20 percent Hisega soils, and 20 percent minor soils.

Pactola soils are on strongly sloping to very steep sides of mountains. Slopes generally are less than 60 percent. Pactola soils have a surface layer of dark gray loam and a subsoil of friable, channery clay loam and very flaggy clay loam. The underlying material is very flaggy silt loam.

Buska soils are on moderately sloping to steep mountains. Slopes generally are less than 30 percent. Buska soils have a surface layer of light brownish gray, channery silt loam and a subsoil of friable, channery silt loam. The underlying material is very channery silt loam.

Hisega soils are on very steep mountains. Slopes generally are 15 to 65 percent. Hisega soils have a surface layer of light olive brown loam and a subsoil of very friable, channery loam. The underlying material is channery loam and very flaggy loam.

Pactola, Buska, and Hisega soils are low in fertility. These soils have moderate available water capacity and permeability.

Minor soils in this unit are Maitland soils that have more organic matter to greater depths than the major soils, on concave side slopes along some drainageways, and poorly drained Marshdale soils, on bottom lands.

This map unit is used for timber production, woodland grazing, and wildlife habitat. Some of the smoother slopes along drainageways have been cleared of timber, and the acreage is used for hay. Maintaining adequate ground cover to control erosion and conserving moisture are the main concerns of management.

The soils in this unit have good potential for woodland grazing and woodland wildlife habitat. They have fair potential for commercial timber production on slopes that are less than 25 percent and poor potential on slopes that are steeper. They have poor potential for cultivated crops, building sites, local roads and streets, and sanitary facilities. Limitations are difficult to overcome. The less sloping soils above the poorly drained flood plain are better building sites than are other places. Sanitary facilities can be a source of pollution to the ground water.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting,

and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

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

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

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

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Satanta loam, 0 to 2 percent slopes, is one of several phases within the Satanta series.

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

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Canyon-Bridget complex, 6 to 25 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Stovho-Trebor association steep, is an example.

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

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Dumps, mine, is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 7, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

The names of some map units on the detailed soil maps do not fully agree with those in the published survey of adjacent Butte and Meade counties. This is due to changes in concepts of the soil series in the application of the classification system and in concepts of the map units.

AaB—Alice fine sandy loam, 0 to 6 percent slopes. This deep, well drained, nearly level and gently sloping soil is on terraces and terrace fronts. Mapped areas are irregular in shape and range from 10 to 200 acres in size. Slopes are plane to slightly convex.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsoil, about 20 inches thick, is very friable fine sandy loam that is dark brown in the upper part and brown in the lower part. The underlying material to a depth of 43 inches is light brown, calcareous sandy loam. Below this, to a depth of 60 inches, is light brown, calcareous, gravelly loamy sand. In some areas, slopes are as much as 9 percent.

Included with this soil in mapping are small areas of Vale soil. Vale soil has more clay than Alice soil and is in the lower part of the landscape. The included soil makes up less than 10 percent of the map unit.

This Alice soil is medium in fertility, is moderately low in content of organic matter, and is easily tilled. Available water capacity is low or moderate. Permeability is moderately rapid in the upper part of the soil and rapid in the underlying material. Runoff is slow.

Most areas of this soil are farmed. This soil has good potential for cultivated crops, rangeland, windbreaks and environmental plantings, recreational uses, and rangeland wildlife habitat. It has good potential for most building sites and sanitary facilities. This soil has poor potential for openland wildlife habitat.

This soil is well suited to small grain and to grasses and legumes for hay and pasture. Soil blowing is a severe hazard if this soil is used for cultivated crops.

Stubble mulching, crop residue management, stripcropping, minimum tillage, and field windbreaks help control soil blowing and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and reduce soil blowing. Seeding this soil to tame pasture plants is effective in controlling soil blowing. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground mulch helps prevent soil blowing and improves the moisture supply for range plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. Most climatically adapted trees and shrubs grow well on this soil except those trees that have a high moisture requirement. Keeping crop residue on the surface during site preparation helps control soil blowing until the planting is established.

This soil has slight limitations for buildings and septic tank absorption fields. Seepage is a severe limitation if this soil is used for sewage lagoons. Sealing the bottom and sides of sewage lagoons helps reduce excessive seepage. All waste disposal systems are a potential source of pollution to shallow ground water.

If this soil is used for local roads and streets, the base material needs to be strengthened to help support vehicular traffic. This map unit is in Capability unit IIIe-8 and Sandy range site.

Ba—Barnum silt loam. This deep, well drained, nearly level soil is on terraces and bottom lands. It is subject to occasional flooding for brief periods. Mapped areas are irregular in shape and range from 10 to 200 acres in size. Some areas are dissected by deep meandering channels. Slopes are mostly less than 1 percent but are as much as 3 percent in places.

Typically, the surface layer is brown silt loam in the upper 3 inches and brown very fine sandy loam in the lower 3 inches. The underlying material to a depth of 60 inches is light reddish brown, very friable loam. In places, the soil has less clay and more sand than is typical for the Barnum soil.

Included with this soil in mapping are small areas of St. Onge and Swint soils. These soils contain more silt and clay and have more organic matter to a greater depth than the Barnum soil, and are in the higher part of the landscape away from streams. The included soils make up about 10 percent of the map unit.

This soil is low in fertility and content of organic matter and is easily tilled. Available water capacity is high, and permeability is moderate. Runoff is slow.

Most areas of this soil are farmed. This soil has good potential for irrigated and dryland crops, rangeland, windbreaks, openland wildlife habitat, and rangeland wildlife habitat. It has poor potential for recreational uses, building sites, and sanitary facilities.

This soil is well suited to small grain and grasses and legumes for hay and pasture. Conserving moisture is the main management concern if this soil is used for cultivated crops. Stubble mulching, crop residue management, and minimum tillage help conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility. Planting and harvesting of crops may be delayed during wet periods. Seeding this soil to tame pasture plants is an alternative use. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of mid and short grasses. Maintaining a good grass cover and ground mulch helps prevent soil blowing and improves the moisture supply for range plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Keeping crop residue on the surface during site preparation helps conserve moisture for optimum tree growth.

This soil is generally not suitable for building sites and sanitary facilities because of occasional flooding. If buildings are constructed on this soil, dikes are needed to protect the site from flooding.

If this soil is used for local roads and streets, the base material needs to be strengthened to support vehicular traffic. This map unit is in Capability unit IIc-1 and Silty range site.

Bb—Barnum silt loam, channeled. This deep, well drained, nearly level soil is on bottom lands. It is subject to occasional flooding for brief periods. Mapped areas are long and narrow in shape and range from 5 to 150 acres in size. Entrenched streams meander through the map unit, and the hummocky microrelief has meander scars throughout. Slopes are mostly less than 1 percent but are as much as 3 percent in places.

Typically, the surface layer is brown silt loam in the upper 3 inches and brown very fine sandy loam in the lower 3 inches. The underlying material to a depth of 60 inches is light reddish brown, very friable loam. In places the underlying material is browner, and in some areas

the surface layer is thicker and darker than is typical for the Barnum soil.

Included with this soil in mapping are small areas of St. Onge soil. They have more silt and clay and more organic matter to a greater depth than Barnum soil and are in the higher parts of the landscape. These small areas make up about 15 percent of the map unit.

This soil is low in fertility and content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is slow.

Most areas of this soil are in rangeland. This soil has good potential for rangeland and fair potential for rangeland wildlife habitat. It has poor potential for farming, recreational uses, windbreaks and environmental plantings, building sites, and sanitary facilities.

This soil is well suited to rangeland. The natural plant community is a mixture of mid and short grasses. Maintaining a good grass cover and ground mulch helps prevent erosion caused by flooding during peak rainfall periods and fast snowmelt. It also helps improve the moisture supply for range plants in dry periods. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferment of grazing during wet periods help maintain or improve rangeland condition.

If special plantings are made and shrubs and trees that require extra moisture are selected, plant cover for wildlife habitat can be established.

This soil generally is not suited to farming, most recreational uses, building sites, sanitary facilities, and local roads and streets because of occasional flooding and deep meandering stream channels. This map unit is in Capability unit VIw-1 and Silty range site.

BcA—Boneek silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on high terraces and uplands. Mapped areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil, about 21 inches thick, is brown, friable silty clay loam in the upper part and silt loam in the lower part. The underlying material to a depth of about 47 inches is pale brown silt loam. Sandstone bedrock is at a depth of 47 inches. In places, the soil has less clay and more sand than is typical of the Boneek soil.

Included with this soil in mapping are small areas of Butche and Canyon soils which have less clay, are shallower to bedrock, and are on a higher part of the landscape than Boneek soil. They make up about 10 percent of the unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability is moderately slow to a depth of 22 inches and moderate below. Runoff is slow.

Most areas of this soil are farmed. This soil has good potential for cultivated crops, rangeland, windbreaks and environmental plantings, recreational uses, and openland and rangeland wildlife habitat. It has fair potential for building sites and sanitary facilities.

This soil is well suited to small grain and grasses and legumes for hay and pasture. Conserving moisture is the main concern if this soil is used for cultivated crops. Stubble mulching, crop residue management, minimum tillage, and field windbreaks help conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve and maintain fertility. Seeding this soil to tame pasture plants is an effective alternative use. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of mid and short grasses. Maintaining a good grass cover and ground mulch helps improve the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings, except those trees and shrubs that have a high moisture requirement. Chance of survival of plants is good if the soil is summer fallowed before planting, and cultivation is continued after planting to control grass and weeds and conserve moisture.

If buildings are constructed on this soil, proper design of foundation and footings and diverting runoff water away from the buildings help prevent structural damage caused by shrinking and swelling of the soil. If the soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitations of slow movement of effluent and moderate depth to bedrock. Lateral seepage above the bedrock is a potential source of pollution to shallow ground water. If sewage lagoons are placed on this soil, the floors need to be placed above bedrock and the sides and bottoms of the lagoon sealed to reduce excessive seepage.

Roads need to be graded to shed water and the base material strengthened to support vehicular traffic if this soil is used for local roads and streets. This map unit is in Capability unit IIc-2 and Silty range site.

BcB—Boneek silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on high terraces and uplands. Mapped areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil, about 21 inches thick, is brown, friable silty clay loam in the upper part and silt loam in the lower part. The underlying material to a depth of about 47 inches is pale brown silt loam. Sandstone bedrock is at a depth of 47 inches. In places, the soil has less clay and more sand than is typical of the Boneek soil.

Included with this soil in mapping are small areas of Butche and Canyon soils. These soils have less clay and are shallower to bedrock than Boneek soil and are on the higher parts of the landscape. They make up about 15 percent of the unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability is moderately slow to a depth of 22 inches and moderate below. Runoff is medium.

Most areas of this soil are farmed. This soil has good potential for cultivated crops, rangeland, windbreaks and environmental plantings, recreational uses, and openland and rangeland wildlife habitat. It has fair potential for most building sites and sanitary facilities.

This soil is well suited to small grain and grasses and legumes for hay and pasture. Controlling erosion is the main concern of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, contour farming, terracing, minimum tillage, and field windbreaks help control erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve and maintain fertility and reduce susceptibility of the soil to erosion. Seeding this soil to tame pasture plants is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of mid and short grasses. Maintaining a good grass cover and ground mulch helps prevent erosion and improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings, except those trees and shrubs that have a high moisture requirement. Chance of survival of plants is good if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

If buildings are constructed on this soil, proper design of foundation and footings and diverting runoff water away from the buildings help prevent structural damage caused by shrinking and swelling of the soil. If the soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitations of slow movement of effluent and moderate depth to bedrock. Lateral seepage above the bedrock is a potential source of pollution to shallow ground water. If sewage lagoons are constructed on this soil, the floors need to be placed above bedrock and the sides and bottom of the lagoon sealed to reduce excessive seepage. Lagoons should be placed in less sloping areas to avoid excessive cutting and filling.

Roads need to be graded to shed water and the base material strengthened to support vehicular traffic if this soil is used for local roads and streets. This map unit is in Capability unit IIe-1 and Silty range site.

BcC—Boneek silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on high terraces and uplands. Mapped areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil, about 17 inches thick, is brown, friable silty clay loam in the upper part and silt loam in the lower part. The underlying material to a depth of about 42 inches is pale brown silt loam. Sandstone bedrock is at a depth of 42 inches.

Included with this soil in mapping are small areas of Butche, Canyon, and Lakoa soils on the higher part of the landscape. Butche and Canyon soils have bedrock at a depth of less than 20 inches. Lakoa soil has a lighter surface layer and more clay in the subsoil than Boneek soil. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability is moderately slow to a depth of 20 inches and moderate below. Runoff is medium.

Most areas of this soil are farmed. The soil has good potential for crops, rangeland, windbreaks and environmental plantings, recreational uses, and rangeland wildlife habitat. It has fair potential for openland wildlife habitat, building sites and sanitary facilities.

This soil is suited to small grain and grasses and legumes. Controlling erosion is the main concern of management if this soil is used for cultivated crops. Terracing, contour farming, stubble mulching, crop residue management, minimum tillage, and field windbreaks help control erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve and maintain fertility and reduce susceptibility of the soil to erosion. Seeding this soil to tame pasture plants is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition. Because of the severe hazard of erosion, this soil needs to be kept in grasses and legumes at least three-fourths of the time.

This soil is well suited to rangeland. The natural plant community is a mixture of mid and short grasses. Maintaining a good grass cover and ground mulch helps prevent erosion and improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings, except those trees and shrubs that

have a high moisture requirement. This soil needs to be summer fallowed before planting to improve first year survival, and cultivation continued after planting to control grass and weeds and conserve moisture.

If buildings are constructed on this soil, proper design of foundation and footings and diverting runoff water away from the buildings help prevent structure damage caused by shrinking and swelling of the soil. If the soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitations of slow movement of effluent and moderate depth to bedrock. Lateral seepage above the bedrock is a potential source of pollution to shallow ground water. If sewage lagoons are constructed on this soil, the floors need to be placed above bedrock and the sides and bottoms of the lagoon sealed to reduce excessive seepage.

Roads need to be graded to shed water and the base material strengthened to support vehicular traffic if this soil is used for local roads and streets. This map unit is in Capability unit IIIe-1 and Silty range site.

BDE—Buska-Rock outcrop association, hilly. This map unit consists of deep, well drained soils and Rock outcrop in the Black Hills. It is on smooth upland divides and sides of mountain valleys and drainageways. Slopes generally are long and smooth and range from 6 to 30 percent.

Individual areas of this map unit range from 160 to several thousand acres in size and are about 60 to 70 percent Buska soil, 15 to 25 percent Rock outcrop, and 20 percent minor soils. Rock outcrop is in areas that range from less than 1 acre to as much as 25 acres in size. It is throughout the unit but is mainly on the upper sides and tops of ridges and points. The minor soils are in areas that range to 40 acres in size. The uses of this unit, however, are such that separate mapping of the larger areas of Rock outcrop and of the minor soils is not practical.

Typically, the Buska soil has a surface layer of light brownish gray silt loam about 15 inches thick that is covered by about 1 inch of forest litter. The subsoil, about 22 inches thick, is friable, channery silt loam that is grayish brown in the upper part and dark grayish brown in the lower part. The underlying material, to a depth of 60 inches, is very channery silt loam and is light brownish gray in the upper part and dark yellowish brown in the lower part. In places, the depth to bedded schist is less than 40 inches.

Rock outcrop consists of exposures of fractured schist and dikes of quartzite. The bedding planes of the schist commonly are at an angle of about 45 to 60 degrees because of the uplift of the Black Hills.

Included with this unit in mapping are areas of Hisega, Maitland, and Marshdale soils. Hisega soil has a weaker grade of structure in the subsoil than the Buska soil. Maitland soil has more organic matter in the surface layer than the Buska soil. Hisega soil is generally in the higher part of the landscape above the Buska soil, and Maitland soil is on foot slopes below the Buska soil. Marshdale soil is poorly drained and is along drainageways in the mountain valleys. These included soils make up 10 to 20 percent of the map unit.

The Buska soil is low in fertility and content of organic matter. Available water capacity and permeability are moderate. Runoff is medium or rapid.

Most areas of this map unit are in ponderosa pine forest. Some of the minor soils in swales and in mountain valleys are in native grass or have been seeded to tame pasture plants and are used for hay or grazing. The soils in this unit have good potential for timber production, woodland grazing, and woodland wildlife habitat. They have fair potential for tame pasture and poor potential for cultivated crops, rangeland, recreational uses, building sites, and sanitary facilities.

This map unit is well suited to timber production, woodland grazing, and woodland wildlife habitat. The natural plant community is dominantly ponderosa pine and an understory of shrubs and grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil losses and improves the moisture supply for forest plants. Selective cutting and thinning reduces the competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals. It also promotes the growth of understory plants for grazing by livestock and woodland wildlife. Proper grazing use of the understory by livestock helps maintain a desirable plant community that provides browse for woodland wildlife.

Seeding cleared areas of this map unit to suitable tame pasture plants is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition after it is established.

Buildings, septic tank absorption fields, and sewage lagoons need to be placed in the lower part of the landscape where slopes are less steep and Rock outcrop and stones are less common. If buildings are constructed on the Buska soil, proper design of foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. Waste disposal systems are a potential source of pollution to shallow ground water. If the soil is used for septic tank filter fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent. Sealing the bottom and sides of sewage lagoons helps reduce seepage.

Strengthening the base material is needed to help overcome the low strength of the Buska soil and to support vehicular traffic. Control of roadside erosion is needed in borrow and cut areas. The Buska soil is in Capability unit VIe-13, and Rock outcrop is in Capability unit VIIIs-1. The map unit is not placed in a range site.

BeE—Butche stony loam, 6 to 50 percent slopes. This shallow, well drained to excessively drained, moderately sloping to very steep soil is on uplands. Many scattered stones 5 to 15 inches in diameter commonly are on and below the surface. Mapped areas are irregular in shape and range from 30 to 600 acres in size.

Typically, the surface layer is brown, stony loam about 3 inches thick. The underlying material to a depth of about 13 inches is brown, very friable, stony loam. Very pale brown and reddish yellow indurated sandstone is at a depth of 13 inches.

Included with this soil in mapping are small areas of Boneek, Lakoa, Maitland, and Satanta soils that are deeper to bedrock than Butche soils. Boneek and Satanta soils generally are in the lower part of the landscape below Butche soils. Lakoa and Maitland soils are on timbered ridgetops above Butche soil and on foot slopes in the lower part of the landscape. The included soils make up 15 percent of the map unit.

This soil is low in fertility and content of organic matter. Available water capacity is very low, and permeability is moderate above the bedrock. Runoff is medium or rapid.

Most areas of this soil are used for rangeland. This soil has fair potential for rangeland and rangeland wildlife habitat and poor potential for farming, recreational uses, windbreaks and environmental plantings, building sites, and sanitary facilities.

This soil is well suited to rangeland. The natural plant community is a mixture of tall and mid grasses and short scattered ponderosa pine. Droughtiness and erosion are the main concerns of rangeland management. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the taller more desirable grasses lose vigor and are replaced by less productive grasses and weeds. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil generally is not suited to cultivated crops, tame pasture, or windbreaks because of the very low available moisture, steep slopes, and shallow depth to bedrock. Trees and shrubs for wildlife habitat can be planted on special sites in this unit, but only trees that have good survival potential should be selected.

Buildings can be located on the less steep parts of the unit, but shallow depth to bedrock limits excavation for foundations and footings. Septic tank absorption fields need to be placed on the deeper soils in the unit. This soil generally is not suitable for sewage lagoons because of steep slopes and shallow depth to bedrock.

Local roads and streets need to be constructed in the less steep parts of the map unit. Roadfill material is scarce because of the shallow depth to hard bedrock. Control of roadside erosion generally is needed in borrow and cut areas. This map unit is in Capability unit VIIs-1 and Shallow range site.

BhE—Butche-Rock outcrop complex, 25 to 50 percent slopes. This map unit consists of shallow, excessively drained, steep soils and Rock outcrop on uplands. The irregularly shaped areas range from 50 to 500 acres in size and are about 55 to 65 percent Butche soil and 20 to 30 percent Rock outcrop. Rock outcrop is on the tops and upper sides of ridges. The Butche soil and Rock outcrop are so intermingled that it is not practical to separate them in mapping. Many large rocks have broken free and are lying on the surface below the Rock outcrop.

Typically, the Butche soil has a surface layer of brown, stony loam about 3 inches thick. The underlying material to a depth of about 13 inches is brown, very friable, stony loam. Very pale brown and reddish yellow indurated sandstone is at a depth of 13 inches.

Rock outcrop consists of exposures of very pale brown and reddish yellow indurated sandstone.

Included with this unit in mapping are small areas of Boneek, Lakoa, and Satanta soils that are more than 40 inches deep to bedrock. Boneek and Satanta soils generally are in the lower part of the landscape below Butche soil. The included soils make up about 15 percent of the map unit.

The Butche soil is low in fertility and content of organic matter. Available water capacity is very low. Permeability is moderate above the bedrock. Runoff is rapid.

Most areas of this map unit are in rangeland. The Butche soil has fair potential for rangeland and rangeland wildlife habitat and poor potential for farming, recreational uses, windbreaks and environmental plantings, building sites, and sanitary facilities.

This map unit is well suited to rangeland. The natural plant cover is a mixture of tall and mid grasses and short scattered ponderosa pine. Droughtiness and erosion are the main concerns of rangeland management. Management that maintains adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive grasses and weeds. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This map unit generally is not suited to cultivated crops, tame pasture, and windbreaks because of the very low available moisture, steep slopes, and shallow depth to bedrock. It is suited to wildlife habitat on selected sites; however, trees and shrubs need to be planted by hand and given special care.

This map unit generally is not suitable as a site for buildings, sanitary facilities, and local roads and streets because of steep slopes, stoniness, and the Rock outcrop. The Butche soil is in Capability unit VIIs-1 and Shallow range site. Rock outcrop is in Capability unit VIIIs-1. It is not placed in a range site.

BkD—Butche-Satanta loams, 6 to 25 percent slopes. This map unit consists of shallow and deep, well drained, moderately sloping to moderately steep soils on uplands. The irregularly shaped areas range from 50 to 1,000 acres in size and are about 55 to 65 percent Butche soil and 30 to 40 percent Satanta soil. Satanta soil generally is less sloping and is in the lower part of the landscape. The two soils are so intermingled that it is not practical to separate them in mapping.

Typically, the Butche soil has a surface layer of brown loam about 3 inches thick. The underlying material to a depth of about 13 inches is brown, very friable, stony loam. Very pale brown and reddish yellow indurated sandstone is at a depth of 13 inches.

Typically, the Satanta soil has a surface layer of brown loam about 7 inches thick. The subsoil, about 30 inches thick, is brown, very friable loam in the upper part and brown and pale brown, friable clay loam and sandy clay loam in the lower part. The underlying material to a depth of 60 inches is pale brown sandy clay loam. In places, this soil has more silt and clay in the subsoil than is typical for Satanta soils, or the depth to sandstone is slightly less than 40 inches.

Included with this unit in mapping are small areas of Lakoa soil that have less organic matter in the surface layer than Satanta soil and are in timbered coves below Butche soil. The included soil makes up about 5 percent of the map unit.

The Butche soil is low in fertility and content of organic matter. Available water capacity is very low. The Satanta soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderate in both soils. Runoff is medium or rapid.

Most areas of these soils are in rangeland. The Butche soil has fair potential for rangeland and rangeland wildlife habitat and poor potential for sanitary facilities and building sites. The Satanta soil has good potential for rangeland and rangeland wildlife habitat and fair potential for most sanitary facilities and building sites. Both soils have poor potential for crops, openland wildlife habitat, recreational uses, and windbreaks and environmental plantings.

This map unit is better suited to rangeland than to other uses. The natural grass cover is a mixture of tall, mid, and short grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

Satanta soils that have slopes of less than 9 percent can be farmed without excessive soil loss by erosion, but they commonly are intermingled with steeper and shallower soils that generally are not suited to cultivation. Seeding disturbed areas of Satanta soil to tame pasture plants is effective in controlling erosion. Proper stocking rates, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition after it is established.

In most places, the areas of Satanta soils are too small for windbreaks, but suitable trees and shrubs for wildlife habitat and other special uses can be planted on selected sites.

Buildings and sanitary facilities need to be placed in the lower part of the landscape on the Satanta soil. If buildings are constructed on this map unit, proper design of foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. If these soils are used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent. Septic tank absorption fields need to be placed in the lower part of the landscape where soils are deeper and are less steep. Sealing the bottom and sides of the lagoon helps reduce seepage.

Local roads and streets need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow areas. This map unit is in Capability unit VIs-2. The Butche soil is in Shallow range site, and Satanta soil is in Silty range site.

CaD—Canyon-Bridget complex, 6 to 25 percent slopes. This map unit consists of shallow and deep, well drained, moderately sloping to moderately steep soils on uplands. The irregularly shaped areas range from 10 to 200 acres in size and are about 45 to 55 percent Canyon soil and 25 to 35 percent Bridget soil. The Bridget soil generally is in the lower part of the landscape. The two soils are so intermingled that it is not practical to separate them in mapping.

Typically, the Canyon soil has a surface layer of brown fine sandy loam about 3 inches thick. The underlying material to a depth of about 16 inches is very friable very fine sandy loam that is light gray in the upper part and white in the lower part. White, fine grained sandstone is at a depth of 16 inches.

Typically, the Bridget soil has a surface layer of dark brown and brown loam about 10 inches thick. The underlying material to a depth of 60 inches is very pale brown, very friable very fine sandy loam.

Included with this unit in mapping are small areas of Midway and Satanta soils. Both of these soils have more clay than Canyon and Bridget soils. Midway soil generally is on steep slopes below Canyon soil, and Satanta soil is on the lower part of the landscape. The included soils make up about 20 percent of the map unit.

The Canyon soil is low in fertility and content of organic matter. Available water capacity is very low. The Bridget soil is medium in fertility and moderately low in content of organic matter. Available water capacity is high.

Permeability is moderate in both soils. Runoff is medium or rapid.

Most areas of these soils are in rangeland. The Canyon soil has fair potential for rangeland and rangeland wildlife habitat. The Bridget soil has good potential for rangeland and rangeland wildlife habitat. Both soils have poor potential for openland wildlife habitat, recreational uses, windbreaks and environmental plantings, and most sanitary facilities and building sites.

This map unit is better suited to rangeland than to other uses. The natural grass cover is a mixture of tall, mid, and short grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

Bridget soils that have slopes of less than 9 percent can be farmed without excessive soil loss by erosion, but they commonly are intermingled with steeper and shallower soils that are not suited to cultivation.

Seeding disturbed areas of Bridget soil to tame pasture plants is effective in controlling erosion. Proper stocking rates, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition after it is established.

Most areas of Bridget soil are too small for windbreaks, but plantings of suitable trees and shrubs for wildlife habitat and other special uses can be made on selected sites.

Buildings and sanitary facilities need to be placed in the lower part of the landscape on the Bridget soil or on the included soils. If buildings are constructed on this map unit, proper design of foundations and footings helps prevent structural damage caused by low strength. Septic tank absorption fields and sewage lagoons need to be placed on the less sloping areas of Bridget soil. Sealing the bottom and sides of the lagoon helps reduce seepage.

Local roads and streets need to be graded to shed water. Because this soil has low strength, the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow areas. This map unit is in Capability unit VIe-11. The Canyon soil is in Shallow range site, and Bridget soil is in Silty range site.

CaE—Canyon-Bridget complex, 9 to 50 percent slopes. This map unit consists of shallow and deep, well drained, strongly sloping to very steep soils on uplands. The irregularly shaped areas range from 10 to 600 acres in size and are about 55 to 65 percent Canyon soil and 20 to 30 percent Bridget soil. The Bridget soil generally is in the lower part of the landscape. The two soils are so intermingled that it is not practical to separate them in mapping. Outcrops of rock are common at the top of the ridge. Large surface stones commonly are on the side slopes below the ridgetops (fig. 4).

Typically, the Canyon soil has a surface layer of brown fine sandy loam about 3 inches thick. The underlying material to a depth of about 16 inches is very friable very fine sandy loam that is light gray in the upper part and white in the lower part. White, fine grained sandstone is at a depth of 16 inches.

Typically, the Bridget soil has a surface layer of dark brown and brown loam about 10 inches thick. The underlying material to a depth of 60 inches is very pale brown, very friable very fine sandy loam.

Included with this unit in mapping are small areas of Midway and Satanta soils. Both of these soils have more clay than Canyon and Bridget soils. Midway soil generally is on steep slopes below Canyon soil, and Satanta soil is on the lower part of the landscape. The included soils make up about 15 percent of the map unit.

The Canyon soil is low in fertility and content of organic matter. Available water capacity is very low. The Bridget soil is medium in fertility and moderately low in content of organic matter. Available water capacity is high. Permeability is moderate in both soils. Runoff is medium or rapid.

Most areas of these soils are in rangeland. The Canyon soil has fair potential for rangeland and rangeland wildlife habitat. The Bridget soil has good potential for rangeland and rangeland wildlife habitat. Both soils have poor potential for openland wildlife habitat, recreational uses, windbreaks and environmental plantings, and most sanitary facilities and building sites.

This map unit is better suited to rangeland than to other uses. The natural grass cover is a mixture of tall, mid, and short grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This map unit generally is not suited to cultivated crops and windbreaks and environmental plantings because of the steep slopes and severe hazard of erosion. Areas of the Bridget soil that have been previously cultivated can be planted to tame pasture. In most areas, the Canyon and Bridget soils are so intermingled that cultivation is not practical. Most areas of Bridget soil are too small for windbreaks, but scalp plantings of suitable trees and shrubs for wildlife habitat and special uses can be made on selected sites.

This map unit is not suitable for buildings, sanitary facilities, and local streets and roads because of steep slopes and rock. This map unit is in Capability unit VIIe-7. The Canyon soil is in Shallow range site, and Bridget soil is in Silty range site.

CBE—Citadel association, hilly. This map unit consists of deep, well drained soils in the Black Hills. It is on smooth upland divides and on the sides of mountain valleys and along drainageways. Slopes generally are long and smooth and range from 6 to 30 percent.

Individual areas of this map unit range from 80 to several thousand acres in size and are about 70 percent Citadel soil and about 30 percent minor soils. The minor soils are in areas that range to 40 acres in size. The uses of this unit, however, are such that separate mapping of the larger areas of the minor soils is not practical.

Typically, the Citadel soil has a surface layer of very dark gray loam about 1 inch thick that is covered by about 1 inch of forest litter. The subsurface layer is light brown, friable fine sandy loam about 5 inches thick. The subsoil, about 34 inches thick, is reddish brown, friable loam in the upper part; reddish brown, firm clay in the middle part; and red, friable, gravelly clay loam in the lower part. The underlying material to a depth of 60 inches is red, cobbly loam. In places, bedrock is less than 40 inches deep.

Included with this unit in mapping are areas of Maitland, Marshdale, and Vanocker soils. Maitland soil has more organic matter in the surface layer than Citadel soil, and Vanocker soil has more clay in the subsoil and more coarse fragments than Citadel soil. Maitland soil is on low side slopes below Citadel soil, and Vanocker soil is on the steeper side slopes. Marshdale soil is poorly drained and is along drainageways.

The Citadel soil is low in fertility and content of organic matter. Available water capacity is high, and permeability is moderately slow. Runoff is medium or rapid. This soil has high shrink-swell potential in the subsoil.

Most areas of this map unit are in ponderosa pine forest. Some of the minor soils in the mountain valleys and along major drainageways are in native grass or have been seeded to tame pasture plants and are used for hay or livestock grazing. The soils in this unit have good potential for timber production, woodland grazing, and woodland wildlife habitat. They have fair potential for tame pasture. They have poor potential for cultivated crops, rangeland, recreational uses, and most building sites and sanitary facilities.

This map unit is better suited to timber production, woodland grazing, and woodland wildlife habitat than to other uses. The natural plant community is dominantly ponderosa pine and a mixture of some hardwoods and an understory of shrubs and grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil losses and improves the moisture supply for forest plants. Selective cutting and thinning reduces the competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals. Selective cutting also promotes the growth of understory plants for grazing by livestock and woodland wildlife. Proper grazing use of the understory by livestock helps maintain a desirable plant community that provides browse for woodland wildlife.

Seeding cleared areas of this map unit to suitable tame pasture plants is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition after it is established.

Buildings can be constructed if the shrinking and swelling of this soil is overcome. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluvent. Buildings and septic tank absorption fields need to be placed in the lower part of the landscape where slopes are less steep.

Local streets and roads need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow and cut areas. This map unit is in Capability unit VIe-13. It is not placed in a range site.

Cc—Dumps, mine. This map unit consists of waste mine tailings which have been discarded from mines. The material is generally very finely ground, but some fragments may be as large as 1/4 inch in diameter. Individual areas of these dumps range from about 2 to 20 acres in size. These dumps were formed when the tailings were pushed over steep hillsides. They are barren of vegetation.

Some of the more coarsely ground material is being used in place of gravel on local roads and streets. This map unit is in Capability unit VIIIs-2. It is not placed in a range site.

EaD—Enning-Minnequa silty clay loams, 6 to 25 percent slopes. This map unit consists of shallow and moderately deep, well drained or somewhat excessively drained, moderately sloping to moderately steep soils on uplands. The irregularly shaped areas range from 10 to 90 acres in size and are about 70 to 80 percent Enning soil and 20 to 30 percent Minnequa soil. The Minnequa soil generally is in the lower part of the landscape. The two soils are so intermingled that it is not practical to separate them in mapping.

Typically, the Enning soil has a surface layer of grayish brown silty clay loam about 4 inches thick. The underlying material to a depth of 17 inches is very friable silty clay loam that is light brownish gray in the upper part and light gray in the lower part. Light gray shale is at a depth of 17 inches.

Typically, the Minnequa soil has a surface layer of grayish brown silty clay loam about 3 inches thick. A transitional layer, about 12 inches thick, is pale brown, friable silty clay loam. The underlying material to a depth of 26 inches is very pale brown, friable silty clay loam.

Pale yellow shale is at a depth of 26 inches. In places, the depth to shale is more than 40 inches.

The Enning and Minnequa soils are low in fertility and content of organic matter. Available water capacity is very low in the Enning soil and low in the Minnequa soil. Permeability is moderate in both soils. Runoff is medium or rapid.

Most areas of these soils are used for rangeland. These soils have fair potential for rangeland, rangeland wildlife habitat, and most recreational uses. They have poor potential for cultivated crops, windbreaks and environmental plantings, and sanitary facilities. The Enning soil has poor potential and the Minnequa soil has fair potential for building sites.

This map unit is better suited to rangeland than to other uses. The natural grass cover is a mixture of tall, mid, and short grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This map unit generally is not suited to cultivated crops, tame pasture, and windbreaks because of the very low or low available moisture capacity and steep slopes. It is suited to wildlife habitat on selected sites; however, trees and shrubs need to be planted by hand and given special care.

This map unit generally is not suitable for sewage lagoons because of slopes and shallow or moderate depth to bedrock. Septic tank absorption fields should be located on the deeper, less sloping soils in this unit. If these soils are used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent. Building sites need to be placed on the lower part of the landscape. If buildings are constructed on this unit, proper design of foundations and footings helps prevent structural damage caused by the low strength of the soil.

If these soils are used for local roads, the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion generally is needed in borrow and cut areas. This map unit is in Capability unit VIe-11. The Enning soil is in Shallow range site, and Minnequa soil is in Thin Upland range site.

GaD—Glenberg Variant fine sandy loam. This deep, well drained, nearly level soil is on terraces and alluvial flood plains. It is subject to frequent flooding for brief periods. The mapped areas are irregular in shape and range from 10 to 260 acres in size.

Typically, the surface layer is dark yellowish brown fine sandy loam about 7 inches thick. The underlying material to a depth of about 60 inches is dark yellowish brown, pale brown, and brown, very friable, stratified fine sandy loam and sandy loam.

The soil is low in fertility and content of organic matter. Available water capacity is moderate, and permeability is moderately rapid or rapid. Runoff is slow. Reaction is neutral to extremely acid.

Most areas of this soil are farmed or in rangeland. This soil has good potential for crops, rangeland, and windbreaks and environmental plantings. It has fair potential for openland and rangeland wildlife habitat. It has poor potential for recreational uses, building sites, and sanitary facilities.

This soil is suited to corn, small grain, and grasses and legumes for hay. Controlling soil blowing is the main concern of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, minimum tillage, and field windbreaks help control soil blowing and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and reduce soil blowing. Seeding this soil to tame pasture plants is effective in controlling soil blowing. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition. Planting and harvesting of crops may be delayed during wet periods.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground mulch helps prevent soil blowing and improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Keeping crop residue on the surface during site preparation helps control soil blowing until the plantings are established.

This soil generally is not suitable for sanitary facilities because of susceptibility to flooding. If buildings are constructed on this soil, dikes are needed to protect the site against flooding. This map unit is in Capability unit IIIe-7 and Overflow range site.

GBE—Grizzly-Virkula association, steep. This map unit consists of deep, well drained soils in the Black Hills. It is on breaks along the edge of ridges and sides of mountain valleys. Slopes generally are long and smooth and typically range from 25 to 60 percent.

Individual areas of this map unit range from 100 to several thousand acres in size and are about 50 to 60 percent Grizzly soil, 20 to 30 percent Virkula soil, and 15 to 20 percent minor soils. Grizzly soil is on convex ridgetops and upper valley side slopes. The Virkula soil is on concave valley side slopes. The minor soils are in areas that range to 30 acres in size. The uses of this unit, however, are such that separate mapping of the Virkula soil and larger areas of the minor soils is not practical.

Typically, the Grizzly soil has a surface layer about 20 inches thick. The surface layer is dark gray, very gravelly silt loam in the upper part, light brownish gray, gravelly silt loam in the middle part, and light gray, very gravelly silt loam in the lower part. The subsoil to a depth of 51 inches is pale brown, very gravelly clay loam and light gray, very gravelly silt loam in the upper part and pale brown, very gravelly clay loam in the lower part. The underlying material is pale yellow, very channery loam.

Typically, the Virkula soil has a surface layer of grayish brown silt loam about 1 inch thick that is covered with about 1 inch of forest litter. The subsurface layer is very pale brown, very friable silt loam about 11 inches thick. The transitional layer, about 3 inches thick, is a mixture of brown, friable silty clay loam, and very pale brown silt loam. The subsoil extends to a depth of 36 inches and is firm clay loam that is brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is pale brown, gravelly clay loam. In places, bedrock is at a shallower depth than is typical for the Virkula soil.

Included with this unit in mapping are areas of Maitland and Marshdale soils and Rock outcrop. Maitland soil has more organic matter in the surface layer and is on foot slopes below Grizzly and Virkula soils. Marshdale soil is poorly drained and is along drainageways in the mountain valleys. The Rock outcrop consists of exposures of gray and tan to buff, fractured igneous rock on the edge of ridgetops and on some valley side slopes.

The Grizzly and Virkula soils are low in fertility and content of organic matter. Available water capacity is high in the Grizzly soil and moderate or high in the Virkula soil. Permeability is moderately slow. Runoff is rapid. These soils have high shrink-swell potential.

Most areas of this map unit are in ponderosa pine forest. Some minor soils in the swales and smoother areas along major drainageways in mountain valleys have been cleared and are in native grass or have been seeded to tame pasture plants and are used for hay or livestock grazing. Although Grizzly and Virkula soils are used for production of commercial timber, they have poor potential for this use. These soils have good potential for woodland wildlife habitat and winter recreational uses. They have poor potential for cultivated crops, building sites, and sanitary facilities.

This map unit is better suited to timber production, woodland grazing, and woodland wildlife habitat than to other uses. The natural plant community is dominantly ponderosa pine and an understory of common juniper, shrubs, and grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves the moisture supply for forest plants. Selective cutting and thinning reduces competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals. Selective cutting also promotes the growth of understory plants for grazing by livestock and woodland wildlife. Proper grazing use of the understory by livestock helps maintain a desirable plant community that provides browse for woodland wildlife. In some areas, at higher elevations, the north-facing and east-facing slopes can be used for ski runs if they are cleared of timber and seeded to suitable grasses to reduce the hazard of erosion.

Seeding cleared areas of this unit to suitable tame pasture plants is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition after it is established.

This map unit has severe limitations for buildings with basements, septic tank absorption fields, sewage lagoons, and local roads and streets because of shallow depth to bedrock, steep slope, and high shrink-swell. Proper design of foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. Sanitary facilities are a potential source of pollution to shallow ground water.

Local roads and streets need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. In many places, fill material is not available for local roads. Control of roadside erosion is needed in borrow and cut areas. This map unit is in Capability unit VIIe-9. It is not placed in a range site.

GcD—Grummit-Rock outcrop complex, 3 to 20 percent slopes. This map unit consists of shallow, well drained, gently sloping to moderately steep soils and Rock outcrop on uplands. The irregularly shaped areas range from 10 to 200 acres in size and are about 75 to 85 percent Grummit soil and 15 to 25 percent Rock outcrop. Rock outcrop is on steeper side slopes along drainageways. The Grummit soil and Rock outcrop are so intermingled that it is not practical to separate them in mapping.

Typically, the Grummit soil has a surface layer of gray clay about 4 inches thick. The underlying material to a depth of 13 inches is gray, friable, shaly clay. Gray shale is at a depth of 13 inches. In places, the depth to shale is more than 13 inches.

The Grummit soil is low in fertility and content of organic matter. Available water capacity is very low, and permeability is moderate. This soil has high shrink-swell potential.

The Rock outcrop consists of large exposures of gray, acid shale. This shale has been weathered to large sand-size particles and is loose on the surface.

Most areas of this map unit are in rangeland. The Grummit soil has fair potential for rangeland and rangeland wildlife habitat and poor potential for cultivated crops, pasture, windbreaks and environmental plantings, recreational uses, building sites, and sanitary facilities.

This map unit is better suited to rangeland than to other uses. The natural plant cover is a mixture of mid and short grasses. The main management concern is susceptibility of the soil to erosion. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive grasses and weeds. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This map unit generally is not suited to cultivated crops, tame pasture, and windbreaks because of the very low available moisture capacity and the severe hazard of erosion. It is suited to wildlife habitat on selected sites; however, trees and shrubs need to be planted by hand and given special care.

This map unit generally is not suitable as a site for buildings, sanitary facilities, and local roads and streets because of the depth to bedrock, high shrink-swell potential, steep slopes, and Rock outcrop. The Grummit soil is in Capability unit VIe-12 and Shallow range site. Rock outcrop is in Capability unit VIIIs-1. It is not placed in a range site.

GdE—Grummit-Rock outcrop complex, 15 to 50 percent slopes. This map unit consists of shallow, well drained, moderately steep and steep soils and very steep Rock outcrop on uplands. The irregularly shaped areas range from 40 to 1,000 acres in size and are about 60 to 70 percent Grummit soil and 30 to 40 percent Rock outcrop. The Rock outcrop is on steeper side slopes along drainageways. The Grummit soil and Rock outcrop are so intermingled that it is not practical to separate them in mapping.

Typically, the Grummit soil has a surface layer of gray clay about 4 inches thick. The underlying material to a depth of 13 inches is gray, friable, shaly clay. Gray shale is at a depth of 13 inches. In places, the depth to shale is more than 13 inches.

The Grummit soil is low in fertility and content of organic matter. Available water capacity is very low, and permeability is moderate. This soil has high shrink-swell potential.

The Rock outcrop consists of large exposures of gray acid shale which has been weathered to large sand-size particles and is loose on the surface.

Most areas of this map unit are in rangeland. The Grummit soil has fair potential for rangeland and rangeland wildlife habitat. It has poor potential for cultivated crops, pasture, windbreaks and environmental plantings, recreational uses, building sites, and sanitary facilities.

This map unit is better suited to rangeland than to other uses. The natural plant cover is a mixture of mid and short grasses. Susceptibility of the soil to erosion is the main management concern. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by less productive grasses and weeds. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This map unit generally is not suited to cultivated crops, tame pasture, and windbreaks because of the very low available moisture capacity, severe hazard of erosion, and steep slopes. It is suited to wildlife habitat on selected sites; however, trees and shrubs need to be planted by hand and given special care.

This map unit generally is not suitable as a site for buildings, sanitary facilities, and local roads and streets because of shallow depth to bedrock, high shrink-swell potential, steep slopes, and Rock outcrop. The Grummit soil is in Capability unit VIIe-8 and Shallow range site. Rock outcrop is in Capability unit VIIIs-1. It is not placed in a range site.

GeD—Gypnevee-Rekop loams, 6 to 25 percent slopes. This map unit consists of deep and shallow, well drained and somewhat excessively drained, moderately sloping to moderately steep soils on uplands. The irregularly shaped areas range from 10 to 350 acres in size and are about 60 to 70 percent Gypnevee soil and 20 to 30 percent Rekop soil. The two soils are so intermingled that it is not practical to separate them in mapping.

Typically, the Gypnevee soil has a surface layer of reddish brown loam about 7 inches thick. The transitional layer is yellowish red, friable silt loam about 6 inches thick. The underlying material to a depth of about 60 inches is silt loam that is reddish yellow in the upper part and light red in the lower part. In places, the surface layer is darker than is typical of the Gypnevee soil.

Typically, the Rekop soil has a surface layer of reddish brown loam about 4 inches thick. The underlying material to a depth of 18 inches is loam that is light brown in the upper part and pink in the lower part. Pinkish white gypsum and alabaster bedrock are at a depth of 18 inches. In places, the bedrock and seams of gypsum are at a shallower depth than is typical for the Rekop soil.

Included with this unit in mapping are small areas of gypsum Rock outcrop on ridgetops. The Rock outcrop makes up about 10 percent of the map unit.

The Gypnevee soil is medium in fertility and low in content of organic matter. Available water capacity is high. The Rekop soil is low in fertility and content of organic matter. Available water capacity is very low. Permeability is moderate in both soils. Runoff is medium or rapid.

Most areas of this map unit are in rangeland. Gypnevee and Rekop soils have poor potential for crops, windbreaks and environmental plantings, and most building sites and sanitary facilities. They have fair potential for rangeland, rangeland wildlife habitat, and most recreational uses.

This map unit is better suited to rangeland than to other uses. The natural grass cover is a mixture of tall, mid, and short grasses. The main management concerns are inadequate moisture, steep slopes, and susceptibility of the soils to erosion. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This map unit generally is not suited to cultivated crops, tame pasture, and windbreaks. It is suited to rangeland and wildlife habitat on selected sites; however, trees and shrubs need to be planted by hand and given special care.

This map unit generally is not suitable for building sites and sanitary facilities because of slope, shallow depth to bedrock, low strength, and the content of soluble gypsum in the soils. If sanitary facilities are constructed, they need to be placed on the less sloping areas of Gypnevee soils.

Local roads and streets need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow areas. This map unit is in Capability unit VIe-3. Gypnevee soil is in Thin Upland range site, and Rekop soil is in Shallow range site.

Ha—Higgins silt loam. This deep, very poorly drained, nearly level soil is on alluvial fans and bottom lands. It is subject to common flooding for brief periods. The mapped areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is light gray silt loam about 3 inches thick. The underlying material to a depth of about 60 inches is white, very friable silt in the upper part and light gray silt in the lower part. In places, the water table is below a depth of 2 feet.

This soil is low in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is very slow or slow. A seasonal water table ranges from the surface to a depth of 2 feet.

Most areas of this soil are in rangeland. This soil has good potential for rangeland and windbreaks and environmental plantings. It has fair potential for wetland and rangeland wildlife habitat and poor potential for cultivated crops, recreational uses, building sites, and sanitary facilities.

This soil is well suited to rangeland. Wetness is the main management concern if this soil is used for grazing. The natural plant community is a mixture of tall, mid, and short grasses. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil.

This soil generally is unsuited to cultivated crops and recreational uses because of wetness.

This soil is not suitable for building sites, sanitary facilities, and local streets and roads because of flooding and the seasonal high water table. This map unit is in Capability unit Vw-1 and Subirrigated range site.

HBF—Hisega-Rock outcrop association, steep. This map unit consists of deep, well drained soils and Rock outcrop on mountain ridges and on the sides of mountain valleys in the Black Hills. Slopes commonly are 25 to 50 percent but range from 15 to 65 percent.

Individual areas of this map unit range from 40 to several thousand acres in size and are about 55 to 65 percent Hisega soil, 20 to 30 percent Rock outcrop, and 15 percent minor soils. Rock outcrop generally is on the tops and upper sides of ridges and points in areas that range from less than 1 acre to as much as 60 acres in size. The minor soils are in areas that range to 40 acres in size. The uses of this unit, however, are such that separate mapping of the larger areas of Rock outcrop and of the minor soils is not practical (fig. 5).

Typically, the Hisega soil has a surface layer of light olive brown loam about 4 inches thick that is covered with about 1 inch of forest litter. The subsoil, about 15 inches thick, is brown, very friable channery loam. The underlying material to a depth of 60 inches is brown, channery loam in the upper part and grayish brown, very flaggy loam in the lower part. In places, the subsoil is less than 9 inches thick and the depth to schist is less than 40 inches.

Rock outcrop consists of exposures of fractured schist and dikes of quartzite. The bedding planes of the schist commonly are at an angle of 45 to 60 degrees because of the uplift of the Black Hills.

Included with this unit in mapping are areas of Buska, Maitland, and Marshdale soils. Buska soil has more clay and a stronger structure in the subsoil than Hisega soil and typically is in the mid and lower parts of the landscape below Hisega soil. Maitland soil has more organic matter in the surface layer and is on the foot slopes in the lower part of the landscape. Marshdale soil is poorly drained and is along drainageways, in swales, and in narrow valleys. The included soils make up 10 to 20 percent of the map unit.

The Hisega soil is low in fertility and content of organic matter. Available water capacity and permeability are moderate. Runoff is rapid.

Most areas of this map unit are in ponderosa pine forest. Some of the minor soils in swales and in mountain valleys are in native grass or have been seeded to tame pasture and are used for hay or grazing. These

soils have good potential for timber production, woodland grazing, and woodland wildlife habitat. They have poor potential for cultivated crops, tame pasture, rangeland, recreational uses, building sites, and sanitary facilities.

This map unit is better suited to timber production, woodland grazing, and woodland wildlife habitat than to other uses. The natural plant community is dominantly ponderosa pine and an understory of shrubs and grasses. The hazard of erosion is very severe. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil losses and improves the moisture supply for forest plants. Some ponderosa pine is harvested by selective cutting on the less steep slopes, but use of wheeled equipment is restricted on steep slopes. The hazard of erosion is reduced by partial cutting. Selective cutting and thinning that opens the understory to sunlight reduces the competition for moisture and improves grass production. Opening the tree stand makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor and promotes the growth of mature trees that can be harvested at shorter intervals. Proper stocking rate helps maintain a desirable plant community that provides adequate grass and shrub browse for wildlife and reduces the hazard of erosion on these steep slopes.

This map unit has severe limitations for local roads and streets, building sites, sewage lagoons, and septic tank absorption fields because of steep slopes and Rock outcrop. Slippage occurs if the soils are disturbed. Buildings, sanitary facilities, and roads and streets need to be placed in the lower part of the landscape on minor soils where the slopes are not so steep. The Hisega soil is in Capability unit VIIe-9, and Rock outcrop is in Capability unit VIIIs-1. The map unit is not placed in a range site.

HcA—Hisle silt loam, 0 to 3 percent slopes. This moderately deep, well drained, nearly level soil is on high terraces and uplands. The mapped areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is gray silt loam about 2 inches thick. The subsoil, about 13 inches thick, is grayish brown, very firm clay. The underlying material to a depth of 36 inches is gray clay. Light gray shale is at a depth of 36 inches. In a small area, the surface layer is thicker and darker than is typical for the Hisle soil.

Included with this soil in mapping are small areas of Grummit, Kyle, Pierre, and Snomo soils and Slickspots. Grummit and Snomo soils are noncalcareous, are acid throughout, and are on higher parts of the landscape. Kyle and Pierre soils have less salt in the subsoil. Slickspots are in slightly depressed, barren areas that have a puddled or "slicked-over" surface. These included areas make up about 15 percent of the map unit.

This soil is low in fertility and content of organic matter. Available water capacity is low, and permeability is very slow. Runoff is slow. Shrink-swell potential is high.

Most of this soil is in rangeland. This soil has poor potential for rangeland and rangeland wildlife habitat, cultivated crops, windbreaks and environmental plantings, most recreational uses, building sites, and most sanitary facilities.

This soil is better suited to rangeland than to other uses. The main management concern is droughtiness because of the unfavorable rooting zone. The natural plant community is a mixture of mid and short grasses. Maintaining good grass cover and ground mulch helps improve the moisture supply for range plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve range condition.

This soil generally is not suited to cultivated crops, tame pasture, and windbreaks because of poor tilth, unfavorable rooting zone, very slow permeability, and low available moisture capacity. It is suited to wildlife habitat on selected sites; however, trees and shrubs need to be planted by hand and given special care.

This soil generally is not suitable as a site for buildings, septic tank absorption fields, and local roads and streets because of high shrink-swell potential and low strength. If sewage lagoons are installed, the underlying shale should not be disturbed. This map unit is in Capability unit VIs-3 and Thin Claypan range site.

HdA—Hisle-Slickspots complex, 0 to 3 percent slopes. This map unit consists of moderately deep, well drained, nearly level soils and Slickspots on high terraces and uplands. The irregularly shaped areas range from 10 to 300 acres in size and are about 60 to 70 percent Hisle soil and 15 to 25 percent Slickspots. Hisle soil is on slightly raised grassed-over areas. Slickspots are on slightly depressed barren areas. The Hisle soil and Slickspots are so intermingled that it is not practical to separate them in mapping.

Typically, the Hisle soil has a surface layer of gray silt loam about 2 inches thick. The subsoil, about 13 inches thick, is grayish brown, very firm clay. The underlying material to a depth of 36 inches is gray clay. Light gray shale is at a depth of 36 inches.

The Slickspots are on slightly depressed barren areas that have a puddled or "slicked-over" surface and commonly have spots and streaks of salt within a few inches of the surface.

Included with this unit in mapping are small areas of Grummit, Kyle, Pierre, and Snomo soils. Grummit and Snomo soils are noncalcareous, are acid throughout, and are on the higher part of the landscape. Kyle and Pierre soils have less salt in the subsoil than the Hisle-Slickspots complex. The included soils make up about 10 to 15 percent of the map unit.

The Hisle soil is low in fertility and content of organic matter. Available water capacity is low, and permeability is very slow. The soil has high shrink-swell potential. Runoff is slow on the Hisle soil, and Slickspots are ponded.

Most areas of this map unit are in rangeland. The soils in this unit have poor potential for rangeland and rangeland wildlife habitat, cultivated crops, windbreaks and environmental plantings, recreational uses, building sites, and most sanitary facilities.

This map unit is better suited to rangeland than to other uses. The main concern of management is droughtiness caused by an unfavorable rooting zone. The natural plant community is a mixture of mid and short grasses on the Hisle soils. Slickspots have a very sparse cover of cactus. Maintaining a good grass cover and ground mulch helps improve the moisture supply for range plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This map unit generally is not suited to cultivated crops, tame pasture, and windbreaks because of poor tilth, salts, unfavorable rooting zone, very slow permeability, and low available moisture capacity. It is suited to wildlife habitat on selected sites; however, trees and shrubs need to be planted by hand and given special care.

This map unit generally is not suitable as a site for buildings, septic tank absorption fields, and local roads and streets because of high shrink-swell potential and low strength. If sewage lagoons are installed, the underlying shale should not be disturbed. The Hisle soil is in Capability unit VIs-3 and Thin Claypan range site. Slickspots are in Capability unit VIIIs-3. They are not placed in a range site.

KaA—Kyle clay, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands and alluvial fans. The mapped areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is grayish brown clay about 5 inches thick. The subsoil, about 15 inches thick, is grayish brown, very firm clay. The underlying material to a depth of 60 inches is clay that is gray in the upper part and grayish brown in the lower part.

Included with this soil in mapping are small areas of Hisle, Nunn, and Pierre soils. Hisle soil has a claypan subsoil and is on the lower part of the landscape. Nunn soil has less clay and more sand than Kyle soil and is on the higher part of the landscape, generally above Kyle soil. Pierre soil is shallower to shale than Kyle soil and is on the higher part of the landscape, generally above Kyle soil. The included soils make up about 10 percent of the map unit.

The Kyle soil is medium in fertility and moderately low in content of organic matter. Available water capacity is low or moderate, and permeability is very slow. The soil is difficult to till because of the high content of clay. Shrink-swell potential is high. Runoff is slow.

Most areas of this soil are in rangeland. The soil has good potential for rangeland and rangeland wildlife habitat and fair potential for cultivated crops, windbreaks, and environmental plantings. It has poor potential for openland wildlife habitat, most recreational uses, and most building sites and sanitary facilities.

This soil is better suited to rangeland than to other uses. The natural grass cover is a mixture of mid and short grasses. Management that maintains an adequate plant cover and ground mulch helps improve soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is suited to windbreaks and other woody plantings. All climatically adapted trees and shrubs grow well on this soil. Summer fallowing before planting increases the chance of survival of seedlings. Cultivation after planting helps control grasses and weeds.

This soil is suited to small grain and grasses and legumes for hay. Conserving moisture and maintaining tilth are the main concerns of management if this soil is used for crops. Stubble mulching, crop residue management, stripcropping, minimum tillage, and field windbreaks help control soil blowing and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and soil tilth and reduce the susceptibility of the soil to blowing.

Seeding to tame pasture is an alternative use of this soil. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

Proper design of building foundations and footings helps prevent structural damage caused by the high shrink-swell and low strength of this soil. Adequate drainage around building sites helps to overcome high shrink-swell potential. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent.

Roads need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. This map unit is in Capability unit IVs-3 and Clayey range site.

KaB—Kyle clay, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands and alluvial fans. The mapped areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is grayish brown clay about 5 inches thick. The subsoil, about 15 inches thick, is

grayish brown, very firm clay. The underlying material to a depth of 60 inches is clay that is gray in the upper part and grayish brown in the lower part.

Included with this soil in mapping are small areas of Hisle, Nunn, and Pierre soils. Hisle soil has a claypan subsoil and is on the lower part of the landscape. Nunn soil has less clay and more sand than Kyle soil and is on the higher part of the landscape, generally above Kyle soil. Pierre soil is shallow to shale.

This soil is medium in fertility and moderately low in content of organic matter. Available water capacity is low or moderate, and permeability is very slow. The Kyle soil is difficult to till because of the high content of clay. Shrink-swell potential is high. Runoff is medium.

Most areas of this soil are in rangeland. The soil has good potential for rangeland and rangeland wildlife habitat and fair potential for cultivated crops and windbreaks and environmental plantings. It has poor potential for openland wildlife habitat, for most recreational uses, and for most building sites and sanitary facilities.

This soil is better suited to rangeland than to other uses. The natural grass cover is a mixture of mid and short grasses. Management that maintains an adequate plant cover and ground mulch helps prevent erosion and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Summer fallowing before planting increases the chance of survival of seedlings. Cultivation after planting helps control grasses and weeds.

This soil is suited to small grain and grasses and legumes for hay. Conserving moisture, controlling erosion, and maintaining tilth are the main management concerns if this soil is used for cultivated crops. Stubble mulching, crop residue management, stripcropping, minimum tillage, and field windbreaks help control soil blowing and erosion and conserve moisture. Terraces are effective in controlling erosion on the more sloping areas. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and reduce susceptibility of the soil to blowing and erosion.

Seeding this soil to tame pasture is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

Proper design of building foundations and footings helps prevent structural damage caused by high shrink-swell potential and the low strength of this soil. Adequate drainage around building sites helps to overcome the high shrink-swell.

Roads need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent. This map unit is in Capability unit IVe-3 and Clayey range site.

LaE—Lakoa silt loam, 25 to 50 percent slopes. This deep, well drained, steep and very steep soil is on uplands. The mapped areas are irregular in shape and range from 15 to 700 acres in size.

Typically, the Lakoa soil has a surface layer of light brownish gray silt loam about 3 inches thick that is covered by 2 inches of forest litter. The transitional layer is yellowish brown, friable loam about 3 inches thick. The subsoil extends to a depth of about 30 inches and is brown, firm clay loam in the upper part; yellowish brown and reddish yellow, firm clay loam in the middle part; and brown and very pale brown, friable sandy clay loam in the lower part. The underlying material to a depth of 42 inches is brown and very pale brown sandy loam. Very pale brown sandstone is at a depth of 42 inches. In places, this soil has a thicker, darker surface layer than is typical of the Lakoa soil.

Included with this unit in mapping are small areas of Boneek and Butche soils. Boneek soil has a thicker, darker surface layer than Lakoa soil and is on lower untimbered side slopes. Butche soil is less than 20 inches deep to bedrock and is on ridges and side slopes. Both soils generally are below Lakoa soil.

The Lakoa soil is low in fertility and content of organic matter. Available water capacity and permeability are moderate. Runoff is rapid.

Most areas of this map unit are in native woodland. This soil has good potential for woodland grazing and woodland wildlife habitat. It has poor potential for cultivated crops, windbreaks, recreational uses, building sites, and sanitary facilities.

This map unit is better suited to woodland grazing and woodland wildlife habitat than to other uses. The natural plant community is dominantly ponderosa pine and mixed hardwoods and an understory of shrubs and grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil losses and improves the moisture supply for forest plants. A limited number of ponderosa pine can be harvested by selective cutting on the less steep slopes, but use of wheeled equipment is restricted because of the slope. Selective cutting and thinning reduces the competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals. This practice also promotes the growth of understory plants, which can be grazed by livestock and woodland wildlife. Proper grazing use of the understory by livestock helps maintain a desirable plant community that provides browse for woodland wildlife.

This soil generally is not suited to crops and windbreaks because of steep slopes and the severe hazard of erosion. Scalp planting may be practiced to establish climatically adapted trees and shrubs, but optimum survival, growth, and vigor should not be expected.

This soil generally is not suitable for building sites or for sanitary facilities because of steep and very steep slopes. This map unit is in Capability unit VIIe-3. It is not placed in a range site.

MaC—Maitland loam, 2 to 9 percent slopes. This deep, well drained, gently sloping and moderately sloping soil is on mountain uplands. The mapped areas are long and narrow in shape and range from 30 to 150 acres in size.

Typically, the surface layer is gray loam about 7 inches thick. The subsurface layer is light brownish gray, very friable very fine sandy loam about 4 inches thick. The transitional layer, about 5 inches thick, is brown and light brownish gray, friable loam. The subsoil extends to a depth of about 44 inches and is light brown, friable clay loam in the upper part; light yellowish brown clay loam in the middle part; and light yellowish brown loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown fine sandy loam in the upper part and pale brown and light yellowish brown loam in the lower part.

Included with this soil in mapping are small areas of Marshdale soil, generally less than 10 acres in size. Marshdale soil is darker to a greater depth and is wetter than Maitland soil. The included soil makes up about 10 percent of the map unit.

This Maitland soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is medium.

Most areas of this soil are in grassland. The soil has good potential for pasture and woodland wildlife habitat; fair potential for crops, recreational uses, building sites, and sanitary facilities; and poor potential for cultivated crops, openland wildlife habitat, and rangeland wildlife habitat.

This soil is suited to tame pasture and hay after timber has been harvested. The main concern in tame pasture management is excessive soil loss by erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition and is effective in controlling erosion. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff.

This soil is suited to timber production. Controlled harvesting of ponderosa pine by selective cutting and thinning reduces the competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals.

The less sloping areas of this soil are suitable for camp sites, paths and trails, and picnic areas. Slope limits use for playgrounds. Camp sites should not be placed on the included Marshdale soil along drainageways because of possible flooding.

This soil generally is unsuited to most cultivated crops because of the short growing season.

If buildings are constructed on this soil, proper design of foundations and footings and diverting runoff water away from the buildings help prevent structural damage caused by shrinking and swelling of the soil. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent. Ground water may be contaminated if absorption fields are placed near the Marshdale soil.

If this soil is used for local roads and streets, roads need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow and cut areas. This map unit is in Capability unit IVe-1. It is not placed in a range site.

MaD—Maitland loam, 9 to 50 percent slopes. This deep, well drained, strongly sloping to very steep soil is on uplands. The mapped areas are irregular in shape and range from 30 to 800 acres in size.

Typically, the surface layer is gray loam about 7 inches thick. The subsurface layer is light brownish gray, very friable very fine sandy loam about 4 inches thick. The transitional layer, about 5 inches thick, is brown and light brownish gray, friable loam. The subsoil extends to a depth of 44 inches and is light brown, friable clay loam in the upper part; light yellowish brown clay loam in the middle part; and light yellowish brown loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown fine sandy loam in the upper part and pale brown and light yellowish brown loam in the lower part. In places, this soil has a thinner and lighter colored surface layer than is typical for the Maitland soil.

Included with this soil in mapping are small areas of Boneek and Butche soils. Boneek soil has more clay in the subsoil than Maitland soil and generally is above Maitland soil. Butche soil is shallow to bedrock and is above Maitland soil. The included soils make up 15 percent of the unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is medium or rapid.

Most areas of this soil are in grazable woodland. The soil has good potential for woodland grazing and woodland wildlife habitat. It has poor potential for cultivated crops, rangeland, windbreaks, recreational uses, most building sites, and sanitary facilities.

This soil is better suited to woodland grazing for livestock and woodland wildlife habitat than to other uses. The natural plant community is mainly bur oak and pon-

derosa pine and an understory of tall and mid grasses. The main concern in grazable woodland management is erosion. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. Selective cutting and thinning of trees reduces competition for sunlight and moisture and promotes the growth of understory plants for grazing by livestock and woodland wildlife. If the woodland is overgrazed, more desirable taller grasses lose vigor and are replaced by less productive grasses and weeds. Proper grazing use and deferred grazing help maintain or improve woodland grazing condition.

This soil generally is not suited to cultivated crops and windbreaks because of steep slopes and the hazard of erosion. Suitable trees and shrubs for wildlife habitat, however, can be planted on selected sites by scalping or other special methods.

Campgrounds and picnic areas need to be placed on the less sloping areas of this soil.

If buildings are constructed on this soil, the less sloping areas should be selected. Proper design of foundations and footings helps prevent structural damage caused by low strength of the soil and shrink-swell. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent. Absorption fields need to be placed on the less sloping areas. This soil generally is too steep for constructing sewage lagoons.

Local roads and streets need to be built in the less steep areas of this soil, and base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow and cut areas. This map unit is in Capability unit VIe-13. It is not placed in a range site.

MBE—Marshdale-Maitland association, sloping. This map unit consists of deep, poorly drained and well drained soils on bottom lands, terraces, and mountain uplands. Slopes commonly are 2 to 9 percent.

The individual areas of this map unit are long and narrow and range from 30 to 300 acres in size. This unit is about 60 percent Marshdale soil and 40 percent Maitland soil. Marshdale soil is in the lower part of the landscape along drainageways and is subject to common flooding for brief periods. Maitland soil is in the upper part of the landscape. The Maitland soil is in areas that are large enough to map separately; however, the uses of this unit are such that separate mapping is not practical.

Typically, the Marshdale soil has a surface layer of dark gray loam about 10 inches thick. The subsurface layer is very dark gray, very friable loam about 15 inches thick. The subsoil to a depth of 60 inches is gray, firm clay loam.

Typically, the Maitland soil has a surface layer of gray loam about 7 inches thick. The subsurface layer is light brownish gray very fine sandy loam about 4 inches thick. The transitional layer, about 5 inches thick, is brown and light brownish gray, friable loam. The subsoil extends to a depth of about 28 inches and is light brown, friable clay loam in the upper part; light yellowish brown, friable clay loam in the middle part; and light yellowish brown, friable loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown fine sandy loam in the upper part and pale brown and light yellowish brown loam in the lower part.

The Marshdale soil is high in fertility and content of organic matter. The Maitland soil is medium in fertility and moderate in content of organic matter. Available water capacity is high for both soils. Permeability is moderately slow in the Marshdale soil and moderate in the Maitland soil. Runoff is medium. A seasonal water table ranges from the surface to a depth of 2 feet in the Marshdale soil.

Most areas of this map unit are in grassland. The soils have fair potential for most recreational uses and poor potential for most building sites and sanitary facilities. The Marshdale soil has poor potential and the Maitland soil has good potential for woodland wildlife habitat.

This map unit is better suited to tame pasture and tame hay than to other uses. The main concerns in tame pasture management are erosion on the Maitland soil and flooding on the Marshdale soil. Proper stocking rate, rotation grazing, application of fertilizers, and control of weeds help to keep the pasture in good condition and are effective in controlling erosion. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture on the Maitland soil by reducing runoff.

The Maitland soil is suited to timber production. Controlled timber harvest of ponderosa pine by selective cutting and thinning reduces the competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals.

This map unit is suited to such recreational uses as playgrounds, camp sites, paths and trails, and picnic areas; these facilities, however, need to be placed on the Maitland soil. The hazard of flooding limits the Marshdale soil for recreational use.

This map unit generally is unsuited to most cultivated crops because of the short growing season and common flooding on the Marshdale soil.

Building sites, sanitary facilities, and local roads and streets need to be placed on the Maitland soil. If buildings are constructed on this map unit, foundations and footings need to be designed to prevent structural damage caused by the low strength and shrinking and swelling of the soil. Septic tank absorption fields need to be placed on selected sites to avoid contamination of shallow ground water in the Marshdale soil. If this soil is used for septic tank absorption fields, enlarging the ab-

sorption area helps to overcome the limitation of slow movement of effluent.

Local roads and streets need to be placed on the upper part of the landscape, and the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow and cut areas. These soils generally are not suited to sewage lagoons because of seasonal flooding and possible contamination of ground water.

This Marshdale soil is in Capability unit IVw-1 and Subirrigated range site. This Maitland soil is in Capability unit IVe-1. It has not been placed in a range site.

McD—Midway-Razor silty clay loams, 6 to 25 percent slopes. This map unit consists of shallow and moderately deep, well drained, moderately sloping to moderately steep soils on uplands. The irregularly shaped areas range from 10 to 100 acres in size. They are about 55 to 65 percent Midway soil and 20 to 30 percent Razor soil. Midway soil generally is in the upper part of the landscape, and Razor soil is in the lower part of the landscape.

Typically, the Midway soil has a surface layer of very dark grayish brown silty clay loam about 2 inches thick. The transitional layer is grayish brown, very firm silty clay about 4 inches thick. The underlying material to a depth of about 16 inches is silty clay that is pale yellow and grayish brown in the upper part and pale yellow and light olive gray in the lower part. Pale yellow and light olive gray shale is at a depth of 16 inches.

Typically, the Razor soil has a surface layer of dark gray silty clay loam about 3 inches thick. The subsoil, about 13 inches thick, is friable silty clay loam that is gray in the upper part and grayish brown in the lower part. The underlying material to a depth of 34 inches is silty clay loam that is light gray in the upper part and light brownish gray in the lower part. Light brownish gray, platy shale is at a depth of 34 inches.

Included with this unit in mapping are small areas of Bridget, Canyon, and Savo soils. The deep Bridget soil has less clay than Midway and Razor soils and is on less steep slopes. Canyon soil has less clay and more sand than Midway and Razor soils. Both soils generally are above Midway and Razor soils. Savo soil does not have bedrock within a depth of 60 inches and is on side slopes below Midway and Razor soils. The included soils make up about 15 percent of the map unit.

The Midway and Razor soils are low in fertility and content of organic matter. Available water capacity is very low in the Midway soil and low in the Razor soil. Permeability is slow in both soils. These soils shrink and swell upon drying and wetting. Runoff is medium or rapid.

Most areas of this map unit are in rangeland. Midway soil has fair potential and Razor soil has good potential for rangeland and rangeland wildlife habitat. Both soils have fair potential for recreational uses. They have poor potential for cultivated crops, windbreaks and environmental plantings, openland wildlife habitat, sanitary facilities, building sites, and local roads and streets.

This map unit is better suited to rangeland than to other uses. The natural grass cover is a mixture of mid and short grasses. The main concern of management is erosion. Management that maintains adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This map unit generally is not suited to cultivated crops, tame pasture, and windbreaks because of low or very low available moisture and steep slopes. It is suited to wildlife habitat on selected sites; however, trees and shrubs need to be planted by hand and given special care.

This map unit generally is not suitable for building sites, sanitary facilities, and local roads and streets because of steep slopes, high shrink-swell potential, low strength, slow permeability, and bedrock at a moderate or shallow depth. If buildings are constructed on this unit, proper design of foundations and footings helps prevent structural damage caused by high shrink-swell potential and low strength of the soil. Sewage lagoons need to be placed on the lower slopes and the sides and bottom of the lagoon sealed to help prevent seepage.

Local roads and streets need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow areas. This map unit is in Capability unit VIe-12. Midway soil is in Shallow Clay range site, and Razor soil is in Clayey range site.

NaB—Nevee silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces and uplands. The mapped areas are irregular in shape and range from 10 to 160 acres in size.

Typically, the surface layer is reddish brown silt loam about 6 inches thick. The underlying material to a depth of 60 inches is very friable silt loam that is reddish yellow in the upper part, yellowish red in the middle part, and red in the lower part. In places, lime is leached more than 10 inches deep.

Included with this soil in mapping are small areas of Spearfish, Tilford, and Vale soils. The Spearfish soil has shale or siltstone at a depth of 10 to 20 inches and is on the upper part of the landscape. Tilford and Vale soils have a thicker dark surface layer than Nevee soil and have more clay than Nevee soil. They are on the lower part of the landscape. The included soils make up about 15 percent of the map unit.

This soil is low in fertility and content of organic matter and is easily tilled through a wide range in moisture

content. Available water capacity is high, and permeability is moderate. Runoff is medium.

Most areas of this soil are farmed or in rangeland. This soil has fair potential for dryland and irrigated crops, rangeland, windbreaks and environmental plantings, rangeland wildlife habitat, recreational uses, most sanitary facilities, building sites, and local roads and streets. It has poor potential for openland wildlife habitat.

This soil is suited to corn, small grain, and grasses and legumes for hay. Controlling erosion and soil blowing and conserving moisture are the main concerns of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, stripcropping, minimum tillage, terracing, and contour cultivation help control erosion and soil blowing and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure helps improve fertility and reduce susceptibility of the soil to blowing and erosion (fig. 6).

Seeding this soil to tame pasture is effective in controlling erosion and soil blowing. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of mid and short grasses. Maintaining a good grass cover and ground mulch helps prevent excessive soil losses and improves the moisture supply for range plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

Proper selection of climatically adapted trees and shrubs is needed to establish windbreaks and environmental plantings successfully; optimum survival, growth, and vigor, however, should not be expected.

Dustiness is a concern if this soil is used for recreational purposes.

Proper design of building foundations and footings helps prevent structural damage caused by the low strength of this soil. If the soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitations of slow movement of effluent and moderate depth to bedrock. Sealing the bottom and sides of sewage lagoons helps reduce seepage.

If this soil is used for local roads and streets, the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow areas. This map unit is in Capability unit IVe-2 and Thin Upland range site.

NaC—Nevee silt loam, 6 to 9 percent slopes. This deep, well drained moderately sloping soil is on terraces and uplands. The mapped areas are irregular in shape and range from 10 to 160 acres in size.

Typically, the surface layer is reddish brown silt loam about 6 inches thick. The underlying material to a depth of 60 inches is very friable silt loam that is reddish yellow in the upper part, yellowish red in the middle part, and red in the lower part. In places, lime is leached to more than 10 inches deep.

Included with this soil in mapping are small areas of Spearfish, Tilford, and Vale soils. Spearfish soil has shale or siltstone at a depth of 10 to 20 inches and is in the upper part of the landscape. Tilford and Vale soils have a thicker dark surface layer than Nevee soil and have more clay than Nevee soil. They are on the lower part of the landscape. The included soils make up about 15 percent of the map unit.

This soil is low in fertility and content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is medium.

Most areas of this soil are in rangeland. This soil has fair potential for rangeland, rangeland wildlife habitat, most recreational uses, most sanitary facilities, building sites, and local roads and streets. The soil has poor potential for cultivated crops, openland wildlife habitat, and windbreaks and environmental plantings.

This soil is suited to corn, small grain, and grasses and legumes for hay. Controlling erosion and soil blowing, conserving moisture, and maintaining or improving content of organic matter are the main concerns of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, stripcropping, minimum tillage, terracing, and contour cultivation help conserve moisture and control erosion and soil blowing. Grassed waterways are effective in controlling erosion along drainageways. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility, increase content of organic matter, and reduce susceptibility of the soil to blowing and erosion. Very careful water management is needed when this soil is irrigated because of the moderate slopes.

Seeding this soil to tame pasture is effective in controlling erosion and soil blowing. Proper stocking rates, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This unit is better suited to rangeland than to other uses. The natural grass cover is a mixture of mid and short grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

Plantings can be established if climatically adapted trees and shrubs are selected, but optimum survival, growth, and vigor should not be expected. Scalp planting helps reduce the severe hazard of erosion.

Dustiness is a concern if this soil is used for recreational purposes.

Proper design of building foundations and footings helps prevent structural damage caused by the low strength of this soil. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitations of slow movement of effluent and moderate depth to bedrock. Sewage lagoons need to be placed on lower slopes and the bottom and sides sealed to reduce seepage.

Strengthening the base material helps overcome the low strength of this soil for supporting vehicular traffic. Control of roadside erosion is needed in borrow areas. This map unit is in Capability unit IVe-3 and Thin Upland range site.

NbD—Nevee-Spearfish-Rock outcrop complex, 9 to 40 percent slopes. This map unit consists of deep and shallow, well drained and well drained to excessively drained, strongly sloping to steep soils and Rock outcrop on uplands. The irregularly shaped areas range from 20 to 250 acres in size and are about 35 percent Nevee soil, about 30 percent Spearfish soil, and about 20 percent Rock outcrop.

The Nevee soil is in the lower part of the landscape, the Spearfish soil is in the middle and upper parts of the landscape, and the Rock outcrop is on the tops and upper sides of ridges and on side slopes of deep gullies.

Typically, the Nevee soil has a surface layer of reddish brown silt loam about 6 inches thick. The underlying material to a depth of 60 inches is very friable silt loam that is reddish yellow in the upper part, yellowish red in the middle part, and red in the lower part. In places, lime is leached more than 10 inches deep.

Typically, the Spearfish soil has a surface layer of reddish brown silt loam about 2 inches thick. The transitional layer is reddish brown, very friable silt loam about 5 inches thick. The underlying material to a depth of about 12 inches is red, very friable silt loam. Red silty shale is at a depth of 12 inches.

Rock outcrop consists of massive exposures of red, silty fractured shale.

Included with this unit in mapping are small areas of Gypnevee and Nihill soils. The Gypnevee soil has more gypsum than Nevee and Spearfish soils. Nihill soil is underlain with sand and gravel and is on the upper part of the landscape above the Spearfish soil. The included soils make up about 15 percent of the map unit.

The Nevee and Spearfish soils are low in fertility and content of organic matter. Available water capacity is high in the Nevee soil and very low in the Spearfish soil. Permeability is moderate in both soils. Runoff is medium or rapid.

Most areas of this map unit are in rangeland. Nevee and Spearfish soils have fair potential for rangeland and rangeland wildlife habitat and poor potential for cultivated crops and windbreaks and environmental plantings. Nevee soil has fair potential for recreational uses, sanitary facilities, building sites, and local roads and streets; Spearfish soil has poor potential for recreational uses, sanitary facilities, building sites, and local roads and streets.

This map unit is better suited to rangeland than to other uses. The natural grass cover is a mixture of tall, mid, and short grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

If climatically adapted trees and shrubs are selected, scalp or specialized plantings can be established for wildlife habitat and for recreational or beautification purposes. Optimum survival, growth, and vigor, however, should not be expected.

Buildings sites and sanitary facilities need to be placed on the lower part of the slope in this map unit. If buildings are constructed, proper design of foundations and footings helps prevent structural damage caused by low strength of these soils. Septic tank absorption fields should be placed on the Nevee soil. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent.

Local roads and streets need to be graded to shed water, and base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow areas. Nevee and Spearfish soils are in Capability unit VIe-3; Nevee soil is in Thin Upland range site, and Spearfish soil is in Shallow range site. Rock outcrop is in Capability unit VIIIs-1. It is not placed in a range site.

NcD—Nihill gravelly loam, 6 to 25 percent slopes. This deep, excessively drained, moderately sloping to moderately steep soil is on upland terraces. The mapped areas are irregular in shape and typically are less than 25 acres in size but range from 5 to 80 acres.

Typically, the surface layer is brown, gravelly loam about 8 inches thick. The underlying material to a depth of 60 inches is very gravelly sandy loam that is light gray in the upper part and very pale brown in the lower part. In places, the soil is redder than is typical for the Nihill soil.

Included with this soil in mapping are small areas of Alice, Satanta, and Spearfish soils. Alice, Satanta, and the shallow Spearfish soils have less gravel than Nihill soil. Alice and Satanta soils are in the upper part of the landscape, generally above Nihill soil. Spearfish soil generally is below Nihill soil. The included soils make up about 15 percent of the map unit.

This soil is low in fertility and content of organic matter. Available water capacity is low, and permeability is moderately rapid. Runoff is medium to rapid.

Most areas of this soil are in rangeland. This soil has fair potential for rangeland and rangeland wildlife habitat, most recreational uses, and local roads and streets. It has poor potential for cultivated crops, openland wildlife habitat, windbreaks and environmental plantings, and most sanitary facilities.

This soil is better suited to rangeland than to other uses. The natural plant community is a mixture of mid and short grasses. Maintaining a good grass cover and ground mulch helps prevent excessive soil loss and improves the moisture supply for range plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

Buildings and sanitary facilities need to be placed on the lower slopes of this unit. Sanitary facilities are a potential source of pollution to shallow ground water. Sealing the bottom and sides of sewage lagoons controls seepage.

Local roads and streets need to be graded to shed water and reduce potential frost action. Control of roadside erosion is needed in borrow areas. This map unit is in Capability unit VIe-3 and Thin Upland range site.

NdA—Nunn clay loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on upland terraces. The mapped areas are irregular in shape and range from 20 to 100 acres in size.

Typically, the surface layer is grayish brown clay loam about 5 inches thick. The subsoil, about 20 inches thick, is dark grayish brown, firm clay loam in the upper part and grayish brown, calcareous clay loam in the lower part. The underlying material to a depth of 60 inches is grayish brown clay loam.

Included with this soil in mapping are small areas of Kyle and Pierre soils. Kyle and Pierre soils have more clay than Nunn soil and Pierre soil has shale at a depth between 20 and 40 inches. These soils are on the lower parts of the landscape, generally below Nunn soils. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderately slow. This soil has high shrink-swell potential in the subsoil. Runoff is slow.

Most areas of this soil are used for cultivated crops. The soil has good potential for crops, rangeland, windbreaks and environmental plantings, rangeland and openland wildlife habitat, recreational uses, and most sanitary facilities. It has poor potential for most building sites and local roads and streets.

This soil is well suited to small grain and grasses and legumes for hay. Conserving moisture is the main concern of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, grassed waterways, stripcropping, minimum tillage, and field windbreaks help conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and maintain an adequate content of organic matter.

Seeding this soil to tame pasture is an alternative use of this soil. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of mid and short grasses. Maintaining a good grass cover and ground mulch improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland conditions.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well on this soil. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

Proper design of building foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent.

Roads need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. This map unit is in Capability unit IIIc-1 and Clayey range site.

NdB—Nunn clay loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on upland terraces. The mapped areas are irregular in shape and range from 30 to 100 acres in size.

Typically, the surface layer is grayish brown clay loam about 5 inches thick. The subsoil, about 20 inches thick, is dark grayish brown, firm clay loam in the upper part and grayish brown, calcareous clay loam in the lower part. The underlying material to a depth of 60 inches is grayish brown clay loam.

Included with this soil in mapping are small areas of Kyle and Pierre soils. Kyle and Pierre soils have more clay than Nunn soils, and Pierre soil has shale at a depth between 20 and 40 inches. They are on the lower part of the landscape, generally below Nunn soil. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderately slow. This soil has high shrink-swell potential in the subsoil. Runoff is medium.

Most areas of this soil are used for cultivated crops. The soil has good potential for crops, rangeland, windbreaks and environmental plantings, rangeland and openland wildlife habitat, recreational uses, and most sanitary facilities. It has poor potential for most building sites and local roads and streets.

This soil is well suited to small grain and grasses and legumes for hay. Controlling erosion and conserving moisture are the main concerns of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, contouring, terracing, minimum tillage, grassed waterways, and field windbreaks help control erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and maintain an adequate content of organic matter.

Seeding this soil to tame pasture is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of mid and short grasses. Maintaining a good grass cover and ground cover mulch helps improve the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well on this soil. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

Proper design of building foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent.

Roads need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. This map unit is in Capability unit IIIe-1 and Clayey range site.

NdC—Nunn clay loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on upland terraces. The mapped areas are irregular in shape and range from 10 to 60 acres in size.

Typically, the surface layer is grayish brown clay loam about 5 inches thick. The subsoil, about 20 inches thick, is dark grayish brown, firm clay loam in the upper part and grayish brown, calcareous clay loam in the lower part. The underlying material to a depth of 60 inches is grayish brown clay loam.

Included in this soil in mapping are small areas of Pierre and Savo soils. Pierre soil has more clay than Nunn soil and has shale at a depth between 20 and 40 inches. Savo soil has less sand than Nunn soil. Pierre and Savo soils are on the lower part of the landscape, generally below Nunn soil. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderately slow. This soil has high shrink-swell potential in the subsoil. Runoff is medium.

Most areas of this soil are used for cultivated crops. This soil has good potential for rangeland, windbreaks and environmental plantings, rangeland wildlife habitat, and recreational use. It has fair potential for cultivated crops, openland wildlife habitat, and sanitary facilities.

This soil is well suited to small grain and grasses and legumes for hay. Controlling erosion and conserving moisture are the main concerns of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, contour farming, terracing, minimum tillage, grassed waterways, and field windbreaks help control erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and maintain an adequate content of organic matter.

Seeding this soil to tame pasture is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of mid and short grasses. Maintaining a good grass cover and ground mulch helps improve the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well on this soil. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

Proper design of building foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent.

Strengthening the base material helps overcome the low strength of this soil for supporting vehicular traffic. Control of roadside erosion is needed in areas where cuts are made. This map unit is in Capability unit IVe-1 and Clayey range site.

PAE—Pactola-Rock outcrop association, hilly. This map unit consists of deep, well drained soils and Rock outcrop in the Black Hills. It is on smooth upland divides and sides of mountain valleys and drainageways. Slopes generally are long and smooth and range from 6 to 30 percent.

Individual areas of this map unit range from 200 to several thousand acres in size and are about 65 percent Pactola soil, 20 percent Rock outcrop, and 15 percent minor soils. Rock outcrop is in areas that range from less than 1 acre to as much as 30 acres in size. It is

throughout the unit but is mainly on tops of ridges and points. The minor soils are in areas that range to 40 acres in size. The uses of this unit are such that separate mapping of the larger areas of Rock outcrop and of the minor soils is not practical.

Typically, the Pactola soil has a surface layer of dark gray loam about 2 inches thick that is covered by about 1 inch of forest litter. A transitional layer is light gray, friable, channery silt loam about 7 inches thick. The subsoil, about 36 inches thick, is grayish brown, friable, channery clay loam in the upper part and very flaggy clay loam in the lower part. The underlying material to a depth of 60 inches is olive brown, very flaggy silt loam.

Rock outcrop consists of exposures of pale brown, hard, fractured metamorphic rock in the form of massive boulders and dikes. Some of these dikes are as much as a mile or more long, but they are so narrow that it is not practical to separate them from the rest of the map unit.

Included with this unit in mapping are areas of Buska, Grizzly, Maitland, and Marshdale soils. Buska soil has more mica than Pactola soil and formed from schist. It is on the smoother part of the landscape. Grizzly soil has less mica than Pactola soil and formed in igneous material. It is on some steeper side slopes and ridges above Pactola soil. Maitland soil has more organic matter in the surface layer than Pactola soil and is on low side slopes below Pactola soil. Marshdale soil is poorly drained and is along drainageways.

The Pactola soil is low in fertility and content of organic matter. Available water capacity and permeability are moderate. Runoff is medium or rapid.

Most areas of this map unit are in ponderosa pine forest. Some minor soils in the mountain valleys along major drainageways are in native grass or have been seeded to tame pasture plants and are used for hay or livestock grazing. The soils in this unit have good potential for timber production, woodland grazing, and woodland wildlife habitat. They have fair potential for tame pasture and poor potential for cultivated crops, rangeland, recreational uses, most building sites, sanitary facilities, and local roads and streets.

This map unit is better suited to timber production and woodland grazing than to other uses. The vegetation is dominantly ponderosa pine and an understory of common juniper, shrubs, and grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves the moisture supply for forest plants. Selective cutting and thinning reduces competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals. Selective cutting also promotes the growth of understory plants for grazing by livestock and woodland wildlife. The use of wheeled equipment to harvest timber is difficult in some places because of slopes and rock.

Seeding cleared areas of this map unit to suitable tame pasture plants is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition after it is established.

Buildings and sanitary facilities need to be placed in the lower part of the landscape where slopes are not so steep and Rock outcrop and stones are less common. If buildings are constructed on the Pactola soil, proper design of foundations and footings helps prevent structural damage caused by shrinking and swelling and low strength of the soil. Sanitary facilities have the potential to pollute shallow ground water. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent. Sealing the bottom and sides of sewage lagoons helps reduce seepage.

Local roads and streets need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow and cut areas. The Pactola soil is in Capability unit VIe-13, and Rock outcrop is in Capability unit VIIIs-1. The map unit is not placed in a range site.

PbE—Paunsaugunt-Rock outcrop complex, 6 to 50 percent slopes. This shallow, well drained or somewhat excessively drained, moderately sloping to very steep soil and Rock outcrop are on uplands. The mapped areas are irregular in shape and range from 10 to 300 acres in size. They are about 45 to 55 percent Paunsaugunt soil and 35 to 45 percent Rock outcrop. Paunsaugunt soil and Rock outcrop are intermingled throughout the map unit.

Typically, the Paunsaugunt soil has a surface layer of dark grayish brown, gravelly silt loam about 5 inches thick. The subsurface layer is dark grayish brown, very friable, channery loam about 5 inches thick. The underlying material to a depth of 17 inches is pink, very friable, channery loam. Light brownish gray limestone is at a depth of 17 inches.

Rock outcrop consists of exposures of light brownish gray, fractured limestone.

Included with this unit in mapping are small areas of Tilford and Vale soils. These soils have fewer coarse fragments than Paunsaugunt soil and are over 40 inches deep to bedrock. They are on the lower part of the landscape. The included soils make up about 10 percent of the map unit.

The Paunsaugunt soil is medium in fertility and moderate in content of organic matter. Available water capacity is very low, and permeability is moderately rapid above the limestone. Runoff is medium or rapid.

Most areas of this map unit are in rangeland. The soil in this unit has fair potential for rangeland and poor potential for cultivated crops, windbreaks and environmental plantings, recreational uses, rangeland, wildlife

habitat, building sites, sanitary facilities, and local roads and streets.

The map unit is better suited to rangeland than to other uses. The natural cover is a mixture of short grasses, sedges, and ponderosa pine. Management that maintains an adequate plant cover and ground mulch helps prevent erosion and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable grasses lose vigor and are replaced by less productive plants. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

Harvest of ponderosa pine is limited because of the sparse stand.

This map unit generally is not suited to cultivated crops, tame pasture, windbreaks, and recreational uses because of the very low available moisture, steep slopes, and shallow depth to bedrock.

This map unit generally is not suitable for buildings, local roads and streets, and sanitary facilities because of steep slopes, stoniness, and shallow depth to bedrock. The Paunsaugunt soil is in Capability unit VIIs-1 and Shallow range site. Rock outcrop is in Capability unit VIIIs-1. It is not placed in a range site.

PcB—Pierre clay, 2 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. The mapped areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is gray clay about 3 inches thick. The subsoil, about 17 inches thick, is grayish brown, firm clay in the upper part and gray, calcareous clay in the lower part. The underlying material to a depth of 29 inches is gray clay. Light brownish gray shale bedrock is at a depth of 29 to 60 inches. In places, cobbles as much as 10 inches in diameter cover 20 percent of the surface.

Included with this soil in mapping are small areas of Grummit, Hisle, Kyle, Nunn, and Stetter Variant soils. Grummit soil is more acid than Pierre soil and is on the upper part of the landscape. Hisle soil has a claypan subsoil. Kyle and Stetter Variant soils are deeper to shale than Pierre soil and are on the lower part of the landscape. The Stetter Variant soil is along streams. The included soils make up about 10 percent of the map unit.

This soil is medium in fertility and moderately low in content of organic matter. Available water capacity is very low or low, and permeability is very slow. This soil is difficult to till because of the narrow range of moisture content in which the soil is workable. Shrink-swell potential is high. Runoff is medium.

Most areas of this soil are in rangeland. The soil has good potential for rangeland and rangeland wildlife habitat; fair potential for cultivated crops and windbreaks and environmental plantings; and poor potential for recreational uses, openland wildlife habitat, building sites, local roads and streets, and most sanitary facilities.

This soil is better suited to rangeland than to other uses. The natural grass cover is a mixture of mid and short grasses. Management that maintains an adequate plant cover and ground mulch helps prevent soil blowing and erosion and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

Climatically adapted trees and shrubs are needed to establish windbreaks and woody plantings on this soil. Summer fallowing before planting increases the chance of survival, and cultivation after planting helps control grass and weeds.

Continuous cropping of this soil is undesirable because of the low moisture content. Stubble mulching, crop residue management, stripcropping, minimum tillage, and contour farming help control soil blowing and erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and regular addition of animal manure help improve fertility and reduce susceptibility of the soil to blowing and erosion. Seeding this soil to tame pasture is effective in controlling soil blowing. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

Proper design of building foundations and footings help prevent structural damage caused by high shrink-swell potential and low strength of this soil. Adequate surface drainage and drainage around footings reduce the hazard of shrink-swell. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitations of slow movement of effluent and moderate depth to bedrock. Sewage lagoons need to be sealed because of fractures in the bedrock.

Local roads and streets need to be graded to provide proper drainage because of the high shrink-swell potential, and the base material needs to be strengthened to help overcome the low strength of this soil. Control of roadside erosion is needed in borrow areas. This map unit is in Capability unit IVe-3 and Clayey range site.

PcD—Pierre clay, 6 to 25 percent slopes. This moderately deep, well drained, moderately sloping to moderately steep soil is on uplands. The mapped areas are irregular in shape and range from 10 to 175 acres in size.

Typically, the surface layer is gray clay about 3 inches thick. The subsoil, about 17 inches thick, is grayish brown, firm clay in the upper part and gray, calcareous clay in the lower part. The underlying material to a depth of 29 inches is gray clay. Light brownish gray shale bedrock is at a depth of 29 to 60 inches. In places, cobblestones as much as 10 inches in diameter and stones as much as 3 feet in diameter cover 30 percent of the surface.

Included with this soil in mapping are small areas of Grummit, Hisle, Snomo, and Stetter soils. Grummit and Snomo soils are more acid than Pierre soil and are on the upper part of the landscape. Hisle soil has a claypan subsoil. Stetter soil is deeper to shale than Pierre soil and is on the lower part of the landscape along streams. In places, the shale is deeper than is typical for Pierre soils. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderately low in content of organic matter. Available water capacity is very low or low, and permeability is very slow. This soil is difficult to till because of the narrow range of moisture content in which the soil is workable. Shrink-swell potential is high. Runoff is medium or rapid.

Most areas of this soil are in rangeland. The soil has good potential for rangeland and rangeland wildlife habitat. It has poor potential for windbreaks and environmental plantings, cultivated crops, openland wildlife habitat, recreational uses, most building sites, sanitary facilities, and local roads and streets.

This soil is better suited to rangeland than to other uses. The natural grass cover is a mixture of mid and short grasses. Management that maintains an adequate plant cover and ground mulch helps prevent erosion and improves soil moisture by reducing runoff. If the soil is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is generally unsuited to cultivated crops because of the slope.

This soil is generally unsuited to windbreak plantings. If climatically adapted trees and shrubs are selected, environmental plantings can be established for wildlife habitat; optimum survival, growth, and vigor, however, should not be expected.

Buildings and sanitary facilities need to be placed in the lower part of the landscape. Proper design of building foundations and footings helps prevent structural damage caused by high shrink-swell potential and low strength of this soil. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitations of slow movement of effluent and moderate depth to bedrock.

Local roads and streets need to be graded to provide good drainage, and the base material needs to be strengthened to help overcome low strength of this soil for supporting vehicular traffic. Control of erosion is needed in borrow areas. This map unit is in Capability unit VIe-4 and Clayey range site.

Pe—Pits, quarry. This map unit consists of open pits from which clay or rock has been removed. Individual areas of these pits range from 2 to 30 acres in size.

Many pits are abandoned rock quarries. At one time, gold or clay for the manufacture of bricks was mined. At present, limestone rock, which is crushed and used as construction material, is mined from some quarries.

Most of these areas are void of vegetation and are suited only to wildlife habitat. This map unit is in Capability unit VIIIs-2. It is not placed in a range site.

RaE—Rekop-Gypnevee-Rock outcrop complex, 15 to 50 percent slopes. This map unit consists of shallow and deep, well drained or somewhat excessively drained, moderately steep to very steep soils and Rock outcrop on uplands. The irregularly shaped areas range from 10 to 100 acres in size and are about 35 percent Rekop soil, 25 percent Gypnevee soil, and 20 percent Rock outcrop. Rock outcrop is on the tops and upper sides of ridges. Rekop and Gypnevee soils and Rock outcrop are so intermingled that it is not practical to separate them in mapping (fig. 7).

Typically, the Rekop soil has a surface layer of reddish brown loam about 4 inches thick. The underlying material to a depth of 18 inches is loam that is light brown in the upper part and pink in the lower part. Pinkish white gypsum and alabaster bedrock are at a depth of 18 inches.

Typically, the Gypnevee soil has a surface layer of reddish brown loam about 7 inches thick. The transitional layer is yellowish red, friable silt loam about 6 inches thick. The underlying material to a depth of about 60 inches is friable silt loam that is reddish yellow in the upper part and light red in the lower part. In places, bedrock is at a shallower depth than is typical of the Gypnevee soil.

Rock outcrop consists of massive exposures of pinkish white and white gypsum and alabaster rock.

Included with this unit in mapping are small areas of Nevee, Spearfish, and Tilford soils. Nevee and Spearfish soils do not have gypsum in the solum. Spearfish soil has bedrock at a depth of less than 20 inches and is on steeper side slopes. Tilford soil has a thicker dark surface layer than Rekop and Gypnevee soils and is on the lower part of the landscape. The included soils make up about 20 percent of the map unit.

The Rekop soil is low in fertility and content of organic matter and has very low available water capacity. The Gypnevee soil is medium in fertility and low in content of organic matter and has high available water capacity. Permeability is moderate in both soils. Runoff is medium or rapid.

Most areas of this map unit are in rangeland. The soils have fair potential for rangeland and rangeland wildlife habitat. They have poor potential for cultivated crops, windbreaks and environmental plantings, building sites, local roads and streets, and sanitary facilities.

This map unit is better suited to rangeland than to other uses. The natural grass cover is a mixture of tall, mid, and short grasses. The main concerns of management are steep slopes and susceptibility of the soil to erosion. Management that maintains an adequate plant

cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This map unit generally is not suited to cultivated crops, tame pasture, and windbreaks because of steep slopes and Rock outcrop. It is suited to wildlife habitat on selected sites; however, trees and shrubs need to be planted by hand and given special care.

This map unit is not suited to building sites, sanitary facilities, and local roads and streets because of steep slopes, shallow depth to bedrock, low strength, and the presence of soluble gypsum. The Rekop soil is in Capability unit VIIe-7 and Shallow range site; Gypnevee soil is in Capability unit VIe-3 and Thin Upland range site. Rock outcrop is in Capability unit VIIIs-1. It is not placed in a range site.

RBF—Rock outcrop-Pactola association, steep. This map unit consists of Rock outcrop and a deep, well drained soil in the Black Hills. It is on breaks along the edge of ridges and on the sides of mountain valleys. Slopes generally are long and rough and range from 25 to 60 percent.

Individual areas of this map unit range from 80 to several thousand acres in size and are about 55 percent Rock outcrop, 35 percent Pactola soil, and 10 percent minor soils. Rock outcrop is on the edge of ridgetops, on points on the ends of side slopes, and on the steeper sides of mountain valleys. Pactola soil is on the less steep valley side slopes. The minor soils are in areas that range to 40 acres in size. The uses of this unit are such that separate mapping of the larger areas of Pactola soil and of the minor soils is not practical.

Rock outcrop consists of exposures of pale brown, massive boulders and dikes of hard, fractured metamorphic rock.

Typically, the Pactola soil has a surface layer of dark gray loam about 2 inches thick that is covered by about 1 inch of forest litter. The transitional layer is light gray, very friable, channery silt loam about 7 inches thick. The subsoil, about 36 inches thick, is grayish brown, friable, channery clay loam in the upper part and very flaggy clay loam in the lower part. The underlying material to a depth of 60 inches is light olive brown, very flaggy silt loam.

Included with this unit in mapping are Grizzly, Maitland, and Marshdale soils. Grizzly soil has more clay in the subsoil than Pactola soil and formed in igneous material. It is on some of the steeper side slopes and ridgetops, generally above Pactola soil. Maitland soil has more organic matter in the surface layer than Pactola soil and is on low side slopes below Pactola. Marshdale soil is poorly drained and is along drainageways.

The Pactola soil is low in fertility and content of organic matter. Available water capacity and permeability are moderate. Runoff is medium or rapid.

Most areas of this map unit are in ponderosa pine forest. Some minor soils in swales and in mountain valleys are in native grass and are used for hay or grazing. The Pactola soil has poor potential for production of commercial timber. It has good potential for woodland grazing and woodland wildlife habitat, and it has poor potential for cultivated crops, windbreaks and environmental plantings, recreational uses, building sites, local roads and streets, and sanitary facilities.

This map unit is better suited to woodland grazing and wildlife habitat than to other uses. The natural plant community is dominantly ponderosa pine and a sparse understory of common juniper, shrubs, and grasses. Erosion is the main concern of management. If selective cutting is practiced, some ponderosa pine can be harvested on the less steep slopes. The use of wheeled equipment is restricted because of steepness. Partial cutting reduces the hazard of erosion. Cutting and thinning of selected areas opens the understory to sunlight, reduces the competition for moisture, and improves grass production. Opening the tree stand makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor and promotes the growth of mature trees that can be harvested at shorter intervals. Proper stocking of livestock prevents overgrazing and helps maintain a desirable plant community that provides adequate grass and shrub browse for wildlife habitat. Such vegetation reduces the hazard of erosion on these steep slopes.

This map unit is not suited to cultivated crops, windbreaks, and recreational uses because of steep slopes and Rock outcrop.

The soils in this map unit have poor potential for local roads and streets, sanitary facilities, and building sites. Soil slippage can occur if the soils are disturbed. Rock outcrop severely limits land development. Rock outcrop is in Capability unit VIIIs-1, and Pactola soil is in Capability unit VIIe-9. The map unit is not placed in a range site.

RCF—Rock outcrop-Vanocker association, very steep. This map unit consists of Rock outcrop and a deep, well drained soil on sides of mountain valleys in the Black Hills. Areas are long and narrow, and slopes typically are 15 to 75 percent but range from 6 to 75 percent. Individual areas of this map unit range from 80 to over 1,000 acres in size and are about 40 percent Rock outcrop, 40 percent Vanocker soil, and 20 percent minor soils. Vanocker soil is in areas ranging from less than 10 to 50 acres in size. It is throughout the unit but is mainly on steep side slopes above the valley floor. The minor soils are in areas that range to 40 acres in size. The uses of this unit are such that separate mapping of the larger areas of Vanocker soil and of the minor soils is not practical.

Rock outcrop consists of exposures of vertical cliffs of limestone and sandstone, which range from 15 to 600 feet in height, and large rocks at the base of the cliffs.

Typically, the Vanocker soil has a surface layer of dark grayish brown loam about 4 inches thick that is covered by about 1 inch of forest litter. The subsoil, about 11 inches thick, is brown channery clay loam. The underlying material to a depth of 60 inches is very pale brown, very channery clay loam.

Included with this unit in mapping are areas of Citadel, Marshdale, and Winetti soils. Citadel soil has more clay in the subsoil than Vanocker soil and is on the smoother less sloping foot slopes, generally below the Vanocker soil. Marshdale soil is poorly drained. Winetti soil has more sand and gravel than Vanocker soil. Marshdale and Winetti soils are along drainageways in mountain valleys.

The Vanocker soil is low in fertility and content of organic matter. Available water capacity and permeability are moderate. Runoff is medium or rapid.

Most areas of this map unit are in ponderosa pine and Black Hills spruce. Some minor soils along drainageways are in native grass. The soil in this map unit has good potential for woodland wildlife habitat; fair potential for woodland grazing; and poor potential for timber production, cultivated crops, rangeland, recreational uses, building sites, local roads and streets, and sanitary facilities.

This map unit is better suited to limited woodland grazing and wildlife habitat than to other uses. The natural plant community is dominantly ponderosa pine, Black Hills spruce, and an understory of shrubs and grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil losses and improves the moisture supply for forest plants. Some selective cutting and thinning can be practical on the less steep slopes, but use of wheeled equipment is restricted because of steepness and Rock outcrop. Opening the understory reduces competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals. It also promotes the growth of understory plants for grazing by livestock and woodland wildlife. Proper grazing use of the understory helps maintain a desirable plant community that provides browse for woodland wildlife.

This map unit is not suited to cultivated crops, rangeland, building sites, and sanitary facilities because of steep slopes and Rock outcrop and seasonal flooding.

Local roads need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion and slippage is needed in borrow and cut areas. Rock outcrop is in Capability unit VIIIs-1, and Vanocker soil is in Capability unit VIIe-9. The map unit is not placed in a range site.

SaA—Satanta loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces and uplands. The mapped areas are irregular in shape and range from 10 to 250 acres in size.

Typically, the surface layer is brown loam about 7 inches thick. The subsoil, about 30 inches thick, is brown, very friable loam in the upper part; brown, friable clay loam in the middle part; and pale brown, friable and very friable clay loam and sandy clay loam in the lower part. The underlying material to a depth of 60 inches is pale brown sandy clay loam. In places, lime is within a depth of 15 inches.

Included with this soil in mapping are small areas of Boneek and Nunn soils. Boneek and Nunn soils have more clay in the subsoil than Satanta soil and are on the lower part of the landscape. The included soils make up about 10 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is slow.

Most areas of this soil are cropped. This soil has good potential for dryland and irrigated crops, rangeland, rangeland wildlife habitat, windbreaks and environmental plantings, and recreational uses. It has fair potential for openland wildlife habitat, most building sites, local roads and streets, and most sanitary facilities.

This soil is suited to small grain, corn, and grasses and legumes for hay. Conserving moisture is the main concern of management. Stubble mulching, crop residue management, minimum tillage, and field windbreaks help conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and maintain adequate content of organic matter.

Seeding this soil to tame pasture is an alternative use of this soil. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground mulch improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other woody plantings. All climatically adapted trees and shrubs grow well on this soil. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

Proper design of building foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. Sealing the bottom and sides of sewage lagoons helps reduce seepage. This soil has low strength. Strengthening the base material is needed to

support vehicular traffic. Proper roadside drainage helps reduce the effects of shrinking and swelling of the soil. This map unit is in Capability unit IIIc-1 and Silty range site.

SaB—Satanta loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces and uplands. The mapped areas are irregular in shape and range from 10 to 250 acres in size.

Typically, the surface layer is brown loam about 7 inches thick. The subsoil, about 30 inches thick, is brown, very friable loam in the upper part; brown, friable clay loam in the middle part; and pale brown, friable and very friable clay loam and sandy clay loam in the lower part. The underlying material to a depth of 60 inches is pale brown sandy clay loam. In places, lime is within 15 inches of the surface.

Included with this soil in mapping are small areas of Boneek and Nunn soils. Boneek and Nunn soils have more clay in the subsoil than Satanta soil and are on the lower part of the landscape. The included soils make up about 10 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is medium.

Most areas of this soil are cropped. This soil has good potential for dryland and irrigated crops, rangeland, rangeland wildlife habitat, windbreaks and environmental plantings, and recreational uses. It has fair potential for openland wildlife habitat, most building sites, local roads and streets, and most sanitary facilities.

This soil is suited to small grain, corn, and grasses and legumes for hay. Conserving moisture and controlling erosion are the main concerns of management if this soil is used for cultivated crops. Stubble mulching, terraces, contour farming, crop residue management, minimum tillage, and field windbreaks help control erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and reduce susceptibility of the soil to erosion.

Seeding this soil to tame pasture is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground mulch helps prevent soil losses and improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Planting trees on the contour helps reduce the hazard of erosion. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grasses and weeds and conserve moisture.

Proper design of building foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. Sealing the bottoms and sides of sewage lagoons helps reduce seepage.

This soil has low strength. Strengthening the base material helps overcome the low strength of this soil for supporting vehicular traffic. Proper roadside drainage helps reduce the effect of shrinking and swelling of the soil. This map unit is in Capability unit IIIe-1 and Silty range site.

SaC—Satanta loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on terraces and uplands. The mapped areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is brown loam about 9 inches thick. The subsoil, about 30 inches thick, is brown, very friable loam in the upper part; brown, friable clay loam in the middle part; and pale brown, friable and very friable clay loam and sandy clay loam in the lower part. The underlying material to a depth of 60 inches is pale brown sandy clay loam. In places, lime is within a depth of 15 inches.

Included with this soil in mapping are small areas of Boneek, Butche, and Nunn soils. Boneek and Nunn soils have more clay in the subsoil than Satanta soil and are on the lower part of the landscape. Butche soil has less clay than Satanta soil, has sandstone at a depth of 10 to 20 inches, and is on the upper part of the landscape. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is medium.

Most areas of this soil are cropped. This soil has good potential for rangeland, rangeland wildlife habitat, windbreaks and environmental plantings, and recreational uses. It has fair potential for cultivated crops, openland wildlife habitat, most building sites, local roads and streets, and most sanitary facilities.

This soil is suited to small grain, corn, and grasses and legumes for hay. Conserving moisture and controlling erosion are the main concerns of management if this soil is used for cultivated crops. Stubble mulching, terraces, contour farming, crop residue management, minimum tillage, and field windbreaks help control erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and reduce susceptibility of the soil to erosion.

Seeding this soil to tame pasture is effective in controlling erosion. Proper stocking rate, rotation grazing,

application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground mulch helps prevent soil losses and improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Planting trees on the contour helps reduce the hazard of erosion. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grasses and weeds and conserve moisture.

Proper design of building foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. Sewage lagoons need to be placed on the less sloping part of the landscape. Sealing the bottom and sides of lagoons helps reduce seepage.

This soil has low strength. Strengthening the base material helps overcome the low strength of this soil for supporting vehicular traffic. Control of roadside erosion is needed in borrow areas. Proper roadside drainage helps reduce the effects of shrinking and swelling of the soil. This map unit is in Capability unit IVe-1 and Silty range site.

SbA—Savo silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces and uplands. The mapped areas are irregular in shape and range from 20 to 100 acres in size.

Typically, the surface layer is dark gray silt loam about 7 inches thick. The subsoil, about 17 inches thick, is brown, firm silty clay loam in the upper part and pale brown, firm silty clay loam in the lower part. The underlying material to a depth of 32 inches is pale brown and very pale brown clay loam. Below this, to a depth of 60 inches, is brown, calcareous silty clay loam.

Included with this soil in mapping are small areas of Nunn, Tilford, and Vale soils. Nunn soil has more fine and coarse sand than Savo soil and is on the higher part of the landscape. Tilford and Vale soils have less clay than Savo soil and are redder than Savo soil. They are on the lower part of the landscape. The included soils make up about 10 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderately slow. Shrink-swell potential is high. Runoff is slow.

Most areas of this soil are cropped. This soil has good potential for cultivated crops, rangeland, windbreaks and environmental plantings, and rangeland wildlife habitat; fair potential for openland wildlife habitat and recreational uses; and poor potential for most building sites, most sanitary facilities, and local roads and streets.

This soil is suited to small grain, corn, and grasses and legumes for hay. Conserving moisture is the main concern of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, minimum tillage, and field windbreaks help conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and maintain an adequate content of organic matter.

Seeding this soil to tame pasture is an alternative use of this soil. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground mulch helps improve the moisture supply for rangeland plants. If the range is overgrazed, the taller more desirable grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

Proper design of building foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent.

This soil has low strength. Strengthening the base material is needed to support vehicular traffic. Proper roadside drainage helps reduce the effects of shrinking and swelling of the soil. This map unit is in Capability unit IIIc-1 and Silty range site.

SbB—Savo silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces and uplands. The mapped areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark gray silt loam about 7 inches thick. The subsoil, about 17 inches thick, is brown, firm silty clay loam in the upper part and pale brown, firm silty clay loam in the lower part. The underlying material to a depth of 32 inches is pale brown and very pale brown clay loam. Below this, to a depth of 60 inches, is brown, calcareous silty clay loam.

Included with this soil in mapping are small areas of Nunn, Tilford, and Vale soils. Nunn soil has more fine and coarser sand than Savo soil and is on the higher part of the landscape. Tilford and Vale soils have less clay than Savo soil and are redder than Savo soil. They

are on the lower part of the landscape. The included soils make up about 10 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderately slow. Shrink-swell potential is high. Runoff is medium.

Most areas of this soil are cropped. This soil has good potential for cultivated crops, rangeland, rangeland wildlife habitat, and windbreaks and environmental plantings; fair potential for openland wildlife habitat, recreational uses, and most sanitary facilities; and poor potential for most building sites and for local roads and streets.

This soil is suited to small grain, corn, and grasses and legumes for hay. Controlling erosion and conserving moisture are the main concerns of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, contour farming, terracing, minimum tillage, grassed waterways, and field windbreaks help control erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and maintain adequate content of organic matter.

Seeding this soil to tame pasture is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground mulch helps prevent soil blowing and improves the moisture supply for rangeland plants. If the range is overgrazed, more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

Proper design of building foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent.

Strengthening the base material helps overcome the low strength of this soil for supporting vehicular traffic. Proper roadside drainage helps reduce the effects of shrinking and swelling of the soil. This map unit is in Capability unit IIIe-1 and Silty range site.

ScD—Snomo-Rock outcrop complex, 6 to 25 percent slopes. This map unit consists of a deep, well drained, moderately sloping to moderately steep soil and Rock outcrop on uplands. The irregularly shaped areas range from 10 to 100 acres in size and are about 50 to 60 percent Snomo soil and 25 to 35 percent Rock outcrop. Rock outcrop is on the steeper side slopes along drainageways. The Snomo soil and Rock outcrop are so intermingled that it is not practical to separate them in mapping.

Typically, the Snomo soil has a surface layer of grayish brown clay about 6 inches thick. The subsoil, about 19 inches thick, is grayish brown, friable clay in the upper part and brown clay in the lower part. The underlying material to a depth of about 49 inches is light gray clay in the upper part and gray, shaly clay in the lower part. Gray fissile shale is at a depth of 49 inches. In places, shale is at a depth of 20 to 40 inches.

Rock outcrop consists of large exposures of gray, fissile, acid shale that breaks down to large sand-size particles and is loose on the surface.

Included with this unit in mapping are small areas of Grummit soil. Grummit soil has shale at a depth of less than 20 inches and generally is in the higher part of the landscape. This included soil makes up about 15 percent of the map unit.

The dominant Snomo soil is low in fertility and content of organic matter. It has low available water capacity and moderate permeability. The soil has high shrink-swell potential.

Most areas of this map unit are in sparsely covered native woodland. The soils of the unit have good potential for rangeland and rangeland wildlife habitat and poor potential for cultivated crops, recreational uses, windbreaks and environmental plantings, most building sites, local roads and streets, and most sanitary facilities.

This map unit is better suited to rangeland than to other uses. The natural plant cover is a mixture of tall, mid, and short grasses and scattered bur oak and ponderosa pine in places. The main concerns of management are inadequate rainfall, soil blowing, and erosion.

Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed, the taller more desirable grasses lose vigor and are replaced by less productive grasses and weeds. Proper grazing use and deferred grazing help maintain or improve rangeland condition. Bur oak and ponderosa pine are intermingled with the grass on the Snomo soil. Some trees are in pockets of the shale Rock outcrop.

This map unit generally is not suited to cultivated crops, tame pasture, and windbreaks because of slope and susceptibility of the soil to blowing and erosion. Bur oak and ponderosa pine for wildlife habitat are suitable on selected sites if they are planted by hand and given special care.

This map unit generally is not suitable for building sites, sanitary facilities, and local roads and streets because of high shrink-swell potential, steep slopes, low strength, and Rock outcrop. The Snomo soil is in Capability unit VIe-4 and Clay Savannah range site. Rock

outcrop is in Capability unit VIIIs-1. It is not placed in a range site.

Sd—Stetter Variant silty clay loam. This deep, well drained, nearly level soil is on terraces and alluvial flood plains. It is subject to common flooding for brief periods. The mapped areas are irregular in shape and range from 10 to 60 acres in size.

Typically, the surface layer is grayish brown silty clay loam about 6 inches thick. The underlying material to a depth of about 60 inches is grayish brown, friable silty clay loam in the upper part and clay in the lower part.

This soil is medium in fertility and moderately low in content of organic matter. Available water capacity is low or moderate, and permeability is slow. The soil has high shrink-swell potential. Runoff is slow. Reaction is slightly acid to strongly acid.

Most areas of this soil are in rangeland. This soil has good potential for rangeland, fair potential for cultivated crops, windbreaks and environmental plantings, and rangeland wildlife habitat, and poor potential for openland wildlife habitat, recreational uses, building sites, local roads and streets, and sanitary facilities.

This soil is well suited to rangeland. The natural plant community is a mixture of tall and mid grasses. Maintaining a good grass cover and ground mulch helps improve the moisture supply for rangeland plants. If the range is overgrazed, the more desirable tall grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is suited to small grain and grasses and legumes for hay. Conserving soil moisture and seasonal flooding are the main management concerns if this soil is used for cultivated crops. Frequent flooding, which can be expected during spring snowmelt or heavy rainfall periods, causes delay in the planting and harvesting of crops in most years. Stubble mulching, use of crop residue, minimum tillage, and field windbreaks help conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and content of organic matter.

Seeding this soil to tame pasture is an alternative use of this soil. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is suited to windbreaks and other woody plantings. All climatically adapted trees and shrubs grow well on this soil. Cultivation needs to be continued after planting to control grass and weeds and conserve moisture.

This soil is not suitable for recreational uses because of common flooding.

This soil has low strength and high shrink-swell potential. Local roads and streets need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. Common flooding needs to be controlled if this soil is used for building sites, local roads and streets, and sanitary facilities. This map unit is in Capability unit IIIs-3 and Overflow range site.

SEE—Stovho association, rolling. This map unit consists of deep, well drained soils in the Black Hills. It is on smooth upland divides and the sides of mountain valleys and along drainageways. Slopes generally are long and smooth and range from 6 to 30 percent.

Individual areas of this map unit range from 80 to several thousand acres in size and are about 70 percent Stovho soil and 30 percent minor soils and Rock outcrop. Minor soils and Rock outcrop are in areas that range to 40 acres in size. The uses of this unit are such that separate mapping of the larger areas of Rock outcrop and minor soils is not practical.

Typically, the Stovho soil has a surface layer of dark grayish brown silt loam about 4 inches thick that is covered by about 1 inch of forest litter. The subsurface layer is light brownish gray, very friable silt loam about 3 inches thick. The transitional layer, about 4 inches thick, is brown, friable silty clay loam. The subsoil extends to a depth of about 36 inches and is brown, firm silty clay in the upper part; light brown, firm silty clay in the middle part; and very pale brown clay loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, cobbly silt loam. In places, the subsoil has less clay than is typical for the Stovho soil.

Included with this soil in mapping are areas of Maitland, Marshdale, and Trebor soils and Rock outcrop. The poorly drained Marshdale soil is along drainageways. Trebor soil has fractured limestone bedrock at a depth of 20 to 40 inches and has more fragments of limestone in the solum than Stovho soil. Rock outcrop consists of exposures of hard, gray fractured limestone and is on edges of round-topped ridges. Some outcrop is nearly vertical.

The Stovho soil is low in fertility and moderately low in content of organic matter. Available water capacity is high, and permeability is moderately slow. The shrink-swell potential is high in the subsoil. Runoff is medium or rapid. Reaction is medium acid to neutral.

Most areas of this map unit are in ponderosa pine and Black Hills spruce forest. Some minor soils in swales and in mountain valleys are in native grass or have been seeded to tame pasture plants and are used for hay or grazing. The soils in this unit have good potential for timber production, woodland grazing, and woodland wildlife habitat and poor potential for cultivated crops, rangeland, most building sites, local roads and streets, and sanitary facilities.

This map unit is better suited to timber production, woodland grazing, and woodland wildlife habitat than to other uses. The natural plant community is dominantly ponderosa pine and Black Hills spruce and an understory of common juniper, shrubs, and grasses. Management that maintains an adequate plant cover and ground

mulch helps prevent excessive soil losses and improves the moisture supply for forest plants. Selective cutting and thinning reduces the competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals. Selective cutting and thinning also promotes the growth of understory plants for grazing by livestock and woodland wildlife. Proper grazing of the understory by livestock helps maintain a desirable plant community that provides browse for woodland wildlife.

Seeding cleared areas of this map unit to suitable tame pasture plants is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition after it is established.

Building sites and sanitary facilities need to be placed in the lower part of the landscape where slopes are less steep and Rock outcrop is less common. If buildings are constructed on the Stovho soil, proper design of foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. Sanitary facilities have the potential to pollute shallow ground water. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent.

Local roads and streets need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow and cut areas. The Stovho soil is in Capability unit VIe-13. The map unit is not placed in a range site.

SGF—Stovho-Trebor association, steep. This map unit consists of deep and moderately deep, well drained soils. It is on upland divides and sides of mountain valleys and along drainageways. Slopes generally are long and smooth and range from 25 to 60 percent.

Individual areas of this map unit range from 60 to several hundred acres in size and are about 45 percent Stovho soil, 30 percent Trebor soil, and 25 percent minor soils. The Stovho soil is on broader ridgetops and smoother side slopes. The Trebor soil is on steeper north-facing and east-facing side slopes and sharp slope breaks into the drainageways. The minor soils are in areas that range to 40 acres in size. The uses of this unit are such that separate mapping of the larger areas of the Trebor soil and of the minor soils is not practical.

Typically, the Stovho soil has a surface layer of dark grayish brown silt loam about 4 inches thick that is covered by about 1 inch of forest litter. The subsurface layer is light brownish gray, very friable silt loam about 3 inches thick. The transitional layer, about 4 inches thick, is brown, friable silty clay loam. The subsoil extends to a depth of about 36 inches and is brown, firm silty clay in the upper part; light brown, firm silty clay in the middle part; and very pale brown clay loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, cobbly silt loam. In places, the soil has less clay in the subsoil than is typical for the Stovho soil.

Typically, the Trebor soil has a surface layer of pinkish gray silt loam, about 2 inches thick, that is covered with about 1 inch of forest litter. The subsoil, about 8 inches thick, is reddish brown, firm channery silty clay in the upper part and reddish brown and very pale brown, friable channery silt loam in the lower part. The underlying material to a depth of 30 inches is yellow channery silt loam. Fractured limestone is at a depth of 30 inches.

Included with these soils in mapping are areas of Marshdale and Vanocker soils and Rock outcrop. The poorly drained Marshdale soil is along drainageways in mountain valleys. Vanocker soil has a weaker grade of structure and less clay in the subsoil than Stovho and Trebor soils. It is on the steeper south-facing and west-facing side slopes and on sharp slope breaks into drainageways. Rock outcrop consists of exposures of hard, gray to buff, fractured limestone on the rimrock areas. It is vertical in places.

The Stovho and Trebor soils are low in fertility. Content of organic matter is moderately low in the Stovho soil and low in the Trebor soil. Available water capacity is high in the Stovho soil and low in the Trebor soil. Permeability is moderately slow, and the shrink-swell potential is high in the subsoil in both soils. Runoff is rapid.

Most areas of this map unit are in ponderosa pine and Black Hills spruce forest. Some minor soils in swales and in mountain valleys are in native grass or have been seeded to tame pasture plants and are used for hay or grazing. The soils in this unit have good potential for timber production, woodland grazing, and woodland wildlife habitat. They have fair potential for tame pasture and poor potential for cultivated crops, rangeland, recreational areas, building sites, local roads and streets, and sanitary facilities.

This map unit is better suited to woodland grazing and woodland wildlife habitat than to other uses. The natural plant community is dominantly ponderosa pine and Black Hills spruce and an understory of shrubs and grasses. A controlled number of ponderosa pine trees can be harvested on the less steep slopes by selective cutting, but use of wheeled equipment is limited because of steepness. The severe hazard of erosion is reduced by partial cutting. Selective cutting and thinning opens the understory to sunlight, reduces competition for moisture, and improves grass production. Opening the tree stand makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and it promotes the growth of mature trees that can be harvested at shorter intervals. Proper stocking rate of livestock prevents overgrazing and helps maintain a desirable plant community, provides adequate grass and shrub browse for wildlife habitat, and reduces the hazard of erosion on these steep slopes.

This map unit generally is not suitable for building sites, local roads and streets, and sanitary facilities. Because the slopes are so steep, landslides are likely to occur if the soils are disturbed. This map unit is in Capability unit VIIe-9. It is not placed in a range site.

ShA—St. Onge loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on low terraces. It is subject to common flooding for very brief periods. The mapped areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsurface layers, about 17 inches thick, are very dark grayish brown, friable silt loam in the upper part and dark grayish brown loam in the lower part. The underlying material to a depth of 60 inches is stratified brown and light brown loam and fine sandy loam.

Included with this soil in mapping are small areas of Barnum and Swint soils. Barnum soil has a thinner surface layer that has less organic matter than St. Onge soil. It is on lower terraces. Swint soil has a dark surface layer less than 20 inches thick and is on upper terraces. The included soils make up about 10 percent of the map unit.

This soil is high in fertility and content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is very slow or slow.

Most areas of this soil are cropped. This soil has good potential for dryland and irrigated crops, rangeland, openland wildlife habitat, and windbreaks and environmental plantings. It has fair potential for rangeland wildlife habitat and recreational uses and has poor potential for building sites, local roads and streets, and sanitary facilities.

This soil is well suited to small grain and grasses and legumes for hay. Conserving moisture is the main concern of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, and field windbreaks conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve or maintain fertility.

Seeding this soil to tame pasture is an alternative use. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining good grass cover and ground mulch helps improve the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

This soil is not suitable for campgrounds because of flooding. It is suitable for picnic areas, playgrounds, and paths and trails when it is not flooded.

This soil generally is not suitable for building sites, local roads and streets, and sanitary facilities because of flooding. This map unit is in Capability unit IIIc-1 and Overflow range site.

Sk—Swint silt loam. This deep, well drained, nearly level soil is on terraces and alluvial fans. This soil is subject to occasional flooding for brief periods. The mapped areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is dark reddish gray silt loam about 8 inches thick. The subsurface layer is dark reddish gray, very friable silt loam about 6 inches thick. The underlying material to a depth of 44 inches is light reddish brown, very friable silt loam in the upper part and reddish brown silt loam in the lower part. Below this to a depth of 60 inches is light reddish brown, calcareous very fine sandy loam.

Included with this soil in mapping are small areas of Barnum and Vale soils. Barnum soil has less silt and clay and less organic matter in the surface layer than Swint soil. It is on the lower part of the landscape and nearer to streams than Swint soil. Vale soil has a stronger grade of structure than Swint soil and is on the upper part of the landscape. The included soils make up about 10 percent of the map unit.

This soil is high in natural fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is slow.

Most areas of this soil are cropped. This soil has good potential for dryland and irrigated crops, rangeland, rangeland wildlife habitat, openland wildlife habitat, windbreaks and environmental plantings, and most recreational uses. It has poor potential for building sites, local roads and streets, and sanitary facilities.

This soil is well suited to small grain and grasses and legumes for hay. Conserving moisture is the main concern of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, minimum tillage, and field windbreaks help conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure helps improve and maintain fertility and content of organic matter. Planting and harvesting of crops may be delayed during wet periods.

Seeding this soil to tame pasture plants is an alternative use. Proper stocking rate, rotation grazing, application of fertilizers and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses.

Maintaining a good grass cover and ground mulch improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

This soil is suitable for picnic areas, playgrounds, and paths and trails. The hazard of flooding limits the use of this soil for camp areas.

This soil generally is not suitable for building sites, local roads and streets, and sanitary facilities because of occasional flooding. This map unit is in Capability unit IIc-2 and Silty range site.

TaA—Tilford silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces, uplands, and alluvial fans. The mapped areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil, about 24 inches thick, is friable, calcareous silt loam that is brown in the upper part and light brown in the lower part. The underlying material to a depth of 60 inches is pink, calcareous silt loam. In places, lime is leached more than 10 inches deep.

Included with this soil in mapping are small areas of Nevee and Vale soils. Nevee soil does not have the thick dark surface layer of Tilford soil and has less clay than Tilford soil. It is in the upper part of the landscape. Vale soil has more clay in the subsoil than Tilford soil. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is slow.

Most areas of this soil are cropped. This soil has good potential for dryland and irrigated crops, rangeland, windbreaks and environmental plantings, rangeland and openland wildlife habitat, building sites, and most sanitary facilities. It has fair potential for recreational uses and local roads and streets.

This soil is well suited to small grain, corn, and grasses and legumes for hay. Conserving moisture is the main concern of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, minimum tillage, and field windbreaks help conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and maintain an adequate content of organic matter.

Seeding this soil to tame pasture is an alternative use. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground cover mulch helps improve the moisture supply for rangeland plants. If the soil is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

A good grass cover needs to be maintained to keep dustiness to a minimum if this soil is used for recreational purposes.

This soil is well suited to building sites and to septic tank absorption fields. Sealing the bottom and sides of sewage lagoons helps reduce seepage.

Strengthening the base material for local roads and streets helps overcome the low strength of this soil for supporting vehicular traffic. This map unit is in Capability unit IIc-2 and Silty range site.

TaB—Tilford silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces, uplands, and alluvial fans. The mapped areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil, about 24 inches thick, is friable, calcareous silt loam that is brown in the upper part and light brown in the lower part. The underlying material to a depth of 60 inches is pink, calcareous silt loam. In places, lime is leached more than 10 inches deep.

Included with the soil in mapping are small areas of Nevee and Vale soils. Nevee soil does not have the thick dark surface layer of Tilford soil and has less clay than Tilford soil. It is in the upper part of the landscape. Vale soil has more clay in the subsoil than Tilford soil. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is medium.

Most areas of this soil are cropped. This soil has good potential for dryland and irrigated crops, rangeland, windbreaks and environmental plantings, rangeland and openland wildlife habitat, building sites, and most sanitary facilities. It has fair potential for recreational uses and local roads and streets.

This soil is well suited to small grain and corn and to grasses and legumes for hay. Conserving moisture and controlling erosion are the main concerns of management if this soil is used for cultivated crops. Stubble

mulching, terraces, contour farming, crop residue management, minimum tillage, and field windbreaks help control soil erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and reduce susceptibility of the soil to erosion.

Seeding this soil to tame pasture is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground cover mulch helps prevent soil losses and improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Trees need to be planted on the contour to help reduce the hazard of erosion. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

A good grass cover needs to be maintained to keep dustiness to a minimum if this soil is used for recreational purposes.

This soil is well suited to building sites and to septic tank absorption fields. Sealing the bottom and sides of sewage lagoons helps reduce seepage.

Strengthening the base material helps overcome the low strength of this soil for supporting vehicular traffic when used for local roads and streets. This map unit is in Capability unit IIe-1 and Silty range site.

TaC—Tilford silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on terraces, uplands, and alluvial fans. The mapped areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil, about 24 inches thick, is friable, calcareous silt loam that is brown in the upper part and light brown in the lower part. The underlying material to a depth of 60 inches is pink, calcareous silt loam. In places, lime is leached more than 10 inches deep.

Included with this soil in mapping are small areas of Nevee and Vale soils. Nevee soil does not have the thick dark surface layer of Tilford soil and has less clay than Tilford soil. It is in the upper part of the landscape. Vale soil has more clay in the subsoil than Tilford soil. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is medium.

Most areas of this soil are cropped. This soil has good potential for crops, rangeland, rangeland wildlife habitat, windbreaks and environmental plantings, building sites, and most sanitary facilities. It has fair potential for openland wildlife habitat, most recreational uses, and local roads and streets.

This soil is well suited to small grain, corn, and grasses and legumes for hay. Controlling erosion is the main concern of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, minimum tillage, terracing, contour farming, and field windbreaks help control erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and reduce susceptibility of the soil to erosion.

Seeding this soil to tame pasture is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground cover mulch helps prevent soil losses and improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Trees should be planted on the contour to help reduce the hazard of erosion. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

A good grass cover should be maintained to keep dustiness to a minimum when this soil is used for recreational purposes. Slopes are of concern if this soil is used for playgrounds.

This soil is well suited to building sites and to septic tank absorption fields. Sealing the bottom and sides of sewage lagoons helps reduce seepage.

Strengthening the base material helps overcome the low strength of this soil for supporting vehicular traffic when used for local roads and streets. Control of roadside erosion is needed in cut areas. This map unit is in Capability unit IIIe-1 and Silty range site.

TBE—Trebor-Rock outcrop association, hilly. This map unit consists of gently rolling and hilly soils and Rock outcrop in the Black Hills. It is on smooth upland divides and on sides of mountain valleys and along

drainageways. Slopes generally are long and smooth and range from 6 to 25 percent.

Individual areas of this unit range from 60 to several hundred acres in size and are about 70 percent Trebor soil, 20 percent Rock outcrop, and 10 percent minor soil. Rock outcrop is in areas ranging from less than 2 acres to 80 acres in size. It is throughout the unit but is mainly on points and rimrock areas. The minor soil is in areas that range to 40 acres in size. The uses of this unit are such that separate mapping of the larger areas of Rock outcrop and of the minor soil is not practical.

Typically, the Trebor soil has a surface layer of pinkish gray silt loam about 2 inches thick that is covered with 1 inch of forest litter. The subsoil, about 8 inches thick, is reddish brown, firm, channery silty clay in the upper part and reddish brown and very pale brown, friable, channery silt loam in the lower part. The underlying material to a depth of 30 inches is yellow, channery silt loam. Fractured limestone is at a depth of 30 inches.

Rock outcrop consists of exposures of hard, gray fractured limestone. In places, the sidewalls are almost vertical.

Included with this unit in mapping are areas of Stovho soil. Stovho soil is deeper and has fewer fragments of limestone than Trebor soil and generally is in the lower part of the landscape.

The Trebor soil is low in fertility and content of organic matter. Available water capacity is low, and permeability is moderately slow. Runoff is medium or rapid.

Most areas of this map unit are in ponderosa pine forest. The soils in this unit have good potential for timber production, woodland grazing, and woodland wildlife habitat. They have poor potential for cultivated crops, rangeland, recreational uses, most building sites, local roads and streets, and most sanitary facilities.

This map unit is better suited to timber production, woodland grazing, and woodland wildlife habitat than to other uses. The natural plant community is dominantly ponderosa pine, Black Hill spruce, and an understory of common juniper, shrubs, and grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil losses and improves the moisture supply for forest plants. Selective cutting and thinning reduces the competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals. Selective cutting and thinning also promotes the growth of understory plants for grazing by livestock and woodland wildlife. Proper grazing use of the understory by livestock helps maintain a desirable plant community that provides browse for woodland wildlife.

Building sites, septic tank absorption fields, and sewage lagoons need to be located on the included Stovho soil in the lower part of the landscape where bedrock is deeper and where slopes are less steep. Proper design of foundations and footings helps prevent structural damage caused by shrinking and swelling of the soil. Most areas of this unit are not suitable for building sites because of steepness.

Local roads and streets need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow and cut areas. The Trebor soil is in Capability unit VIe-13, and Rock outcrop is in Capability unit VIIIs-1. The map unit is not placed in a range site.

VaA—Vale silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces, uplands, and alluvial fans. The mapped areas are irregular in shape and range from 10 to 180 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil, about 21 inches thick, is dark brown, firm silty clay loam in the upper part; brown, firm, calcareous silty clay loam in the middle part; and light brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is light brown, calcareous loam.

Included with this soil in mapping are small areas of Nevee and Tilford soil. Nevee soil has less clay than Vale soil and does not have the thick dark surface layer of Vale soil. It is in the upper part of the landscape. Tilford soil has less clay in the subsoil than Vale soil. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is slow.

Most areas of this soil are cropped. This soil has good potential for dryland and irrigated crops, rangeland, windbreaks and environmental plantings, rangeland and openland wildlife habitat, and building sites. It has fair potential for recreational uses, local roads and streets, and most sanitary facilities.

This soil is well suited to small grain, corn, and grasses and legumes for hay. Conserving moisture is the main concern of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, minimum tillage, and field windbreaks help conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and maintain content of organic matter.

Seeding this soil to tame pasture is an alternative use. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground mulch improve the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short

grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

A good grass cover needs to be maintained to keep dustiness to a minimum if this soil is used for recreational facilities.

This soil is well suited as a site for buildings. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent. Sealing the bottom and sides of sewage lagoons helps reduce seepage.

Strengthening the base material helps overcome the low strength of this soil for local roads and streets. This map unit is in Capability unit IIc-2 and Silty range site.

VaB—Vale silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces, uplands, and alluvial fans. The mapped areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil, about 21 inches thick, is dark brown, firm silty clay loam in the upper part; brown, firm, calcareous silty clay loam in the middle part; and light brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is light brown, calcareous loam.

Included with this soil in mapping are small areas of Nevee, Tilford, and Spearfish soils. Nevee soil has less clay than Vale soil and does not have the thick dark surface layer of Vale soil. It is in the upper part of the landscape. Tilford soil has less clay in the subsoil than Vale soil. The shallow Spearfish soil has less clay than Vale soil and is in the upper part of the landscape. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is medium.

Most areas of this soil are cropped. This soil has good potential for dryland and irrigated crops, building sites, rangeland, windbreaks and environmental plantings, and rangeland and openland wildlife habitat. It has fair potential for recreational uses, local roads and streets, and most sanitary facilities.

This soil is well suited to small grain, corn, and grasses and legumes for hay. Conserving moisture and controlling erosion are the main concerns of management if this soil is used for cultivated crops. Stubble mulching, use of crop residue, terracing, contour farming, minimum tillage, and field windbreaks help control erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility, maintain content of organic matter, and reduce susceptibility of the soil to erosion.

Seeding this soil to tame pasture is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground mulch helps prevent soil losses and improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Trees need to be planted on the contour to help reduce the hazard of erosion. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

A good grass cover needs to be maintained to keep dustiness to a minimum if this soil is used for recreational facilities.

This soil is well suited as a site for buildings. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent. Sealing the bottom and sides of sewage lagoons helps reduce seepage.

Strengthening the base material helps overcome the low strength of this soil for local roads and streets. This map unit is in Capability unit IIe-1 and Silty range site.

VaC—Vale silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on terraces, uplands, and alluvial fans. The mapped areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil, about 20 inches thick, is dark brown, firm silty clay loam in the upper part; brown, firm, calcareous silty clay loam in the middle part; and light brown, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches is light brown, calcareous loam.

Included with this soil in mapping are small areas of Nevee, Tilford, and Spearfish soils. Nevee soil has less clay than Vale soil and does not have the thick dark surface layer of the Vale soil. It is in the upper part of the landscape. Tilford soil has less clay in the subsoil than Vale soil. Spearfish soil has less clay than Vale soil and is in the upper part of the landscape. The included soils make up about 15 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is medium.

Most areas of this soil are cropped. This soil has good potential for crops, rangeland, windbreaks and environmental plantings, rangeland wildlife habitat, and building sites. It has fair potential for openland wildlife habitat, recreational uses, local roads and streets, and sanitary facilities.

This soil is suited to small grain, corn, and grasses and legumes for hay. Controlling erosion is the main concern of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, minimum tillage, terracing, contour farming, and field windbreaks help control erosion and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility, maintain content of organic matter, and reduce susceptibility of the soil to erosion.

Seeding this soil to tame pasture is effective in controlling erosion. Proper stocking rates, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground cover mulch helps prevent soil losses and improves the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is well suited to windbreaks and other types of woody plantings. All climatically adapted trees and shrubs grow well on this soil. Trees need to be planted on the contour to help reduce the hazard of erosion. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued after planting to control grass and weeds and conserve moisture.

A good grass cover needs to be maintained to keep dustiness to a minimum if this soil is used for recreational purposes. Slopes are a concern if this soil is used for playgrounds.

This soil is well suited as a site for buildings. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent.

Strengthening the base material helps overcome the low strength of this soil for local roads and streets. Control of roadside erosion is needed in borrow areas. This map unit is in Capability unit IIIe-1 and Silty range site.

VBF—Vanocker-Citadel association, steep. This map unit consists of deep, well drained, steep and very steep soils in the Black Hills. It is on breaks along the edge of ridges and on the sides of mountain valleys. Slopes generally are long and smooth and range from 25 to 60 percent.

Individual areas of this map unit are irregular in shape and range from 80 to several thousand acres in size. The unit is about 45 percent Vanocker soil, 40 percent Citadel soil, and about 15 percent minor soils. The minor soils are in areas that range to 30 acres in size. The uses of this unit are such that separate mapping of the larger areas of Citadel soil and of the minor soils is not practical.

Typically, the Vanocker soil has a surface layer of dark grayish brown loam about 4 inches thick that is covered by about 1 inch of forest litter. The subsoil, about 11 inches thick, is channery clay loam. The underlying material to a depth of 60 inches is very pale brown, very channery clay loam.

Typically, the Citadel soil has a surface layer of very dark gray loam about 1 inch thick that is covered by about 2 inches of forest litter. The subsurface layer, about 5 inches thick, is light brown, friable, fine sandy loam. The subsoil extends to a depth of about 40 inches and is reddish brown, friable loam in the upper part; reddish brown, firm clay in the middle part; and red, friable, gravelly clay loam in the lower part. The underlying material to a depth of 60 inches is red cobbly loam. In places, bedrock is less than 40 inches deep.

Included with this unit in mapping are areas of Maitland and Marshdale soils. Maitland soil has more organic matter in the surface layer than Vanocker and Citadel soils and is on slopes below Vanocker and Citadel soils. Marshdale soil is poorly drained and is in the drainageways.

The soils in this map unit are low in fertility and content of organic matter. Runoff is rapid. Permeability and available water capacity are moderate in the Vanocker soil, and permeability is moderately slow and available water capacity is high in the Citadel soil.

Most areas of this map unit are in ponderosa pine forest. Some minor soils in mountain valleys and along main drainageways are in native grasses, and a few minor soils have been seeded to tame pasture plants. These grassed areas are used for hay or livestock grazing. The soils in this map unit have poor potential for production of commercial timber, cultivated crops, recreational uses, building sites, local roads and streets, and sanitary facilities. They have good potential for woodland grazing and woodland wildlife habitat.

This map unit is better suited to woodland grazing and woodland wildlife habitat than to other uses. The natural plant community is dominantly ponderosa pine and mixed hardwoods and an understory of shrubs and grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil losses and improves the moisture supply for forest plants. A limited number of ponderosa pine trees is harvested by selective cutting on the less steep slopes. Use

of wheeled equipment is restricted because of steepness. Selective cutting and thinning reduces the competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals. Selective cutting and thinning also promotes the growth of understory plants that can be grazed by livestock and woodland wildlife. Proper grazing use of the understory by livestock helps maintain a desirable plant community that provides browse for woodland wildlife.

This map unit is unsuited to crops and windbreaks because of steep slopes and the severe hazard of erosion.

This map unit generally is too steep for building sites, local roads and streets, and sanitary facilities. Slippage occurs if the soils are disturbed. This map unit is in Capability unit VIIe-9. It is not placed in a range site.

VCE—Virkula association, hilly. This map unit consists of deep, well drained, gently rolling to steep soils in the Black Hills. It is on smooth upland divides and on the sides of mountain valleys and along drainageways. Slopes generally are long and smooth and range from 6 to 30 percent.

Individual areas of this map unit range from 100 to several thousand acres in size and are about 65 percent Virkula soil and about 35 percent minor soils. The minor soils are in areas that range to 40 acres in size. The uses of this unit are such that separate mapping of the larger areas of the minor soils is not practical.

Typically, the Virkula soil has a surface layer of grayish brown silt loam about 1 inch thick that is covered by about 1 inch of forest litter. The subsurface layer is very pale brown, very friable silt loam about 11 inches thick. The transitional layer, about 3 inches thick, is brown, friable silty clay loam. The subsoil extends to a depth of about 36 inches and is brown, firm clay loam in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is pale brown, gravelly clay loam.

Included with this unit in mapping are areas of Citadel, Grizzly, Maitland, Marshdale, and Vanocker soils and smaller areas of Rock outcrop. Citadel soil is redder than Virkula soil and is on smooth lower slopes. Grizzly soil has more fragments of rock than Virkula soil and is on steeper side slopes. Maitland soil has more organic matter in the surface layer than Virkula soil and is on lower side slopes. Marshdale soil is poorly drained and is along drainageways. Vanocker soil has more fragments of rock than Virkula soil and is on the lower part of the landscape. Rock outcrop consists of igneous and metamorphic rock on ridgetops and the tops of main peaks.

The Virkula soils are low in fertility and content of organic matter. Available water capacity is moderate or high, and permeability is moderately slow. The soil has high shrink-swell potential in the subsoil. Runoff is medium or rapid.

Most areas of this map unit are in ponderosa pine forest. Some minor soils in mountain valleys and along main drainageways are in native grass or have been seeded to tame pasture plants and are used for hay or livestock grazing. The soils in this unit have good potential for timber production, woodland grazing, woodland wildlife habitat, and winter recreational uses. They have fair potential for tame pasture and poor potential for cultivated crops, rangeland, most building sites, local roads and streets, and most sanitary facilities.

This map unit is better suited to timber production, woodland grazing, and woodland wildlife habitat than to other uses. The natural plant community is dominantly ponderosa pine and an understory of shrubs and grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil losses and improves the moisture supply for forest plants. Selective cutting and thinning reduces the competition for sunlight and moisture, makes the trees less susceptible to insects and diseases caused by overcrowding and decreased vigor, and promotes the growth of mature trees that can be harvested at shorter intervals. Selective cutting and thinning also promotes the growth of understory plants for grazing by livestock and woodland wildlife. Proper grazing use of the understory by livestock helps maintain a desirable plant community that provides browse for woodland wildlife.

Seeding cleared areas of this map unit to suitable tame pasture plants is effective in controlling erosion. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition after it is established. In some areas of higher elevation, the north-facing and east-facing slopes can be used for ski runs if they are cleared of timber. The areas need to be seeded to suitable grasses to reduce the hazard of erosion.

This map unit has severe limitations for building sites, sanitary facilities, and local roads and streets. Buildings can be constructed on lower slopes if foundations and footings are designed to overcome the high shrink-swell potential and low strength of the soil. If the soils are used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluent.

Local roads and streets need to be graded to shed water, and the base material needs to be strengthened to support vehicular traffic. Control of roadside erosion is needed in borrow and cut areas. The map unit is in Capability unit VIe-13. It is not placed in a range site.

WaA—Weber loam, 0 to 2 percent slopes. This well drained, nearly level soil is moderately deep to sand and gravel on terraces and valley divides. The mapped areas are irregular in shape and range from about 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsoil, about 16 inches thick, is brown, friable silty clay loam. The underlying material to a depth of 60 inches is light brown, gravelly loamy sand.

Included with this soil in mapping are small areas of Satanta and Swint soils. Satanta and Swint soils do not have sand and gravel in the underlying material. Swint soil is in the lower part of the landscape. The included soils make up about 10 percent of the map unit.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is low or moderate. Permeability is moderate in the upper part of the soil and very rapid in the underlying material. Runoff is slow.

Most areas of this soil are cropped. This soil has good potential for rangeland and rangeland wildlife habitat. It has fair potential for cultivated crops, windbreaks and environmental plantings, and recreational uses.

This soil is suited to small grain and grasses and legumes for hay. Conserving moisture is the main concern of management if this soil is used for cultivated crops. Stubble mulching, crop residue management, and minimum tillage helps conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and maintain content of organic matter. Seeding this soil to tame pasture plants is an alternative use of this soil. Proper stocking rate, rotation grazing, application of fertilizer, and control of weeds help keep the pasture in good condition.

This soil is suited to rangeland. The natural plant community is a mixture of mid and short grasses. Maintaining a good grass cover and ground mulch help improve the moisture supply for rangeland plants. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses. Proper grazing use and deferred grazing help maintain or improve rangeland condition.

This soil is suited to windbreaks and other types of woody plantings, but optimum growth should not be expected. Droughtiness caused by moderate depth to sand and gravel may limit growth.

This soil is well suited to most recreational uses.

This soil is well suited to building sites and septic tank absorption fields. Septic tank absorption fields, however, are a potential source of pollution to shallow ground water. Sealing the bottom and sides of sewage lagoons helps reduce seepage.

When this soil is used for local roads and streets, strengthening the base material helps overcome low strength. This map unit is in Capability unit IVs-1 and Silty range site.

Wb—Winetti cobbly loam. This somewhat excessively drained, gently sloping soil is shallow to sand and gravel and is on bottom lands and terraces. Many scattered cobbles 3 to 10 inches in size commonly are on the surface. This soil is subject to rare flooding for brief periods. The mapped areas are long and narrow in shape and range from 20 to 150 acres in size.

Typically, the surface layer is grayish brown, cobbly loam about 5 inches thick. The underlying material to a depth of 60 inches is pale brown, very friable, gravelly sandy loam.

This soil is low in fertility and content of organic matter. Available water capacity is low or moderate, and permeability is moderately rapid. Runoff is slow or medium.

Most areas of this soil are in rangeland. This soil has good potential for rangeland. It has fair potential for rangeland wildlife habitat and poor potential for cultivated crops, openland wildlife habitat, recreational uses, windbreaks and environmental plantings, most building sites and most sanitary facilities. It has fair potential for local roads and streets.

This soil is better suited to rangeland than to other uses. The natural plant community is a mixture of mid and short grasses and perennial forbs suitable for grazing. The main concerns of management are inadequate moisture, flooding, and erosion. Maintaining a good plant cover and ground mulch helps prevent erosion caused by flooding during peak rainfall periods and fast snowmelt. It also helps improve the moisture supply for rangeland plants during dry periods. If the range is overgrazed, the more desirable taller grasses lose vigor and are replaced by less productive short grasses and weeds.

This soil generally is not suited to cultivated crops, tame pasture, and windbreaks because of shallow depth to gravel and frequent flooding. Special plantings of trees and shrubs need to be given special care.

This soil is not suitable for building sites and sanitary facilities because of flooding and seepage.

If this soil is used for local roads and streets, safeguards need to be taken against flooding and frost action. This map unit is in Capability unit VIw-3 and Shallow to gravel range site.

Use and management of the soils

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

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity,

potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

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

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

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

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

Crops and pasture

M. Scott Argabright, conservation agronomist, Soil Conservation Service, assisted in writing this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

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

About 47,000 acres in the survey area were used for hayland, crops, and pasture in 1975, according to updated estimates based on the 1967 Conservation Needs Inventory. Of this total about 25,000 acres were used for alfalfa; 6,000 acres for permanent hayland, native and tame; 6,500 acres for close-sown crops, mainly oats and wheat; 2,000 acres for row crops, mainly corn for silage or grain; 2,000 acres for small grain, summer fallow; and 5,500 acres for permanent pasture.

The potential of the soils in Lawrence County for increased crop production is limited. However, about 8,500 acres of potentially good cropland is used for rangeland, about 2,500 acres is used for pasture, and about 2,000 acres is used for permanent hayland. Food production could also be increased by extending the latest crop production technology to existing cropland in the county. This soil survey can facilitate the application of such technology.

Soil erosion and *soil blowing* are the main soil problems on almost 70 percent of the cropland, hayland, and pasture in Lawrence County. If the slope is more than 2 percent, erosion is a hazard on Boneek, Kyle, Nunn, Pierre, Satanta, Savo, Tilford, and Vale soils.

Loss of the surface layer through erosion or soil blowing is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on such clayey soils as Kyle and Pierre soils and on soils that have thin surface layers, for example, the Nevee soil. Erosion also reduces productivity on soils that tend to be droughty, for example, the Weber soil. Second, soil erosion results in sediment entering streams and lakes. Controlling erosion minimizes the pollution of streams and lakes by sediment and improves water quality for fish and wildlife, recreation, and municipal use.

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

Minimizing tillage and leaving crop residue on the surface help to increase infiltration and reduce the hazards of runoff and erosion. This management can be used on most soils in the survey area.

Terraces and diversions reduce the length of slope and help prevent runoff and erosion. They are most practical on deep, well drained soils that have smooth slopes, for example, on the Boneek, Kyle, Nevee, Nunn, Satanta, Savo, Tilford, and Vale soils. Contouring and contour stripcropping are well suited to these soils. The

Pierre soil is also well suited to contour tillage but is less suited to terraces and diversions because of an unfavorable subsoil which would be exposed in terrace channels.

Soil blowing is a slight to severe hazard on almost all soils in the county. The soil blowing hazard is especially severe on the Alice and Glenberg Variant soils which have fine sandy loam surface layers. The clayey Kyle, Pierre, and Stetter soils and soils that have a high lime content, for example, Barnum and Nevee soils, are also subject to soil blowing. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and void of vegetation or surface mulch. Maintaining plant cover, crop residue, or a rough surface minimizes soil blowing on these soils. Windbreaks of suitable trees and shrubs also are effective in reducing the risk of soil blowing.

Information about the design of erosion control systems for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is not a main management need on most of the soils used for crops, hayland, and pasture in the survey area.

Soil fertility is naturally low in the fine sandy loam Glenberg Variant soil, and in soils that have a high lime content, for example, the Barnum and Nevee soils. Grasses and legumes in the cropping system help to maintain fertility. On all soils, additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer to apply.

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

Poor tilth is a problem on the clayey Kyle and Pierre soils and on the silty clay loam Stetter Variant soil. These soils have a narrow range of moisture content in which they can be easily tilled. If they are wet when tilled, they tend to become very cloddy when dry and good seedbeds are difficult to prepare. Timely tillage, grasses and legumes in the cropping system, crop residue management, and chiseling improve tilth.

Surface layers of most other soils in the survey area are friable and easily tilled through a wide range of moisture content.

Areas of the Barnum, Nevee, Satanta, St. Onge, Swint, Tilford, and Vale soils are irrigated. Management that controls the rate and amount of water application is needed so that excess water is not applied and nutrients are not leached from the root zone or washed off the field.

The Nevee soil and steeper phases of the Tilford and Vale soils are susceptible to soil erosion if irrigated. Controlling the rate of water application, including legume and grass crops in the cropping system, and management of crop residue reduce the risk of erosion on these soils.

Field crops best suited to the soils and climate of the survey area include alfalfa and small grain. Oats, winter wheat, and spring wheat are the main small grain crops. A small acreage of corn and sorghum also is grown. On dryland these crops commonly are harvested for silage.

All commonly grown and climatically adapted crops are suited to most of the soils used for cropland in the county. Small grain and alfalfa are better suited than row crops on such soils as Kyle and Pierre soils. These soils have a clayey subsoil that restricts the amount of water released to plants.

Pasture or hay plants suited to the climate and to most of the soils in the county include alfalfa, crested wheatgrass, intermediate wheatgrass, and pubescent wheatgrass. Crested wheatgrass is well suited to those soils that tend to be droughty, for example, the Weber soil. A bunch-type species, such as crested wheatgrass, should not be planted alone if slopes are more than 6 percent, because of the erosion hazard.

If the poorly drained Higgins and Marshdale soils are used for pasture, the choice of pasture plants is limited to such water-tolerant species as reed canarygrass and Garrison creeping foxtail.

Most areas of the Buska, Citadel, Pactola, Stovho, and Virkula soils remain in native woodland. Some of the smoother areas along the main drainageways are cleared and are used for hay or for livestock grazing. Pasture plants suited to these areas include big bluestem, birdsfoot trefoil, indiangrass, Kentucky bluegrass, orchardgrass, and tall fescue.

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 8. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

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

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 8.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, ero-

sion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

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

Crops other than those shown in table 8 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

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

In the capability system (*9*) all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The capability unit is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning." Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IVe-1 or IIIe-1.

Rangeland

C. M. Schumacher, range conservationist, Soil Conservation Service, assisted in preparing this section.

About 24 percent of Lawrence County is rangeland. More than half of the farm income is derived from livestock, principally cattle. Cow-calf-steer operations are dominant throughout the county. The average size of operating units is about 750 acres.

On many operating units the forage produced on rangeland is supplemented by summer grazing on grazable woodlands and fall grazing on hay meadows. In winter it is necessary to feed hay.

The native vegetation in some parts of the county has been depleted by continued excessive use. Some of the acreage that was once open grassland is now covered with short grasses and weeds. The amount of forage produced may be less than half of that originally produced. Productivity of the rangeland can be increased by using management practices that are effective for specific kinds of soil and range sites.

Most of the rangeland soils are located in the northern part of the county. These soils support mixed grasses, and potential productivity is high. Woodland soils are in much of the southern part of the county. These soils support, in addition to trees, an understory of plants that provide considerable forage for grazing animals. Potential grazing productivity of the wooded soils depends to a great extent on the percent of tree canopy.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 9 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 9.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The main concern of management on most of the rangeland is control of grazing so that the kinds and amounts of plants that make up the potential plant community are reestablished or maintained. If sound range management based on the soil survey information and rangeland inventories is applied, the potential is good for increasing the productivity of range in the area.

Woodland management and productivity

By David L. Hintz, forester, Soil Conservation Service.

Approximately 282,000 acres of native woodland are in the Black Hills part of the survey area. Ponderosa pine is the main tree species of commercial value. Other tree species common to this area are American elm, Black Hills spruce, bur oak, hophornbeam, paper birch, and quaking aspen. Narrow strips of deciduous trees are adjacent to the streams outside of the Black Hills. Species common to these areas are American elm, bur oak, and plains cottonwood.

The potential of the soils in the Black Hills for timber production is poor or very poor. Multiple use objectives need to be considered for all woodland soils. The main uses for these soils are timber production, woodland wildlife habitat, recreation, and grazing by domestic livestock.

The woodland interpretations for the woodland soils in the Black Hills are based on plot and field data collected by the Rocky Mountain Forest and Range Experiment Station, the Black Hills National Forest, and the Soil Conservation Service.

Table 10 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; 5, low; and 6, very low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 10 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

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

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

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

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* (*5*) of merchantable or *important trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

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

Windbreaks and environmental plantings

Windbreaks have been planted since the days of the early settlers for the protection of the farmstead and livestock. A need for these plantings still exits. In recent years, field windbreaks have been planted to help control soil blowing. Thousands of acres in the county are still in need of windbreak plantings.

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

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

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

Table 11 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 11, based on measurements and observation of established plantings that have

been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Wildlife habitat

John B. Farley, biologist, Soil Conservation Service, assisted in preparing this section.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, and oats.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are intermediate wheatgrass, smooth bromegrass, sweetclover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big bluestem, Missouri goldenrod, western wheatgrass, and blue grama.

Hardwood trees are planted trees and shrubs that provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of hardwood trees are American plum, common chokecherry, green ash, Russian-olive, and silver buffaloberry.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water 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, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, saltgrass, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas

are to be developed. Examples of shallow water areas are shallow dugouts, level ditches, marshes, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, ring-necked pheasant, western meadowlark, mourning dove, robin, fox squirrel, cottontail, jackrabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas includes wild turkey, ruffed grouse, thrushes, woodpeckers, squirrels, red fox, raccoon, deer, and elk.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, American coot, herons, shore birds, redwing blackbird, muskrat, mink, and beaver.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland includes pronghorn antelope, coyote, whitetail deer, mule deer, red fox, prairie dog, whitetail jackrabbit, bobcat, greater prairie chicken, western meadow lark, lark bunting, sharp-tailed grouse, and horned lark.

Recreation

The soils of the survey area are rated in table 13 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

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

The information in table 13 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 15, and interpretations for dwellings without basements and for local roads and streets, given in table 14.

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

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

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

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

Engineering

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

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

relationships between the soil properties and the behavior of soils in various engineering uses.

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

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

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

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

The information is presented mainly in tables. Table 14 shows, for each kind of soil, the degree and kind of limitations for building site development; table 15, for sanitary facilities; and table 17, for water management. Table 16 shows the suitability of each kind of soil as a source of construction materials.

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

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

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 14. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 5 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 14 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-

swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 14 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

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

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 15 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

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

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

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

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

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

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobblestones, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment

on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

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

Unless otherwise stated, the limitations in table 15 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

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

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

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

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 16 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

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

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 18 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

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

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 16 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 18.

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

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

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

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

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

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

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 17 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

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

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

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

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

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

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

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 18 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 18 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 18 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in

diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 21. The estimated classification, without group index numbers, is given in table 18. Also in table 18 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 19 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual

fields can differ greatly from the value given in table 19. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.43. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

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

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 20 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding,

nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 20 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries of soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 21.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by The South Dakota Department of Transportation, Division of Highways.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The codes for shrinkage and Unified classification are those assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-69); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); and moisture-density, method A (T99-57).

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is

described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*8*). Unless otherwise noted, matrix colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Alice series

The Alice series consists of deep, well drained soils that formed in alluvium. These soils are on terraces and terrace fronts. Permeability is moderately rapid through the solum and rapid in the underlying material. Slopes range from 0 to 6 percent.

Alice soils commonly are adjacent to Barnum and Vale soils in the landscape. Barnum soils are fine-loamy, do not have a mollic epipedon, and are on bottom lands. Vale soils are fine-silty and have an argillic horizon.

Typical pedon of Alice fine sandy loam, 0 to 6 percent slopes, 1,955 feet north and 1,620 feet west of the southeast corner of sec. 11, T. 7 N., R. 2 E.:

A1—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, many roots; slightly acid; clear smooth boundary.

B21—8 to 13 inches; dark brown (7.5YR 4/3) fine sandy loam, very dark brown (7.5YR 3/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; common roots; neutral; clear smooth boundary.

B22—13 to 18 inches; dark brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak coarse prismatic structure; hard, very friable; common roots; neutral; clear smooth boundary.

B3ca—18 to 28 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, very friable, common roots; common accumulations of carbonates; violent effervescence; mildly alkaline; gradual boundary.

C—28 to 43 inches; light brown (7.5YR 6/4) sandy loam, dark brown (7.5YR 4/4) moist; massive; soft, very friable; few roots; violent effervescence; mildly alkaline; clear wavy boundary.

IIC—43 to 60 inches; light brown (7.5YR 6/4) gravelly loamy sand, brown (7.5YR 5/4) moist; single grain; soft, very friable; violent effervescence; mildly alkaline.

The thickness of the solum and depth to free carbonates range from 18 to 38 inches. The mollic epipedon is from 9 to 16 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3 in hue of 10YR. It is fine sandy loam or loamy fine sand that ranges from slightly acid to mildly alkaline. The A horizon is 8 to 12 inches thick. The B2 horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 to 4 in hue of 7.5YR or 10YR. It is fine sandy loam or sandy loam that is neutral or mildly alkaline. The C horizon has value of 6 or 7 (4 to 6 moist) and chroma of 3 or 4 in hue of 7.5YR or 10YR. In some pedons it is fine sandy loam or sandy loam to a depth of 60 inches or more.

Barnum series

The Barnum series consists of deep, well drained soils that formed in alluvium. These soils are on terraces and bottom lands. Permeability is moderate. Slopes are 0 to 3 percent.

Barnum soils commonly are adjacent to Swint and Vale soils in the landscape. Swint and Vale soils have a mollic epipedon. Vale soils are on uplands.

Typical pedon of Barnum silt loam, 100 feet south and 1,980 feet west of the northeast corner of sec. 16, T. 7 N., R. 1 E.:

A11—0 to 3 inches; brown (7.5YR 5/3) silt loam, dark brown (7.5YR 3/2) moist; weak thick platy structure; slightly hard, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A12—3 to 6 inches; brown (7.5YR 5/4) very fine sandy loam, dark brown (7.5YR 4/2) moist; moderate fine granular structure; slightly hard, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C1—6 to 18 inches; light reddish brown (5YR 6/4) loam, reddish brown (5YR 4/4) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; strong effervescence; mildly alkaline; gradual boundary.

C2—18 to 26 inches; light reddish brown (5YR 6/4) loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline; gradual boundary.

C3—26 to 60 inches; light reddish brown (5YR 6/4) loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The pedon typically is calcareous to the surface but in places it is leached a few inches.

The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 to 5 in hue of 5YR or 7.5YR. It is mildly alkaline or moderately alkaline and is 3 to 6 inches thick. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 3 to 6 in hue of 10YR to 5YR. It is moderately alkaline or strongly alkaline. The C horizon is stratified throughout.

Boneek series

The Boneek series consists of deep, well drained soils that formed in silty material overlying sandstone and siltstone. These soils are on uplands and high terraces. Permeability is moderately slow in the solum and moderate in the underlying material. Slopes range from 0 to 9 percent.

Boneek soils commonly are adjacent to Butche, Lakoa, and Satanta soils in the landscape. Butche soils are shallower to sandstone than Boneek soils. Lakoa soils have an albic horizon. Satanta soils have less clay in the subsoil than Boneek soils.

Typical pedon of Boneek silt loam, 2 to 6 percent slopes, 1,100 feet west and 1,000 feet south of the northeast corner of sec. 18, T. 6 N., R. 4 E.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable; many roots; slightly acid; abrupt smooth boundary.

B21t—8 to 16 inches; brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 4/3) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, friable; many roots; slightly acid; gradual boundary.

B22t—16 to 22 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak medium or prismatic structure parting to moderate medium and fine blocky; very hard, friable; common roots; neutral; gradual boundary.

B3ca—22 to 29 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; very hard, friable; few roots; slight effervescence; mildly alkaline; clear wavy boundary.

Cca—29 to 47 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable; few roots; common fine accumulations of carbonate as soft masses, seams, and threads; strong effervescence; mildly alkaline.

Cr—47 to 60 inches; sandstone.

The solum ranges from 19 to 30 inches in thickness. Depth to free carbonates is from 10 to 24 inches. Depth to bedrock typically is 40 to 60 inches but is more than 60 inches in places.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3 in hue of 10YR or 7.5YR. It is silt loam or loam and ranges from 5 to 8 inches thick. The B21t horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 to 4 in hue of 7.5YR or 5YR. It is silty clay loam or silty clay. The B22t horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4 in hue of 10YR or 7.5YR. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 1 to 3 in hue of 10YR or 2.5Y. It is silt loam or silty clay loam.

Bridget series

The Bridget series consists of deep, well drained soils that formed in calcareous sediment. These soils are on uplands. Permeability is moderate. Slopes range from 6 to 20 percent.

Bridget soils commonly are adjacent to Canyon and Satanta soils in the landscape. Canyon soils have soft bedrock within a depth of 20 inches and generally are above Bridget soils. Satanta soils have a mollic epipedon and an argillic horizon.

Typical pedon of Bridget loam in an area of Canyon-Bridget complex, 6 to 25 percent slopes, 396 feet south and 396 feet west of the northeast corner of sec. 18, T. 7 N., R. 2 E.:

A1—0 to 8 inches; dark brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; many roots; mildly alkaline; abrupt smooth boundary.

ACca—8 to 10 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak coarse subangular blocky; soft, very friable; common roots; mildly alkaline; violent effervescence; gradual wavy boundary.

C1—10 to 17 inches; very pale brown (10YR 7/3) very fine sandy loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure; slightly hard, very friable; common roots; violent effervescence; mildly alkaline; gradual wavy boundary.

C2—17 to 29 inches; very pale brown (10YR 8/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable; few roots; violent effervescence; mildly alkaline; gradual wavy boundary.

C3—29 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; hard, very friable; mildly alkaline.

The solum ranges from 7 to 20 inches in thickness. The solum typically is leached of free carbonates to about 8 inches, but in some cultivated areas it is calcareous to the surface.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3 in hue of 10YR. It is loam, silt loam, or very fine sandy loam. The AC horizon is transitional in color between the A horizon and the upper part of the C horizon. The AC horizon is not present in some pedons. The C horizon has value of 6 to 8 (4 to 6 moist) and chroma of 2 to 4 in hue of 10YR. It is a very fine sandy loam, loam, silt loam, or fine sandy loam.

Buska series

The Buska series consists of deep, well drained soils that formed in material weathered from micaceous schist. These soils are on mountains. Permeability is moderate. Slopes range from 6 to 30 percent.

Buska soils commonly are adjacent to Hisega and Pactola soils in the landscape. Hisega soils do not have an argillic horizon and generally are above Buska soils. Pactola soils have less mica than Buska soils.

Typical pedon of Buska silt loam in an area of Buska-Rock outcrop association, hilly, 1,150 feet east and 2,400 feet north of the southwest corner of sec. 2, T. 2 N., R. 3 E.:

O—1 inch to 0; forest litter and partially decomposed forest litter.

A2—0 to 15 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak thick platy structure parting to weak medium and coarse granular; slightly hard, friable; many roots; many fine pores; 15 percent fragments of schist; neutral; gradual wavy boundary.

B&A—15 to 20 inches; grayish brown (10YR 5/2) channery silt loam, dark grayish brown (10YR 4/2) moist (B2t); grayish brown (10YR 5/2) channnery loam, very dark grayish brown (10YR 3/2) moist (A2); weak thick platy structure parting to weak fine and medium subangular blocky; hard, friable; common fine and coarse roots; many fine pores; 25 percent fragments of schist; neutral; gradual wavy boundary.

B2t—20 to 27 inches; grayish brown (2.5Y 5/2) channery silt loam, very dark grayish brown (2.5Y 3/2) moist; weak medium prismatic structure parting to moderate coarse and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine and coarse roots; common fine pores; 40 percent fragments of schist; neutral; gradual wavy boundary.

B3—27 to 37 inches; dark grayish brown (2.5Y 4/2) channery silt loam, very dark grayish brown (2.5Y 3/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine and coarse roots; common fine pores; 45 percent fragments of schist; neutral; gradual wavy boundary.

C1—37 to 42 inches; light brownish gray (2.5Y 6/2) very channery silt loam, very dark grayish brown (2.5Y 3/2) moist; weak coarse prismatic structure; hard, friable; few fine and coarse roots; common fine pores; 50 percent fragments of schist; rock structure evident; abrupt wavy boundary.

C2—42 to 60 inches; dark yellowish brown (10YR 4/4) very channery silt loam, dark yellowish brown (10YR 3/4) moist; massive; light olive gray (5Y 6/2) inherent iron stains; hard, friable; common fine pores; 80 percent fragments of schist; rock structure evident; slight effervescence; neutral.

The solum ranges from 25 to 50 inches in thickness. Free carbonates are below the solum and are generally at a depth of more than 40 inches. Fragments of schist make up 35 to 60 percent, by volume, of the solum and 50 to 80 percent of the underlying material. Depth to consolidated bedrock typically is more than 60 inches but ranges from 40 to more than 60 inches. The color value of 3 moist in the solum is inherent to the bedrock.

Some pedons have an A1 horizon less than 2 inches thick. The A2 horizon has value of 4 to 7 (3 to 6 moist) and chroma of 2 or 3 in hue of 7.5YR, 10YR, or 2.5Y. It typically is channery loam or silt loam, but it is loam or silt loam in some pedons. The A2 horizon is slightly acid or neutral and is 10 to 25 inches thick. Some pedons lack a B&A horizon. The B2t horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3 in hue of 7.5YR, 10YR, or 2.5Y. It is channery silt loam or channery loam. The B2 horizon is slightly acid or neutral. The C horizon is slightly acid to mildly alkaline.

Butche series

The Butche series consists of shallow, well drained to excessively drained soils that formed in material weathered from hard sandstone. These soils are on uplands. Permeability is moderate. Slopes range from 6 to 50 percent.

Butche soils are similar to Canyon soils and are adjacent to Lakoa and Satanta soils in the landscape. Canyon soils have free carbonates, have soft bedrock within a depth of 20 inches, and generally are below Butche soils. Lakoa soils have an argillic horizon and are more than 40 inches to bedrock. Satanta soils have a mollic epipedon, an argillic horizon, and are more than 40 inches to bedrock. Satanta soils generally have less steep slopes than Butche soils.

Typical pedon of Butche stony loam in an area of Butche-Rock outcrop complex, 25 to 50 percent slopes, 2,640 feet east and 800 feet south of the northwest corner of sec. 30, T. 6 N., R. 4 E.:

A1—0 to 3 inches; brown (10YR 5/3) stony loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; common roots; 15 percent fragments of sandstone; neutral; clear wavy boundary.

C—3 to 13 inches; brown (7.5YR 5/4) stony loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable; common roots; 15 percent fragments of sandstone; neutral; clear wavy boundary.

R—13 to 20 inches; very pale brown (10YR 7/4) and reddish yellow (7.5YR 7/8) indurated sandstone, yellowish brown (10YR 5/4) and reddish yellow (7.5YR 6/6) moist; neutral.

The depth to sandstone is from 7 to 20 inches. The soil and underlying sandstone are slightly acid to mildly alkaline. Stones commonly are on the surface. Coarse fragments in the soil above the sandstone are 10 to 30 percent by volume.

The A1 horizon has value of 4 to 6 (2 to 4 moist) and chroma of 2 or 3 in hue of 10YR or 7.5YR. It is stony loam, loam, or fine sandy loam and is 2 to 5 inches thick. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 6 in hue of 10YR, 7.5YR, or 5YR.

Canyon series

The Canyon series consists of shallow, well drained soils that formed in residuum from calcareous sandstone. These soils are on uplands. Permeability is moderate. Slopes range from 6 to 50 percent.

Canyon soils commonly are adjacent to Bridget and Satanta soils in the landscape. Bridget and Satanta soils have a mollic epipedon and are generally below Canyon soils. Satanta soils have an argillic horizon.

Typical pedon of Canyon fine sandy loam in an area of Canyon-Bridget complex, 9 to 50 percent slopes, 800 feet south and 100 feet east of the northwest corner of sec. 25, T. 7 N., R. 2 E.:

A1—0 to 3 inches; brown (10YR 5/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; very weak fine granular structure; loose, very friable; many roots; violent effervescence; moderately alkaline; clear wavy boundary.

C1—3 to 6 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; weak fine subangular blocky structure; very hard, very friable; many roots; common fine accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

C2—6 to 16 inches; white (2.5Y 8/2) very fine sandy loam, light brownish gray (2.5Y 6/2) moist; weak fine subangular blocky structure; very hard, very friable; common roots; bedding planes evident; common fine accumulations of carbonate; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—16 to 35 inches; white (2.5Y 8/2) fine grained sandstone.

The depth to bedrock is from 8 to 20 inches. The control section has an average 18 to 27 percent clay content.

The A1 horizon has value of 4 to 7 (3 to 6 moist) and chroma of 2 or 3 in hue of 10YR. It is a fine sandy loam, loam, or silt loam and is 3 to 6 inches thick. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 2 or 3 in hue of 10YR or 2.5Y. It is very fine sandy loam, loam, or silt loam.

Citadel series

The Citadel series consists of deep, well drained soils that formed in material weathered from calcareous sandstone, limestone, and soft shale. These soils are on mountain uplands. Permeability is moderately slow. Slopes range from 6 to 40 percent.

Citadel soils commonly are adjacent to Vanocker soils in the landscape. Vanocker soils do not have an argillic horizon, have less clay, and generally are below the Citadel soils.

Typical pedon of Citadel loam in an area of Citadel association, hilly, 2,300 feet south and 165 feet west of the northeast corner of sec. 1, T. 5 N., R. 1 E.:

O1—1 inch to 0; forest litter and partially decayed litter.

A1—0 to 1 inch; very dark gray (10YR 3/1) loam, black (10YR 2/l) moist; weak very fine granular structure; soft, very friable; many fine and medium roots; medium acid; abrupt smooth boundary.

A2—1 to 6 inches; light brown (7.5YR 6/3) fine sandy loam, dark brown (7.5YR 4/3) moist; weak thin and medium platy structure; soft, very friable; many fine and medium roots; medium acid; clear wavy boundary.

B&A—6 to 11 inches; reddish brown (2.5YR 4/4) loam, dark reddish brown (2.5Y 3/4) moist (B2t) with light reddish brown (5YR 6/4) very fine sandy loam, yellowish red (5YR 5/6) moist (A2); weak fine and medium subangular blocky structure; slightly hard, friable; common fine and medium roots; strongly acid; clear wavy boundary.

B21t—11 to 25 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5Y 3/4) moist; strong medium blocky structure; hard, firm, sticky and plastic; common medium and coarse roots; 10 percent by volume fragments of rock; medium acid; clear wavy boundary.

B3—25 to 40 inches; red (2.5YR 4/6) gravelly clay loam, dark reddish brown (2.5YR 3/4) moist; strong fine and medium blocky structure; hard, friable, slightly sticky and slightly plastic; 30 percent by volume fragments of rock; common accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—40 to 60 inches; red (2.5YR 5/6) cobbly loam, (2.5YR 4/6) moist; massive; soft, very friable; 35 percent by volume fragments of rock; strong effervescence; moderately alkaline.

The solum ranges from 13 to 46 inches in thickness. Depth to bedrock is from 40 to 60 inches or more. Coarse fragments of limestone and fine grained sandstone range to 25 percent, by volume, in the solum and to as much as 60 percent in the C horizon. Depth to free carbonate is from 13 to 35 inches. The solum is strongly acid to slightly acid.

The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 in hue of 10YR to 5YR. It is very fine sandy loam, loam, or silt loam and is from 0 to 3 inches thick. The A2 horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3 in hue of 10YR to 5 YR. It is fine sandy loam, loam, or silt loam and ranges from 3 to 12 inches thick. The B2t horizon has value of 4 to 6 (4 or 5 moist) and chroma of 3 to 6 in hue of 7.5YR to 2.5YR. It is clay loam or clay. The B3 horizon and the C horizon have hue of 10YR to 2.5YR.

Enning series

The Enning series consists of shallow, well drained or somewhat excessively drained soils that formed in silty sediment derived from chalky shale. These soils are on uplands. Permeability is moderate. Slopes range from 6 to 25 percent.

Enning soils commonly are adjacent to Minnequa soils in the landscape. Minnequa soils have soft bedrock between a depth of 20 and 40 inches and generally are below Enning soils.

Typical pedon of Enning silty clay loam in an area of Enning-Minnequa silty clay loams, 6 to 25 percent slopes, 1,800 feet east and 20 feet south of the northwest corner of sec. 24, T. 7 N., R. 4 E.:

A11—0 to 1 inch; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure parting to weak very fine granular; slightly hard, very friable; violent effervescence; mildly alkaline; abrupt smooth boundary.

A12—1 to 4 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak very fine and fine granular structure; slightly hard, very friable; violent effervescence; mildly alkaline; clear smooth boundary.

C1—4 to 12 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; violent effervescence; mildly alkaline; gradual smooth boundary.

C2—12 to 17 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak very thin and thin platy partially weathered shale; slightly hard, very friable; violent effervescence; mildly alkaline; gradual wavy boundary.

Cr—17 to 60 inches; light gray (2.5Y 7/2) and pale yellow (2.5Y 8/4) shale, grayish brown (2.5Y 5/2) and light yellowish brown (2.5Y 6/4) moist; common nests of gypsum; violent effervescence; mildly alkaline.

The depth to bedrock is from 10 to 20 inches. Free carbonates are at or near the surface. Calcium carbonate equivalent ranges from 65 to as much as 85 percent.

The A horizon has value of 5 to 7 (3 or 4 moist) and chroma of 2 to 4 in hue of 10YR or 2.5Y. It is silty clay loam or silt loam and is 3 to 5 inches thick. The C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 to 4 in hue of 10YR or 2.5Y. It is silt loam or silty clay loam.

Glenberg Variant

The Glenberg Variant consists of deep, well drained soils that formed in alluvial sediment derived from mountain outwash and from mine tailings. These soils are on flood plains and low terraces along creek bottoms. Permeability is moderately rapid. Slopes 0 to 4 percent.

Glenberg Variant soils commonly are adjacent to St. Onge soils in the landscape. St. Onge soils are fine-loamy and have a thicker mollic epipedon than Glenberg Variant soils.

Typical pedon of Glenberg Variant fine sandy loam, 250 feet south and 1,320 feet east of the northwest corner of sec. 2, T. 6, R. 4 E.:

A1—0 to 7 inches, dark yellowish brown (10YR 4/4) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable; many roots; neutral; clear smooth boundary.

C1—7 to 10 inches; dark yellowish brown (10YR 4/4) fine sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable; many roots; neutral; clear smooth boundary.

C2—10 to 16 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak thick platy structure; soft, very friable; common roots; strongly acid; clear smooth boundary.

C3—16 to 28 inches; pale brown (10YR 6/3) sandy loam stratified with very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; common roots; very strongly acid; clear smooth boundary.

C4—28 to 60 inches; brown (7.5YR 4/2) fine sandy loam stratified with loamy sand, dark brown (7.5YR 3/2) moist; massive; soft, very friable; few roots; very slight effervescence; extremely acid.

Glenberg Variant soils range from neutral to strongly acid in the upper 16 inches of the pedon and from strongly acid to extremely acid below 16 inches. The control section typically is fine sandy loam or sandy loam; but in some pedons, it is loam.

The A horizon has value of 4 to 7 (3 to 5 moist) and chroma of 2 or 3 in hue of 10YR or 2.5Y. The C horizon has value of 4 to 7 (3 to 5 moist) and chroma of 2 to 4 in hue of 2.5Y to 7.5YR.

Grizzly series

The Grizzly series consists of deep, well drained soils that formed in igneous material. These soils are on

mountains. Permeability is moderately slow. Slopes range from 6 to 65 percent.

Grizzly soils commonly are adjacent to Virkula soils in the landscape. Virkula soils have fewer coarse fragments in the solum than Grizzly soils.

Typical pedon of Grizzly very gravelly silt loam in an area of Grizzly-Virkula association, steep, 1,320 feet west and 1,485 feet north of the southeast corner of sec. 11, T. 4 N., R. 3 E.:

O1—2 inches to 0; forest litter and partially decayed forest litter.

A1—0 to 3 inches; dark gray (10YR 4/2) very gravelly silt loam, very dark brown (10YR 2/2) moist; weak very fine granular structure; soft, very friable; few worm casts; some decayed forest litter; 65 percent by volume coarse fragments; medium acid; clear wavy boundary.

A21—3 to 10 inches; light brownish gray (10YR 6/2) gravelly silt loam; dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; common fine to coarse roots; few worm casts; 45 percent by volume fragments of rock; medium acid; clear wavy boundary.

A22—10 to 20 inches; light gray (10YR 7/2) very gravelly silt loam, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable; common fine to coarse roots; 65 percent by volume fragments of rock; medium acid; gradual wavy boundary.

B&A—20 to 32 inches; pale brown (10YR 6/3) very gravelly clay loam, dark yellowish brown (10YR 4/4) moist (B2t), with light gray (10YR 7/2) very gravelly silt loam, brown (10YR 5/3) moist (A2); moderate fine and medium subangular blocky structure; slightly hard, friable; common fine to coarse roots; 75 percent by volume fragments of rock; medium acid; gradual wavy boundary.

B2t—32 to 42 inches; pale brown (10YR 6/3) very gravelly clay loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; common fine to coarse roots; 55 percent by volume fragments of rock; medium acid.

B3—42 to 51 inches; strong brown (7.5YR 5/6) very gravelly clay loam, strong brown (7.5YR 4/6) moist; weak medium and coarse subangular blocky structure; very hard, friable; 55 percent fragments of rock; neutral; gradual wavy boundary.

C—51 to 60 inches; pale yellow (2.5Y 7/4) very channery clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct mottles of yellowish brown (10YR 5/6); massive; very hard; 60 percent fragments of rock; neutral.

The solum ranges from 40 to more than 60 inches in thickness. Depth to bedrock typically is more than 60 inches but ranges from 40 to 60 inches or more. Depth to fractured rock containing soil material and with evidence of rock structure typically is at a depth of more than 60 inches, but is as shallow as 20 inches. Fragments of igneous rock range from 35 to as much as 80 percent at depths less than 60 inches.

The A2 horizon has value of 5 to 8 (3 to 6 moist) and chroma of 3 or 4 in hue of 10YR or 7.5YR. The B2t horizon has value of 4 to 6 (3 to 4 moist) and chroma of 4 to 6 in hue of 10YR or 7.5YR. It has an average between 35 to 45 percent clay content.

Grummit series

The Grummit series consists of shallow, well drained soils that formed in clayey material weathered from acid shale. These soils are on uplands. Permeability is moderate. Slopes range from 3 to 30 percent.

Grummit soils commonly are adjacent to Snomo soils. Snomo soils are deeper to shale than Grummit soils. They have a cambic horizon and are generally above Grummit soils.

Typical pedon of Grummit clay in an area of Grummit-Rock outcrop complex, 15 to 50 percent slopes, 60 feet south and 25 feet east of the northwest corner of sec. 12, T. 7 N., R. 4 E.:

A1—0 to 4 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; weak very fine and fine granular structure; hard, friable; many roots; many very fine fragments of shale; strongly acid; clear smooth boundary.

C1—4 to 7 inches; gray (10YR 5/1) shaly clay, very dark gray (10YR 3/1) moist; weak very fine and fine subangular blocky structure; very hard, friable; many roots; 10 percent fragments of shale; strongly acid; gradual wavy boundary.

C2—7 to 13 inches; gray (10YR 5/1) shaly clay, very dark gray (10YR 3/1) moist; weak fine and medium subangular blocky structure; very hard, friable; many roots; 40 percent fragments of shale; strongly acid; clear wavy boundary.

Cr—13 to 60 inches; gray (10YR 5/1) clay shale, very dark gray (10YR 3/1) moist; yellow (2.5Y 8/6) and yellowish red (5YR 5/6) stains on faces of fragments of shale, light olive brown (2.5Y 5/6) and yellowish red (5YR 4/6) moist; very strongly acid.

The depth to shale typically is 10 to 18 inches and ranges from 5 to 20 inches. Colors throughout the profile are inherited from the shale. Horizons above the shale are 55 to 65 percent clay content. The soil is strongly acid to extremely acid.

The A1 horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2 in hue of 10YR or 2.5Y. The C horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2 in hue of 10YR to 5Y. Weathered fragments of shale make up as much as 20 percent, by volume, of the

upper part of the C horizon and from 30 to 50 percent of the lower part of the C horizon.

Gypnevee series

The Gypnevee series consists of deep, well drained soils that formed in residuum weathered from gypsum bedrock. These soils are on uplands. Permeability is moderate. Slopes range from 6 to 20 percent.

Gypnevee soils commonly are adjacent to Nevee and Rekop soils in the landscape. Nevee soils formed in material in which gypsum was not present. Rekop soils are underlain by bedrock at a depth of 10 to 20 inches.

Typical pedon of Gypnevee loam in an area of Gypnevee-Rekop loams, 6 to 25 percent slopes, 2,970 feet east and 50 feet south of the northwest corner of sec. 6, T. 6 N., R. 1 E.:

A11—0 to 2 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; weak medium platy structure parting to weak fine and medium granular; hard, friable; abundant roots; violent effervescence; mildly alkaline; abrupt smooth boundary.

A12—2 to 7 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; weak very thick platy structure parting to weak coarse subangular blocky; hard, friable; plentiful roots; violent effervescence; mildly alkaline; abrupt smooth boundary.

AC—7 to 13 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure; hard, friable; few fine threads of gypsum; few roots; violent effervescence; mildly alkaline; gradual smooth boundary.

C1—13 to 19 inches; reddish yellow (5YR 7/6) silt loam, yellowish red (5YR 5/6) moist; massive; slightly hard, friable; common fine irregularly shaped white crystals of gypsum; violent effervescence; mildly alkaline; gradual smooth boundary.

C2—19 to 50 inches; light red (2.5YR 6/6) silt loam, red (2.5YR 5/6) moist; massive; slightly hard, friable; common fine pinkish white (5YR 8/2) threads of gypsum; violent effervescence; mildly alkaline; gradual smooth boundary.

C3—50 to 60 inches; light red (2.5YR 6/6) silt loam, red (2.5YR 4/6) moist; massive; slightly hard, friable; common medium irregularly shaped white crystals of gypsum; violent effervescence; mildly alkaline.

The depth to bedrock is 40 to more than 60 inches. Free carbonates are at or within a few inches in depth of the surface.

The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 3 to 6 in hue of 10YR to 5 YR. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 3 to 6 in hue of 10YR to 5YR. It has a large amount of free carbonate and gypsum crystals.

Higgins series

The Higgins series consists of deep, very poorly drained soils that formed in silty alluvium very high in gypsum. These soils are on alluvial fans and bottom lands. Permeability is moderate. Slopes are 0 to 2 percent.

Higgins soils commonly are adjacent to Barnum soils in the landscape. Barnum soils do not have gypsum.

Typical pedon of Higgins silt loam, 2,400 feet west and 750 feet north of the southeast corner of sec. 16, T. 7 N., R. 1 E.:

A1—0 to 3 inches; light gray (10YR 7/2) silt loam; dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; many fine and medium roots; violent effervescence (16 percent calcium carbonate); mildly alkaline; clear smooth boundary.

C1ca—3 to 9 inches; white (2.5Y 8/1) silt, light brownish gray (2.5Y 6/2) moist; few fine distinct mottles of yellowish brown (10YR 5/6) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; common fine roots; many very fine crystals of gypsum; violent effervescence (16 percent calcium carbonate); mildly alkaline; gradual smooth boundary.

C2ca—9 to 25 inches; white (2.5Y 8/1) silt, light brownish gray (2.5Y 6/2) moist; few fine distinct mottles of yellowish brown (10YR 5/6) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; common fine roots; many very fine crystals of gypsum; violent effervescence (11 percent calcium carbonate); mildly alkaline; gradual smooth boundary.

C3ca—25 to 35 inches; white (2.5Y 8/1) silt; light gray (2.5Y 7/2) moist; few fine faint mottles of yellowish brown (10YR 5/6) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; few fine roots; many fine crystals of gypsum; violent effervescence (16 percent calcium carbonate); mildly alkaline; gradual smooth boundary.

C4—35 to 60 inches; light gray (2.5Y 7/2) and (N 7/0) silt; light brownish gray (2.5Y 6/2) with streaks of gray (N 6/0) moist; massive; slightly hard; very friable; many fine crystals of gypsum (5 percent calcium carbonate); mildly alkaline; gradual smooth boundary.

Typically, carbonates are at or within a depth of 5 inches of the surface. In the C horizon, carbonates and gypsum range from 40 to more than 60 percent.

The A horizon has value of 5 to 7 (3 to 6 moist) and chroma of 1 or 2 in hue of 7.5YR to 2.5Y. Typically, it is silt or silt loam but is loam in some pedons. The Cca horizon has value of 6 to 8 (5 to 7 moist) and chroma of 1 or 2 in hue of 7.5YR to 2.5Y. The C horizon is neutral to 2.5Y in hue.

Hisega series

The Hisega series consists of deep, well drained soils that formed in material weathered from micaceous schist. These soils are on mountains. Permeability is moderate. Slopes range from l5 to 65 percent.

Hisega soils commonly are adjacent to Buska and Pactola soils in the landscape. Buska soils have an argillic horizon and generally are above Hisega soils. Pactola soils have an argillic horizon and generally have less steep slopes than Hisega soils.

Typical pedon of Hisega loam in an area of Hisega-Rock outcrop association, steep, 660 feet east and 1,240 feet south of the northwest corner of sec. 34, T. 3 N., R. 3 E.:

O1—1 inch to 0; forest litter and partially decayed litter.

A1—0 to 4 inches; light olive brown (2.5Y 5/4) loam, black (2.5Y 2/2) moist; weak medium and coarse subangular blocky structure; soft, very friable; many fine and medium roots; 10 percent by volume schist fragments; neutral; clear wavy boundary.

B2—4 to 19 inches; brown (10YR 4/3) channery loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; soft, very friable; many fine and medium roots; 20 percent by volume schist fragments; slightly acid; clear wavy boundary.

C1—19 to 30 inches; brown (10YR 5/3) channery loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable; many medium and coarse roots; 50 percent by volume schist fragments scattered randomly; neutral; gradual wavy boundary.

C2—30 to 60 inches; grayish brown (2.5Y 5/2) very flaggy loam; dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable; common medium roots along fractures and cleavage planes of the bedrock; 80 percent by volume schist fragments oriented toward the northwest at about 65 degrees; neutral.

The solum ranges from 10 to 19 inches in thickness. Some pedons have free carbonates below a depth of 40 inches. Depth to consolidated schist is 40 to 60 inches or more. Fragments of schist are from 15 to as much as 50 percent, by volume, in the solum and from 50 to as much as 80 percent in the C horizon. Color value of 3 moist in the B horizon and C horizon are inherent to the bedrock.

The A1 horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 to 3 in hue of 7.5YR, 10YR, or 2.5Y. It is loam, silt loam, channery loam, or channery silt loam and is slightly acid or neutral. It is 1 inch to 3 inches thick. The B2 horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4 in hue of 7.5YR, 10YR, or 2.5Y. It is channery loam or channery silt loam and is slightly acid or neutral. The C horizon has the same range of colors as the B2 horizon. It is very channery loam, very channery silt loam, very flaggy loam, or very flaggy silt loam. It is slightly acid to mildly alkaline.

Hisle series

The Hisle series consists of moderately deep, well drained soils that formed in alluvium and material weathered from clay shale. These soils are on uplands. Permeability is very slow. Slopes are 0 to 3 percent.

Hisle soils commonly are adjacent to Grummit, Kyle, and Pierre soils in the landscape. Those soils do not have a natric horizon.

Typical pedon of Hisle silt loam in an area of Hisle-Slickspots complex, 0 to 3 percent slopes, 25 feet north and 1,100 feet east of the southwest corner of sec. 1, T. 7 N., R. 4 E.:

A2—0 to 2 inches; gray (10YR 6/1) silt loam, dark grayish brown (10YR 4/2) moist; weak thick platy structure parting to weak very fine granular; slightly hard, friable; common roots; few pebbles on the surface; slightly acid; abrupt wavy boundary.

B21t—2 to 4 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium columnar structure parting to moderate medium and coarse blocky; extremely hard, very firm; few roots; shiny films on surfaces of peds; light gray (10YR 7/1) silt coatings on column tops, dark grayish brown (10YR 4/2) moist; mildly alkaline; clear smooth boundary.

B22t—4 to 10 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate fine and medium blocky; extremely hard, very firm; few roots; shiny films on surfaces of peds; moderately alkaline; clear wavy boundary.

B3ca—10 to 15 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; extremely hard, very firm; few roots; few fine accumulations of carbonates; slight effervescence; moderately alkaline; gradual wavy boundary.

C1casa—15 to 25 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak coarse subangular blocky structure; extremely hard, very firm; few roots; common fine accumulations of carbonate and salts; slight effervescence; moderately alkaline; gradual wavy boundary.

Csacs—25 to 36 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; massive; extremely hard, very firm; common accumulations of salts and gypsum; very slight effervescence; moderately alkaline; gradual wavy boundary.

Cr—36 to 60 inches; light gray (10YR 6/1) fractured soft shale.

The solum ranges from 5 to 26 inches in thickness. Depth to shale is from 20 to 40 inches. Depth to carbonate is from 4 to 18 inches but typically is less than 12 inches.

The A2 horizon has value of 5 or 6 (4 or 5 moist) and chroma of 1 or 2 in hue of 10YR or 2.5Y. It is loam or silt loam. The B horizon has value of 5 to 7 (4 to 6 moist) and chroma of 1 to 3 in hue of 10YR to 5Y. It is clay or silty clay and has an average 50 and 60 percent clay content. Accumulations of salts and carbonates are in the lower part of the B horizon or in the C horizon.

Kyle series

The Kyle series consists of deep, well drained soils that formed in clay sediment weathered from clay shale. These soils are on uplands. Permeability is very slow. Slopes range from 0 to 6 percent.

Kyle soils commonly are adjacent to Hisle and Pierre soils in the landscape. Hisle soils have a natric horizon. Pierre soils are shallower to shale than Kyle soils.

Typical pedon of Kyle clay, 2 to 6 percent slopes, 2,500 feet west and 370 feet south of the northeast corner of sec. 17, T. 6 N., R. 4 E.:

A11—0 to 2 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure parting to moderate fine granular; hard, friable; many 1/2 inch cracks, 2 to 6 inches apart at surface; neutral; abrupt wavy boundary.

A12—2 to 5 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; very hard, firm; neutral; abrupt wavy boundary.

B2—5 to 14 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure parting to weak very coarse subangular blocky; extremely hard, very firm; shiny films on surfaces of peds; slight effervescence; mildly alkaline; clear wavy boundary.

B3ca—14 to 20 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak very coarse subangular blocky structure; extremely hard, very firm; shiny films on surfaces of peds; few medium accumulations of carbonate; slight effervescence; mildly alkaline; gradual boundary.

C1—20 to 28 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; massive; extremely hard, very firm; slight effervescence; moderately alkaline; gradual boundary.

C2—28 to 40 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; massive; extremely hard, very firm; few fine accumulations of salt; slight effervescence; mildly alkaline; gradual boundary.

C3—40 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm; slight effervescence; mildly alkaline.

The solum ranges from 18 to 30 inches in thickness. Depth to shale is more than 40 inches.

The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 to 3 in hue of 2.5Y or 5Y. It is clay and ranges from 2 to 6 inches in thickness. The B horizon has value of 5 or 6 (4 or 5 moist) and chroma of 1 to 3 in hue of 2.5Y or 5Y. The B horizon has an average 60 to 65 percent clay content.

Lakoa series

The Lakoa series consists of deep, well drained soils that formed in material weathered from interbedded sandstone and shale. These soils are on uplands. Permeability is moderate. Slopes range from 25 to 50 percent.

Lakoa soils commonly are adjacent to Butche and Maitland soils in the landscape. Butche soils have less clay, are less than 20 inches deep to bedrock, and generally are below the Lakoa soils. Maitland soils have thicker and darker A1 horizons than Lakoa soils.

Typical pedon of Lakoa silt loam, 25 to 50 percent slopes, 2,150 feet south and 800 feet east of the northwest corner of sec. 3l, T. 7 N., R. 3 E.:

O—2 inches to 0; forest litter and partially decomposed forest litter; abrupt smooth boundary.

A2—0 to 3 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure; slightly hard, very friable; many roots; strongly acid; clear wavy boundary.

B&A—3 to 6 inches; yellowish brown (10YR 5/4) loam, dark brown (7.5YR 4/2) moist (B); light brownish gray (10YR 6/2) coatings and masses, dark brownish gray (10YR 4/2) moist (A); weak medium and coarse subangular blocky structure; hard, friable; many roots; many fragments of rock from 1/8 inch to 2 inches in diameter; medium acid; clear wavy boundary.

B21t—6 to 15 inches; brown (7.5YR 5/4) and (10YR 5/3) clay loam, dark brown (7.5YR 4/4) and (10YR 4/3) moist; weak coarse and medium prismatic structure parting to strong fine and medium blocky; very hard, firm; shiny films on surfaces of peds, common roots; few pebbles; medium acid; clear wavy boundary.

B22t—15 to 26 inches; yellowish brown (10YR 5/4) and reddish yellow (7.5YR 6/6) clay loam, dark brown (10YR 4/4) and strong brown (7.5YR 5/6) moist; weak coarse and medium prismatic structure parting to strong fine and medium blocky; very hard, firm; shiny films on faces of peds; about 15 percent fragments of sandstone; common roots; medium acid; clear wavy boundary.

B23t—26 to 30 inches; brown (7.5YR 5/4) and very pale brown (10YR 7/4) sandy clay loam, dark brown (7.5YR 4/4) and brownish yellow (10YR 6/6) moist;

moderate fine blocky structure; very hard, friable; about 15 percent fragments of sandstone; common roots; medium acid; clear wavy boundary.

C1—30 to 42 inches; brown (7.5YR 5/4) and very pale brown (10YR 7/4) sandy loam, dark brown (7.5YR 4/4) and light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable; about 15 percent fragments of sandstone; medium acid; gradual wavy boundary.

R—42 to 60 inches; very pale brown (10YR 7/4) sandstone, yellowish brown (10YR 5/4) moist; brown (7.5YR 5/2) stains along fractures, dark brown (7.5YR 3/2) moist.

The solum ranges from 16 to 41 inches in thickness. The solum is strongly acid to neutral. Depth to bedrock is 40 to more than 60 inches. Content of coarse fragments is from 5 to as much as 20 percent, by volume, in the lower part of the B horizon and the C horizon. Depth to carbonates is from 36 to more than 60 inches. A thin A1 horizon is in places where plant cover is established.

The A2 horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 or 3 in hue of 10YR. It is silt loam, loam, or very fine sandy loam. Interfingering of the A2 horizon into the B2t horizon is common. The A2 horizon is 2 to 8 inches thick. The B2t horizon has value of 5 to 7 (4 to 6 moist) and chroma of 3 to 6 in hue of 7.5YR or 10YR. It ranges from clay loam to sandy clay and has an average 27 to 35 percent clay content.

Maitland series

The Maitland series consists of deep, well drained soils that formed in material weathered from interbedded sandstone, limestone, and shale. These soils are on uplands. Permeability is moderate. Slopes range from 2 to 50 percent.

Maitland soils commonly are near Citadel and Lakoa soils in the landscape. Citadel and Lakoa soils have a thinner, lighter colored A1 horizon than Maitland soils. In addition, Citadel soils have a more clayey subsoil than Maitland soils.

Typical pedon of Maitland loam, 9 to 50 percent slopes, 2,500 feet west and 400 feet north of the southeast corner of sec. 18, T. 6 N., R. 4 E.:

O1—1 inch to 0; partially decomposed leaves and roots; medium acid; abrupt smooth boundary.

A1—0 to 7 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, very friable; many roots; medium acid; clear wavy boundary.

A2—7 to 11 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; very weak thin platy structure parting to weak fine crumb; very hard, very friable; common roots; medium acid; gradual wavy boundary.

B&A—11 to 16 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist (B); many light brownish gray (10YR 6/2) silt coatings and masses, dark brown (10YR 4/3) moist (A); moderate fine subangular blocky structure; hard, friable; few roots; some gray (10YR 5/1) organic coats on surfaces of peds, very dark gray (10YR 3/1) moist; strongly acid; clear wavy boundary.

B21t—16 to 25 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 4/4) moist; very weak coarse prismatic structure parting to moderate to strong medium and fine subangular blocky and blocky; hard, friable; shiny films on surfaces of peds; few roots; strongly acid; clear wavy boundary.

B22t—25 to 36 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate coarse prismatic structure parting to moderate to strong medium and coarse subangular blocky; hard, friable; shiny films on surfaces of peds; few roots; strongly acid; gradual wavy boundary.

B23t—36 to 44 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; moderate coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable; shiny films on surfaces of peds; few roots; strongly acid; clear wavy boundary.

C1—44 to 52 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; common medium yellow (10YR 7/6) mottles; yellowish brown (10YR 5/6) moist; massive; hard, very friable; very few roots; medium acid; clear wavy boundary.

C2—52 to 60 inches; pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) loam, brown (10YR 5/3) and dark yellowish brown (10YR 4/4) moist; massive; hard, very friable; many accumulations of carbonates; strong effervescence; mildly alkaline.

The solum ranges from 25 to 53 inches in thickness. The solum is slightly acid to strongly acid.

The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is loam or very fine sandy loam. The A2 horizon has value of 6 to 7 (4 or 5 moist) and chroma of 2 or 3 in hue of 7.5YR or 10YR. The B2t horizon has value of 5 to 7 (4 or 5 moist) and chroma of 3 to 6 in hue of 5YR to 10YR. It is clay loam or loam and has an average 25 to 35 percent clay content.

Marshdale series

The Marshdale series consists of deep, poorly drained soils that formed in alluvium transported from surrounding mountain uplands. These soils are on terraces and bottom lands. Permeability is moderately slow. Slopes range from 2 to 10 percent.

Marshdale soils are near Citadel and Vanocker soils in the landscape. Citadel and Vanocker soils are on adjacent steeper slopes and do not have a water table.

Typical pedon of Marshdale loam in an area of Marshdale-Maitland association, sloping, 680 feet south and 1,815 feet west of the northeast corner of sec. 27, T. 3 N., R. 5 E.:

A11—0 to 10 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak thin and medium platy structure parting to weak fine and medium granular; slightly hard, very friable; many roots; mildly alkaline; clear wavy boundary.

A12—10 to 25 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; common roots; mildly alkaline; gradual wavy boundary.

B21g—25 to 35 inches; gray (10YR 5/1) clay loam, dark gray (10YR 4/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few roots; mildly alkaline; diffuse wavy boundary.

B22g—35 to 60 inches; gray (10YR 5/1) clay loam, dark gray (10YR 4/1) moist; fine distinct mottles of dark yellowish brown (10YR 4/6) moist; massive; very hard, firm; few roots; mildly alkaline.

The mollic epipedon is 24 to 50 inches thick. Depth to uniformly calcareous material is 40 inches or more.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3 and is neutral or has hue of 5Y to 7.5YR. It is loam or clay loam. the B2g horizon has value of 5 to 7 (4 to 6 moist) and chroma of 1 to 3. It is neutral or has hue of 5Y to 7.5YR.

Midway series

The Midway series consists of shallow, well drained soils that formed in material weathered from clay shale. These soils are on uplands. Permeability is slow. Slopes range from 6 to 25 percent.

Midway soils commonly are adjacent to Canyon and Razor soils in the landscape. Canyon soils are loamy and generally are above Midway soils. Razor soils are underlain by shale at a depth of 20 to 40 inches.

Typical pedon of Midway silty clay loam, in an area of Midway-Razor silty clay loams, 6 to 25 percent slopes, 1,820 feet west and 830 feet north of the southeast corner of sec. 16, T. 6 N., R. 4 E.:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate very fine and fine granular structure; slightly hard, very friable; many roots; neutral; abrupt smooth boundary.

AC—2 to 6 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; hard, very firm; many roots; slight effervescence; moderately alkaline; clear smooth boundary.

C1—6 to 11 inches; pale yellow (2.5Y 8/4) and grayish brown (2.5Y 5/2) silty clay, light brownish gray (2.5Y 6/2) and dark grayish brown (2.5Y 4/2) moist; weak very fine and fine subangular blocky structure; hard, friable; common roots; strong effervescence; moderately alkaline; clear wavy boundary.

C2—11 to 16 inches; pale yellow (2.5Y 8/4) and light olive gray (5Y 6/2) silty clay, light yellowish brown (2.5Y 6/4) and olive gray (5Y 5/2) moist; massive; hard, friable; common roots; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—16 to 30 inches; pale yellow (2.5Y 7/4 and 8/4) and light olive gray (5Y 6/2) shale, light yellowish brown (2.5Y 6/4), light olive brown (2.5Y 5/4), and olive gray (5Y 5/2) moist; few roots along fractures; violent effervescence; moderately alkaline.

Bedrock is at a depth of 6 to 20 inches. Typically, Midway soils have free carbonates to the surface, but in some pedons carbonates are leached a few inches in depth.

The A horizon has value of 3 to 6 (2 to 5 moist) an chroma of 2 or 3 in hue of 10YR or 2.5Y. It is 2 to 6 inches thick. Where values are darker than 5 (3.5 moist), the A horizon is less than 4 inches thick. The C horizon has value of 5 to 8 (4 to 6 moist) and chroma of 2 to 4 in hue of 10YR to 5Y.

Minnequa series

The Minnequa series consists of moderately deep, well drained soils that formed in loamy sediment derived from calcareous shale. These soils are on uplands. Permeability is moderate. Slopes range from 6 to 25 percent.

Minnequa soils commonly are adjacent to Enning soils in the landscape. Enning soils are shallow and generally are above the Minnequa soils.

Typical pedon of Minnequa silty clay loam in an area of Enning-Minnequa silty clay loams, 6 to 25 percent slopes, 1,780 feet east and 20 feet south of the northwest corner of sec. 24, T. 7 N., R. 4 E.:

A11—0 to 3 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak very fine and fine granular; slightly hard, friable; many roots; violent effervescence; mildly alkaline; abrupt smooth boundary.

A12—3 to 5 inches; pale brown (10YR 6/3) silty clay loam; brown (10YR 4/3) moist; weak fine and medium granular structure; hard, friable; common

roots; violent effervescence; mildly alkaline; gradual smooth boundary.

AC—5 to 15 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable; common roots; violent effervescence; mildly alkaline; gradual smooth boundary.

C1—15 to 26 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, friable; few roots; violent effervescence; mildly alkaline; abrupt smooth boundary.

Cr—26 to 60 inches; pale yellow (2.5Y 7/3) shale, light olive brown (2.5Y 5/4) moist; very hard, friable; few roots along fracture; many fine and medium prominent crystals of gypsum; violent effervescence; mildly alkaline.

The depth to shale is 20 to 40 inches. Free carbonates are at the surface or within a depth of 3 inches.

The A horizon has value of 5 to 8 (3 to 7 moist) and chroma of 1 to 4 in hue of 5Y to 7.5YR. It is silty clay loam or silt loam. The C horizon has value of 5 to 8 (3 to 7 moist) and chroma of 1 to 4 in hue of 5Y to 7.5YR.

Nevee series

The Nevee series consists of deep, well drained soils that formed in material weathered from reddish silty shale, siltstone, or sandstone. These soils are on terraces and uplands. Permeability is moderate. Slopes range from 2 to 15 percent.

Nevee soils commonly are adjacent to Spearfish, Tilford, and Vale soils in the landscape. Spearfish soils are underlain by shale and siltstone at a depth of 10 to 20 inches and are on the higher parts of the landscape. Tilford and Vale soils have a mollic epipedon.

Typical pedon of Nevee silt loam, 6 to 9 percent slopes, 460 feet west and 2,375 feet north of the southeast corner of sec. 19, T. 7 N., R. 2 E.:

A11—0 to 3 inches; reddish brown (5YR 4/4) silt loam, dark reddish brown (5YR 3/3) moist; weak thin platy structure parting to weak very fine granular; soft, very friable; many roots; violent effervescence; neutral; abrupt smooth boundary.

A12—3 to 6 inches; reddish brown (5YR 4/4) silt loam, dark reddish brown (5YR 3/4) moist; weak coarse subangular blocky structure; soft, very friable; many roots; slight effervescence; neutral; clear wavy boundary.

C1ca—6 to 25 inches; reddish yellow (5YR 6/6) silt loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable; common roots; common fine accumulations of carbonate; violent effervescence; mildly alkaline; clear wavy boundary.

C2—25 to 41 inches; yellowish red (5YR 5/6) silt loam, red (2.5YR 4/6) moist; massive; soft, very friable; few roots; violent effervescence; mildly alkaline; clear wavy boundary.

C3s—41 to 60 inches; red (2.5YR 5/6) silt loam, red (2.5YR 4/6) moist; soft, very friable; strong effervescence; mildly alkaline.

The depth to silty shale, siltstone, or sandstone is more than 40 inches. Depth to free carbonates is less than 10 inches.

The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 to 4 in hue of 5YR or 10YR. The A horizon typically is silt loam, but in some pedons it is loam or very fine sandy loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 3 to 6 in hue of 2.5YR to 7.5YR.

Nihill series

The Nihill series consists of deep, excessively drained soils that formed in alluvium. These soils are on edges of upland terraces. Permeability is moderately rapid. Slopes range from 6 to 25 percent.

Nihill soils commonly are near Alice and Satanta soils in the landscape. Alice and Satanta soils have less gravel in the upper part of the profile than Nihill soils.

Typical pedon of Nihill gravelly loam, 6 to 25 percent slopes, 1,150 feet east and 150 feet south of the northwest corner of sec. 12, T. 7 N., R. 3 E.:

A1—0 to 8 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable; many roots; about 20 percent gravel coated with carbonates; violent effervescence; mildly alkaline; clear wavy boundary.

C1—8 to 12 inches; light gray (10YR 7/2) very gravelly sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; few roots; about 50 percent gravel coated with carbonates; violent effervescence; mildly alkaline; gradual wavy boundary.

C2—12 to 60 inches; very pale brown (10YR 7/4) very gravelly sandy loam, light yellowish brown (10YR 6/4) moist; massive; loose, very friable; violent effervescence; mildly alkaline.

Gravel is within a depth of 10 inches. Gravel is 35 to 70 percent, by volume, in the control section. Very thin coatings of carbonates are on the undersides of some of the gravel.

The A horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 or 3 in hue of 10YR or 2.5Y. It is gravelly sandy loam or gravelly loam 6 to 10 inches thick. The C horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 to 4 in hue of 10YR or 2.5Y. It is very gravelly sandy loam to very gravelly clay loam.

Nunn series

The Nunn series consists of deep, well drained soils that formed in alluvium on upland terraces. Permeability is moderately slow. Slopes range from 2 to 9 percent.

Nunn soils commonly are adjacent to Kyle, Pierre, and Savo soils in the landscape. Kyle and Pierre soils have more clay in the solum than Nunn soils, and Savo soils have less sand than Nunn soils. Kyle, Pierre, and Savo soils are in the lower part of the landscape.

Typical pedon of Nunn clay loam, 0 to 2 percent slopes, 230 feet north and 1,565 feet west of the southeast corner of sec. 12, T. 7 N., R. 4 E.:

Ap—0 to 5 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; very hard, firm; slightly acid; abrupt smooth boundary.

B21t—5 to 12 inches; dark grayish brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to moderate medium and coarse blocky and subangular blocky; very hard, firm; neutral; clear wavy boundary.

B22t—12 to 17 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate medium and coarse blocky; very hard, firm; common medium accumulations of carbonate; slight effervescence; moderately alkaline; clear wavy boundary.

B3ca—17 to 25 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; very hard, firm; common distinct accumulations of carbonate; slight effervescence; moderately alkaline; gradual wavy boundary.

Cca—25 to 60 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; massive; very hard, firm; common distinct accumulations of carbonate in seams and threads; strong effervescence; mildly alkaline.

The solum ranges from 16 to 40 inches in thickness. Depth to free carbonates is from 10 to 25 inches. The mollic epipedon is 7 to 19 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is clay loam 4 to 8 inches thick. The B2t horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3 in hue of 7.5YR, 10YR, or 2.5Y. It is clay loam or clay and has an average 35 to 50 percent clay content. The B3ca and Cca horizons have common to many accumulations of carbonate.

Pactola series

The Pactola series consists of deep, well drained soils that formed in material weathered from metamorphic material. These soils are on mountains. Permeability is moderate. Slopes range from 6 to 60 percent.

Pactola soils commonly are adjacent to Buska and Hisega soils in the landscape. Buska and Hisega soils have more mica than Pactola soils. Hisega soils do not have an argillic horizon and generally are on steeper slopes than Pactola soils.

Typical pedon of Pactola loam, in an area of Pactola-Rock outcrop association, hilly, 550 feet north and 1,340 feet west of the southeast corner of sec. 11, T. 2 N., R. 4 E.:

O1—1 inch to 0; forest litter and partially decayed litter.

A1—0 to 2 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak thin platy structure parting to weak very fine granular; soft, very friable; many fine roots; few fine fragments of soft slate; slightly acid; abrupt smooth boundary.

A2—2 to 9 inches; light gray (10YR 7/2) channery silt loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure; soft, very friable; many fine and medium roots; 45 percent by volume of fragments of soft slate; medium acid; clear wavy boundary.

B&A—9 to 22 inches; grayish brown (10YR 5/2) channery clay loam, dark grayish brown (10YR 4/2) moist (B2t) and light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist (A2); weak fine and medium subangular blocky structure; slightly hard, friable; common fine and medium roots; 50 percent by volume fragments of soft slate; medium acid; gradual wavy boundary.

B2t—22 to 45 inches; brown (10YR 5/3) very flaggy clay loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure of fine earth; slightly hard, firm, slightly sticky and slightly plastic; common fine to coarse roots; 75 percent by volume fragments of soft slate; medium acid; diffuse wavy boundary.

C—45 to 60 inches; light olive brown (2.5Y 5/3) very flaggy silt loam, very dark grayish brown (2.5Y 3/2) moist; massive; soft, friable; few medium and coarse roots; 75 percent of fragments of soft slate; slightly acid.

The solum ranges from 21 to 58 inches in thickness. Metamorphic rock with soil material between bedding planes and along fractures is at a depth of less than 40 inches. Some parts of the solum are 35 to 70 percent, by volume, fragments of metamorphic rock. The chroma is inherent to the parent material.

The A2 horizon has value of 5 to 7 (3 to 6 moist) and chroma of 1 to 3 in hue of 10YR or 2.5Y. Some pedons have an A1 horizon 1 inch to 2 inches thick. The color range of the B horizon and A horizon is similar to that of the B2t horizon and A2 horizon. The B2t horizon has value of 5 to 7 (4 to 6 moist) and chroma of 3 to 5 in hue of 10YR or 2.5Y.

Paunsaugunt series

The Paunsaugunt series consists of shallow, well drained or somewhat excessively drained soils that formed in material weathered from limestone. These soils are on mountain uplands. Permeability is moderately rapid. Slopes range from 6 to 50 percent.

Paunsaugunt soils commonly are adjacent to Citadel and Vale soils in the landscape. Citadel soils have an argillic horizon, are deeper to limestone bedrock than Paunsaugunt soils and generally are above Paunsaugunt soils. Vale soils have an argillic horizon and generally are below Paunsaugunt soils.

Typical pedon of Paunsaugunt gravelly silt loam in an area of Paunsaugunt-Rock outcrop complex, 6 to 50 percent slopes, 1,000 feet north and 1,200 feet west of the southeast corner of sec. 36, T. 7 N., R. 4 E.:

A11—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; 15 percent by volume fragments of limestone; strong effervescence; mildly alkaline; gradual wavy boundary.

A12—5 to 10 inches; dark grayish brown (10YR 4/2) channery loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; 35 percent by volume fragments of limestone; violent effervescence; mildly alkaline; clear smooth boundary.

C—10 to 17 inches; pink (7.5YR 7/3) channery loam, brown (7.5YR 5/3) moist; massive; soft, very friable; violent effervescence; mildly alkaline; abrupt smooth boundary.

R—17 to 30 inches; light brownish gray (10YR 6/2) hard limestone; cracks in upper part filled with material from the C horizon; brown (7.5YR 5/2) and weak red (10R 5/4) coatings on fracture faces.

The depth to bedrock is 10 to 20 inches. The profile is commonly calcareous to the surface, and fragments of limestone range from 35 to as much as 50 percent in the control section.

The A horizon has value of 4 or 5 (2 or 3 moist) and hue of 10YR or 7.5YR. It is gravelly silt loam or gravelly loam. The C horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3 in hue of 10YR or 7.5YR. Channery loam interfingers into cracks in the bedrock.

Pierre series

The Pierre series consists of moderately deep, well drained soils that formed in clay material weathered from clay shale. These soils are on uplands. Permeability is very slow. Slopes range from 2 to 25 percent.

Pierre soils commonly are adjacent to Hisle and Kyle soils. Hisle soils have a natric horizon. Kyle soils are deeper to shale than Pierre soils.

Typical pedon of Pierre clay, 6 to 25 percent slopes, 1,050 feet east and 1,600 feet north of the southwest corner of sec. 6, T. 6 N., R. 4 E.:

A1—0 to 3 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak medium and fine subangular blocky structure; very hard, firm; 12 percent cobblestones; neutral; abrupt smooth boundary.

B21—3 to 8 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; extremely hard, firm; neutral; gradual wavy boundary.

B22—8 to 15 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak very coarse prismatic structure parting to weak coarse and medium subangular blocky; extremely hard, firm; shiny coatings on surfaces of peds; light olive brown (2.5Y 5/4) common medium distinct stains, olive brown (2.5Y 4/4) moist; slight effervescence; mildly alkaline; gradual wavy boundary.

B3ca—15 to 20 inches; gray (5Y 6/1) clay, gray (5Y 5/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; extremely hard, firm; olive gray (5Y 5/2) common medium distinct stains, olive gray (5Y 4/2) moist; many fine shale fragments; few accumulations of carbonate in seams; slight effervescence; mildly alkaline; gradual wavy boundary.

C2cs—20 to 29 inches; gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; partially weathered shale; extremely hard, firm; pale olive (5Y 6/4) common medium distinct stains, olive (5Y 4/4) moist; many crystals of gypsum; mildly alkaline; gradual wavy boundary.

Cr—29 to 60 inches; light brownish gray (2.5Y 6/2) shale, olive brown (2.5Y 4/4) moist; light yellowish brown (2.5Y 6/4) stains, grayish brown (2.5Y 5/2) moist; neutral.

The solum ranges from 15 to 30 inches in thickness. Free carbonates are at or near the surface. Depth to shale is 20 to 40 inches. The surfaces of most pedons are 8 to 15 percent cobblestones as much as 10 inches in diameter.

The A horizon has value of 5 or 6 (4 or 5 moist) and chroma of 1 to 3 in hue of 2.5Y or 5Y. It is 3 to 7 inches thick. The B horizon has value of 5 or 6 (4 or 5 moist) and chroma of 1 to 3 in hue of 2.5Y or 5Y. It has an average of about 60 percent clay content. The C horizon has weathered shale fragments, gypsum, and salts.

Razor series

The Razor series consists of moderately deep, well drained soils that formed in material weathered from clay shale. These soils are on uplands. Permeability is slow. Slopes range from 6 to 15 percent.

Razor soils commonly are adjacent to Midway soils. Midway soils are underlain by shale at a depth of 6 to 20 inches.

Typical pedon of Razor silty clay loam, in an area of Midway-Razor silty clay loams, 6 to 25 percent slopes, 1,820 feet west and 930 feet north of the southeast corner of sec. 16, T. 6 N., R. 4 E.:

A1—0 to 3 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine and medium granular structure; hard, very friable; abundant roots; mildly alkaline; abrupt smooth boundary.

B2—3 to 6 inches; gray (2.5Y 5/1) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; plentiful roots; mildly alkaline; abrupt wavy boundary.

B3ca—6 to 16 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few roots; violent effervescence; mildly alkaline; clear wavy boundary.

C1—16 to 25 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable; few roots; violent effervescence; mildly alkaline; clear wavy boundary.

C2—25 to 34 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable; violent effervescence; mildly alkaline; clear wavy boundary.

Cr—34 to 60 inches; light brownish gray (2.5Y 6/2) shale, grayish brown (2.5Y 5/2) moist; very hard, very friable; strong effervescence; mildly alkaline.

The solum ranges from 8 to 20 inches in thickness. Soft siltstone or shale is at a depth of 20 to 40 inches.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 or 2. It is silt loam or silty clay loam. The B2 horizon has value of 4 or 5 (2 to 4 moist) and chroma of 2 or 3 in hue of 10YR or 2.5Y. It is silty clay loam, silty clay, or clay. The B3 horizon and C horizon have value of 5 to 7 (4 or 6 moist) and chroma of 2 or 3 in hue of 10YR or 2.5Y. In some pedons, the content of very fine shale fragments ranges from few to many.

Rekop series

The Rekop series consists of shallow, well drained and somewhat excessively drained soils that formed in sediment weathered from reddish brown gypsiferous siltstone, gypsum bedrock, and alabaster. These soils are on uplands. Permeability is moderate. Slopes range from 6 to 30 percent.

Rekop soils commonly are adjacent to Gypnevee and Nevee soils. Gypnevee soils are underlain by bedrock at a depth of more than 40 inches. Nevee soils have less gypsum in the solum.

Typical pedon of Rekop loam in an area of Rekop-Gypnevee-Rock outcrop complex, 15 to 50 percent slopes, 165 feet south of the northeast corner of sec. 35, T. 7 N., R. 2 E.:

A11—0 to 4 inches; reddish brown (5YR 5/3) loam, reddish brown (5YR 4/3) moist; weak medium and thick platy structure parting to weak very fine granular; soft, very friable; many roots; strong effervescence; mildly alkaline; gradual wavy boundary.

C1cs—4 to 12 inches; light brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) moist; weak thick platy structure parting to weak coarse subangular blocky; soft, very friable; 10 percent fragments of gypsum; common roots; violent effervescence; neutral; gradual wavy boundary.

C2cs—12 to 18 inches; pink (7.5YR 7/4) loam, brown (7.5YR 5/4) moist; massive; soft, very friable; 30 percent gypsum; few roots; violent effervescence; neutral; gradual wavy boundary.

Cr—18 to 60 inches; pinkish white (7.5YR 8/2) gypsum and alabaster bedrock, pinkish white (7.5YR 8/2) moist; slight effervescence; neutral.

The depth to bedrock is 10 to 20 inches.

The A horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4 in hue of 7.5YR to 2.5YR. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 4 to 6 in hue of 7.5YR to 2.5YR. Fragments of gypsum are common throughout the Ccs horizon and content ranges to 60 percent, by volume.

Satanta series

The Satanta series consists of deep, well drained soils that formed in loamy alluvium. These soils are on uplands and terraces. Permeability is moderate. Slopes range from 0 to 9 percent.

Satanta soils commonly are adjacent to Boneek, Butche, and Nunn soils. Boneek and Nunn soils have more clay in the subsoil than Satanta soils. Butche soils do not have an argillic horizon. They are 7 to 20 inches to bedrock and are on the steeper slopes generally above Satanta soils.

Typical pedon of Satanta loam, 0 to 2 percent slopes, 400 feet west and 100 feet south of the northeast corner of sec. 8, T. 7 N., R. 3 E.:

Ap—0 to 7 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak fine and medium granular

structure; very hard, friable; slightly acid; abrupt smooth boundary.

B1—7 to 12 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to weak coarse and medium subangular blocky; very hard, very friable; shiny film on faces of peds; mildly alkaline; clear wavy boundary.

B22t—12 to 20 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak medium subangular blocky; very hard, friable; shiny film on faces of peds; slight effervescence in lower part; mildly alkaline; gradual wavy boundary.

B31ca—20 to 27 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; common fine and medium accumulations of carbonates; strong effervescence; moderately alkaline; gradual-smooth boundary.

B32ca—27 to 37 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, very friable; few fine accumulations of carbonates; violent effervescence; moderately alkaline; gradual smooth boundary.

C—37 to 60 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; massive; hard, very friable; violent effervescence; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness. Depth to free carbonates is from 15 to 30 inches. The mollic epipedon is from 8 to 15 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is loam or fine sandy loam and is 6 to 12 inches thick. The B1 horizon is similar to the A horizon in color. The B2t horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4 in hue of 7.5YR to 2.5Y. It is loam, clay loam, or sandy clay loam and has a clay content of 25 to 35 percent. Some pedons do not have free carbonates in the lower part of the B2t horizon. The B3ca horizon and the C horizon have value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4 in hue of 10YR or 2.5Y. They are clay loam or sandy clay loam.

Savo series

The Savo series consists of deep, well drained soils that formed in silty and loamy deposits. These soils are on terraces and uplands. Permeability is moderately slow. Slopes range from 0 to 6 percent.

Savo soils commonly are adjacent to Nunn and Tilford soils. Nunn soils have more sand than Savo soils and are on higher parts of the landscape. Tilford soils do not have an argillic horizon. They have redder hue and are above Savo soils.

Typical pedon of Savo silt loam, 2 to 6 percent slopes, 1,755 feet west and 2,505 feet south of the northeast corner of sec. 7, T. 6 N., R. 3 E.:

Ap—0 to 7 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; moderate thin and medium platy structure parting to weak medium subangular blocky; hard, friable; many roots; slightly acid; abrupt smooth boundary.

B2t—7 to 18 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium and coarse blocky; very hard, firm; common roots; shiny film on surfaces of peds; neutral; clear wavy boundary.

B3ca—18 to 24 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; moderate coarse and medium prismatic structure parting to moderate medium and coarse blocky; very hard, firm; common roots; shiny film on surfaces of peds; strong effervescence; moderately alkaline; clear wavy boundary.

Cca—24 to 32 inches; pale brown (10YR 6/3) and very pale brown (10YR 7/5) clay loam, brown (10YR 5/3) and light olive brown (2.5Y 5/4) moist; weak fine subangular blocky structure; very hard, friable; few roots; about 15 to 25 percent gravel; many accumulations of carbonate and coatings of carbonate on faces of peds and pebbles; violent effervescence; moderately alkaline; clear wavy boundary.

IIB2b—32 to 48 inches; brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 4/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; very hard, firm; few roots; common accumulations of carbonate in seams and coatings of carbonate on faces of peds; violent effervescence; moderately alkaline; gradual boundary.

IIC2—48 to 60 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; massive; very hard, firm; common accumulations of carbonate in seams and coatings of carbonate on faces of peds; strong effervescence; moderately alkaline.

The solum ranges from 16 to 24 inches in thickness. Depth to carbonate is from 12 to 20 inches.

The A horizon has value of 4 or 5 (3 moist) and chroma of 1 or 2. The B2t horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3 in hue of 10YR or 2.5Y. It is silty clay loam or silty clay and has an average clay content of 35 to 50 percent. In some pedons the B3ca horizon and the Cca horizon have many carbonate coatings on the surface of peds.

Snomo series

The Snomo series consists of deep, well drained soils that formed in transported material weathered from acid

shale. These soils are on uplands. Permeability is moderate. Slopes range from 6 to 25 percent.

Snomo soils commonly are adjacent to Grummit and Pierre soils and shale Rock outcrop. Grummit and Pierre soils are less than 40 inches deep to shale. The Pierre soils are less acid, are on lower slopes, and generally are below Snomo soils.

Typical pedon of Snomo clay, in an area of Snomo-Rock outcrop, 6 to 25 percent slopes, 1,100 feet east and 1,500 feet south of the northwest corner of sec. 29, T. 7 N., R. 4 E.:

A11—0 to 2 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to moderate fine granular; hard, friable; many roots; medium acid; abrupt smooth boundary.

A12—2 to 6 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; hard, friable; common roots; medium acid; clear wavy boundary.

B21—6 to 13 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; dark grayish brown (2.5Y 4/2) crushed moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable; common roots; strongly acid; clear wavy boundary.

B22—13 to 25 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few roots; many very fine fragments of shale; strongly acid; gradual wavy boundary.

C1—25 to 45 inches; light gray (10YR 6/1) clay, dark gray (10YR 4/1) moist; massive; hard, friable; many very fine brown (10YR 5/3) mottles and many very fine and fine fragments of brown (10YR 4/3) shale; extremely acid; gradual smooth boundary.

C2—45 to 49 inches; gray (10YR 5/1) shaly clay, very dark gray (10YR 3/1) moist; massive; hard, friable; yellowish brown (10YR 5/4) and brownish yellow (10YR 6/6) stains on fragments of shale; many fine and medium fragments of shale; extremely acid; gradual smooth boundary.

Cr—49 to 60 inches; gray (10YR 5/1) bedded fissile shale, very dark gray (10YR 3/1) moist; yellowish brown (10YR 5/6) stains on fracture surfaces; brittle; extremely acid.

The solum ranges from 25 to 40 inches in thickness. Depth to shale is more than 40 inches. The soil is medium acid to extremely acid.

The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. It ranges from 4 to 8 inches thick. In some pedons, fine fragments of shale may make up as much as 15 percent, by volume, of the A horizon. The B2 horion has value of 5 or 6 (3 or 4 moist) and chroma of 3 or 4 in hue of 2.5Y to 7.5YR. In some pedons, fine fragments of shale make up as much as 20 percent, by volume, of the B2 horizon. The C horizon has 15 to as much as 50 percent, by volume, of fine to coarse fragments of shale.

Spearfish series

The Spearfish series consists of shallow, well drained and excessively drained soils that formed in material weathered from red gypsiferous siltstone, sandstone, and shale. These soils are on uplands. Permeability is moderate. Slopes range from 9 to 40 percent.

Spearfish soils commonly are adjacent to Nevee soils. Nevee soils have bedrock at a depth of more than 40 inches and are on the lower parts of the landscape.

Typical pedon of Spearfish silt loam in an area of Nevee-Spearfish-Rock outcrop complex, 9 to 40 percent slopes, 435 feet east and 435 feet south of the northwest corner of sec. 35, T. 6 N., R. 4 E.:

A1—0 to 2 inches; reddish brown (5YR 5/4) silt loam, dark reddish brown (5YR 3/3) moist; weak very thin platy structure parting to weak very fine granular; slightly hard, very friable; many roots; slight effervescence; mildly alkaline; clear smooth boundary.

AC—2 to 7 inches; reddish brown (2.5YR 5/4) silt loam, dark red (2.5YR 3/6) moist; weak very fine and fine granular structure; slightly hard, very friable; few roots; slight effervescence; moderately alkaline; gradual smooth boundary.

C1—7 to 12 inches; red (2.5Y 5/6) silt loam, dark red (2.5YR 3/6) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; few roots; many very fine and fine chips of shale; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—12 to 60 inches; red (2.5YR 5/6) silty shale, red (2.5YR 4/6) moist; massive; extremely hard, very firm; few roots in the upper 6 inches; slight effervescence; strong effervescence on chips of shale; moderately alkaline; gradual wavy boundary.

The depth to bedrock is from 6 to 20 inches.

The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 to 4 in hue of 5YR to 7.5YR. It is silt loam, loam, or very fine sandy loam. The AC horizon and the C horizon have value of 5 or 6 (3 to 5 moist) and chroma of 4 to 6 in hue of 2.5YR to 7.5YR. The underlying siltstone, sandstone, or shale ranges from soft to hard, but in most areas it is easily dug with a spade. Seams of gypsum are common between the bedding planes.

Stetter Variant

The Stetter Variant consists of deep, well drained soils that formed in alluvium weathered from clayey shale.

These soils are on bottom lands. Permeability is slow. Slopes are 0 to 3 percent.

Stetter Variant soils commonly are adjacent to Grummit, Kyle, and Snomo soils in the landscape. Grummit soils have shale at a depth of 5 to 20 inches. Kyle and Snomo soils have a cambic horizon. All of these soils are above the Stetter Variant soils.

Typical pedon of Stetter Variant silty clay loam, 825 feet south and 850 feet east of the northwest corner of sec. 1, T. 7 N., R. 4 E.:

A11—0 to 3 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak very thin platy structure parting to weak very fine and fine granular; slightly hard, very friable; many roots; slightly acid; abrupt smooth boundary.

A12—3 to 6 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; very hard, friable; many roots; medium acid; clear wavy boundary.

C1—6 to 16 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure; very hard, friable; common roots; medium acid; clear wavy boundary.

C2—16 to 29 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; weak very thin platy structure; very hard, friable; common roots; strongly acid; clear wavy boundary.

C3—29 to 35 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; massive; very hard, friable; few roots; strongly acid; clear wavy boundary.

C4—35 to 60 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; massive; very hard, friable; few roots; few fine accumulations of salts as threads; strongly acid.

The soil is slightly acid to strongly acid. Colors of the soil are inherited from the dark colored shales.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 or 2 in hue of 10YR or 2.5Y. It is silty clay loam or clay and is 2 to 6 inches thick. The C horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 or 2 in hue of 10YR or 2.5Y. It is silty clay loam or clay and has an average of 45 to 60 percent clay.

Stovho series

The Stovho series consists of deep, well drained soils that formed in silty materials overlying limestone. These soils are on mountains. Permeability is moderately slow. Slopes range from 4 to 40 percent.

Stovho soils commonly are adjacent to Citadel and Trebor soils in the landscape. Citadel soils are warmer than and are below Stovho soils. Trebor soils are shallower to limestone bedrock and generally are above Stovho soils.

Typical pedon of Stovho silt loam in an area of Stovho association, rolling, 950 feet north and 2,530 feet east of the southwest corner of sec. 35, T. 3 N., R. 1 E.:

O—1 inch to 0; forest litter and partially decomposed forest litter.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable; many very fine to medium roots; many worm casts of grayish brown (10YR 5/2); slightly acid; clear wavy boundary.

A2—4 to 7 inches; light brownish gray (10YR 6/2) silt loam, brown (10YR 4/3) moist; weak thick platy structure parting to weak fine subangular blocky; soft, very friable; discontinuous and lenticular in shape; many very fine to medium roots; medium acid; clear wavy boundary.

B&A—7 to 11 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 3/4) moist (B2t); light brownish gray (10YR 4/3) silt loam moist (A2); weak fine and medium subangular blocky structure; slightly hard, friable; many fine to coarse roots; few fragments of limestone; medium acid; clear wavy boundary.

B21t—11 to 16 inches; brown (10YR 5/3) silty clay, dark brown (7.5YR 4/4) moist; exterior of ped dark brown (7.5YR 3/3) moist; strong fine and medium blocky structure with silt coats on faces of peds; hard, firm, sticky and plastic; common fine to coarse roots; medium acid; gradual wavy boundary.

B22t—16 to 28 inches; light brown (7.5YR 6/3) silty clay, dark brown (7.5YR 4/3) moist; exterior ped of dark brown (7.5YR 3/3) moist; strong medium prismatic structure parting to moderate medium blocky; hard, firm, sticky and plastic; common fine to coarse roots; medium acid; clear wavy boundary.

B3—28 to 36 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) and pale brown (10YR 6/3) moist; moderate fine and medium blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine to coarse roots; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—36 to 58 inches; very pale brown (10YR 8/3) cobbly silt loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; common fine and medium roots; 20 percent by volume fragments of limestone; common fine accumulations of carbonate; violent effervescence; moderately alkaline; diffuse boundary.

C2ca—58 to 60 inches; very pale brown (10YR 7/4) cobbly silt loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable; common fine and medium roots; 15 percent by volume fragments of limestone; many fine threads and spherical accumulations of carbonate; strong effervescence; moderately alkaline.

The solum ranges from 28 to 60 inches in thickness. Depth to free carbonates is from 25 to 60 inches. Fractured limestone bedrock is at a depth of 40 inches or more. Worm activity is common in the upper 6 inches of the solum.

The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 in hue of 10YR or 7.5YR. It is silt loam or loam and is 3 to 8 inches thick. The A2 horizon has value of 5 through 7 (4 or 5 moist) and chroma of 2 or 3 in hue of 10YR or 7.5YR. It is silt loam, loam, or very fine sandy loam. Some pedons do not have a B&A horizon. The B2t horizon has value of 5 to 7 (4 or 5 moist) and chroma of 3 or 4 in hue of 10YR to 7.5YR. It typically is silty clay loam or clay but ranges to clay loam or channery clay. It is between 35 and 45 percent content of clay.

St. Onge series

The St. Onge series consists of deep, well drained soils that formed in calcareous, stratified loamy alluvium. These soils are on terraces, bottom lands, and alluvial fans. Permeability is moderate. Slopes are 0 to 2 percent.

St. Onge soils commonly are adjacent to Barnum and Swint soils in the landscape. Barnum soils do not have a mollic epipedon and are below St. Onge soils. Swint soils have a mollic epipedon less than 20 inches thick and generally are above St. Onge soils.

Typical pedon of St. Onge loam, 0 to 2 percent slopes, 2,900 feet west and 1,100 feet south of the northeast corner of sec. 11, T. 7 N., R. 2 E.:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak very fine and fine granular structure; hard, friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A12—7 to 17 inches; very dark grayish brown (10YR 3/2) silt loam, black (10YR 2/1) moist; weak coarse and medium subangular blocky structure; hard, friable; strong effervescence; mildly alkaline; clear wavy boundary.

A13—17 to 24 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak medium and coarse subangular blocky; hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C1—24 to 32 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 4/3) moist; weak medium prismatic structure; hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—32 to 42 inches; light brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) moist; massive; hard, friable; many fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual boundary.

C3—42 to 52 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; massive; soft, very friable; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C4—52 to 60 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; massive; hard, friable; many fine accumulations of carbonates; violent effervescence; mildly alkaline.

The mollic epipedon is 20 to more than 40 inches in thickness. Typically, the depth to free carbonates is from 0 to 10 inches, but some pedons are leached to a depth of 18 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. It is loam, silt loam, or very fine sandy loam and ranges from 20 to 48 inches in thickness. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4 in hue of 5YR to 10YR. It typically is stratified with loam, fine sandy loam, silt loam, very fine sandy loam, and clay loam.

Swint series

The Swint series consists of deep, well drained soils that formed in stratified reddish loamy alluvium. These soils are on terraces and alluvial fans. Permeability is moderate. Slopes range from 0 to 4 percent.

Swint soils commonly are adjacent to Barnum and Vale soils in the landscape. Barnum soils do not have a mollic epipedon and generally are below Swint soils. Vale soils have an argillic horizon and generally are above Swint soils.

Typical pedon of Swint silt loam, 1,150 feet south and 1,100 feet east of the northwest corner of sec. 28, T. 7 N., R. 2 E.:

Ap—0 to 8 inches; dark reddish gray (5YR 4/2) silt loam, dark reddish brown (5YR 2/2) moist; moderate fine subangular blocky structure; hard, very friable; few roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—8 to 14 inches; dark reddish gray (5YR 4/2) silt loam, dark reddish brown (5YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; hard, very friable; common fine reddish brown (5YR 5/4) worm channels; few roots; slight effervescence; mildly alkaline; clear wavy boundary.

C1—14 to 27 inches; light reddish brown (5YR 6/4) silt loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; hard, very friable; few roots; dark reddish gray (5YR 4/2) organic coats along worm channels; strong effervescence; moderately alkaline; clear wavy boundary.

C2—27 to 44 inches; reddish brown (5YR 5/3) silt loam, reddish brown (5YR 4/3) moist; weak coarse subangular blocky structure; hard, very friable; strong effervescence; moderately alkaline; clear wavy boundary.
C3—44 to 60 inches; light reddish brown (5YR 6/4) very fine sandy loam, reddish brown (5YR 4/4) moist; massive; hard, very friable; strong effervescence; moderately alkaline.

The mollic epipedon is 10 to 20 inches thick. Free carbonates are at the surface or within a depth of 8 inches. Buried horizons are in some pedons.

The A horizon has value of 3 to 5 dry (2 or 3 moist) and chroma of 2 or 3 in hue of 5YR or 10YR. It is silt loam, loam, or very fine sandy loam. The C horizon has value of 4 to 6 (3 to 5 moist) and chroma of 3 to 6 in hue of 2.5YR to 7.5YR. It is loam, silt loam, or very fine sandy loam and commonly is stratified with thin layers of coarser material.

Tilford series

The Tilford series consists of deep, well drained soils that formed in silty alluvium and material weathered from reddish silty shales and siltstone. These soils are on uplands. Permeability is moderate. Slopes range from 0 to 15 percent.

Tilford soils commonly are adjacent to Nevee and Vale soils in the landscape. Nevee soils do not have a mollic epipedon and are on steeper slopes generally above Tilford soils. Vale soils have an argillic horizon.

Typical pedon of Tilford silt loam, 2 to 6 percent slopes, 2,640 feet west and 1,960 feet north of the southeast corner of sec. 32, T. 7 N., R. 2 E.:

Ap—0 to 6 inches; brown (7.5YR 4/3) silt loam, dark brown (7.5YR 3/2) moist; moderate very fine and fine granular structure; hard, very friable; many roots; neutral; abrupt smooth boundary.
B21—6 to 9 inches; brown (7.5YR 5/3) silt loam, dark brown (7.5YR 3/3) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; common roots; slight effervescence; neutral; clear smooth boundary.
B22—9 to 20 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 4/4) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; common roots; strong effervescence; mildly alkaline; gradual wavy boundary.
B3ca—20 to 30 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure; hard, friable; few roots; disseminated carbonates and threads of carbonates; violent effervescence; mildly alkaline; gradual wavy boundary.
C1—30 to 43 inches; pink (7.5YR 7/4) silt loam, light brown (7.5YR 6/4) moist; massive; slightly hard, friable; few roots; violent effervescence; mildly alkaline; gradual wavy boundary.
C2—43 to 60 inches; pink (7.5YR 7/4) silt loam, brown (7.5YR 5/4) moist; massive; very hard, very firm; few roots; violent effervescence; mildly alkaline.

The solum ranges from 16 to 31 inches in thickness. Depth to free carbonates is from 0 to 10 inches. In some pedons, silty shale is at a depth below 40 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3 in hue of 10YR or 7.5YR. It is silt loam or loam and is 3 to 6 inches thick. The B2 horizon has value of 4 to 6 (3 or 4 moist) and chroma of 3 to 6 in hue of 7.5YR to 2.5YR. It typically is silt loam, but some pedons are loam and have an average 18 to 25 percent clay content. The B3 horizon has value of 5 or 6 (4 or 5 moist) and chroma of 4 to 6 in hue of 7.5YR to 2.5YR. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 4 to 6 in hue of 7.5YR to 2.5YR.

Trebor series

The Trebor series consists of moderately deep, well drained soils that formed in material weathered from underlying limestone. These soils are on mountains. Permeability is moderately slow. Slopes range from 6 to 30 percent.

Trebor soils commonly are adjacent to Citadel and Stovho soils in the landscape. Citadel soils have fewer coarse fragments, a thicker argillic horizon, and generally are at a lower elevation. Stovho soils are more than 40 inches deep to bedrock and have fewer coarse fragments.

Typical pedon of Trebor silt loam in an area of Trebor-Rock outcrop association, hilly, 2,475 feet east and 660 feet north of the southwest corner of sec. 31, T. 3 N., R. 2 E.:

O—1 inch to 0; forest litter and partially decomposed forest litter.
A2—0 to 2 inches; pinkish gray (7.5YR 7/2) silt loam, dark brown (7.5YR 4/3) moist; weak medium and thick platy structure; slightly hard, friable; many fine roots; slightly acid; abrupt wavy boundary.
B2t—2 to 6 inches; reddish brown (5YR 5/3) channery silty clay, reddish brown (5YR 4/3) moist; surfaces of peds dark reddish brown (5YR 3/3) moist; weak coarse prismatic structure parting to moderate fine and medium blocky; very hard, firm, sticky and plastic; common fine and coarse roots; common fine pores; 20 percent fragments of limestone; neutral; gradual wavy boundary.
B3—6 to 10 inches; reddish brown (5YR 5/3) and very pale brown (10YR 7/4) channery silt loam, reddish brown (5YR 4/3) and yellowish brown (10YR 5/4)

moist; moderate fine and medium subangular blocky structure; hard, friable; slightly sticky and slightly plastic; few fine and coarse roots; 30 percent fragments of limestone; slight effervescence; mildly alkaline; gradual wavy boundary.

C—10 to 30 inches; yellow (10YR 8/6) channery silt loam, brownish yellow (10YR 6/6) moist; weak medium and coarse subangular blocky structure; hard, friable; few fine and coarse roots; 45 percent fragments of limestone; strong effervescence; moderately alkaline; gradual wavy boundary.

R—30 to 40 inches; fractured limestone.

The solum ranges from 8 to 22 inches in thickness. Depth to the base of the argillic horizon is 5 to 10 inches. Depth to bedrock is 20 to 40 inches. Depth to free carbonates is 5 to 14 inches. Coarse fragments of limestone range to 50 percent in the solum and to 70 percent in the C horizon.

The A2 horizon has value of 4 to 7 (3 to 5 moist) and chroma of 2 or 3 in hue of 7.5YR or 10YR. It is loam or silt loam and is from 1 inch to 4 inches thick. Some pedons have an A1 horizon 1 inch or less in thickness. Some pedons have a B&A horizon. The B2t horizon has value of 5 or 6 (3 or 4 moist) and chroma of 3 or 4 in hue of 5YR or 7.5YR. It is channery clay loam, channery clay, or channery silty clay and has an average of 35 to 40 percent clay content. The C horizon is very channery silt loam, very channery loam, very channery clay loam, channery silt loam, channery loam, or channery clay loam.

Vale series

The Vale series consists of deep, well drained soils that formed in silty and loamy alluvium from reddish silty shale. These soils are on uplands. Permeability is moderate. Slopes range from 0 to 9 percent.

Vale soils commonly are adjacent to Nevee, Tilford, and Spearfish soils in the landscape. Nevee and Spearfish soils do not have a mollic epipedon and an argillic horizon. Tilford soils do not have an argillic horizon. Spearfish soils have soft bedrock at a depth of 6 to 20 inches and are on steeper slopes generally above Vale soils.

Typical pedon of Vale silt loam, 0 to 2 percent slopes, 450 feet west and 2,250 feet south of the northeast corner of sec. 29, T. 7 N., R. 2 E.:

Ap—0 to 6 inches; dark brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; soft, friable; mildly alkaline; abrupt smooth boundary.

B21t—6 to 12 inches; dark brown (7.5YR 4/3) silty clay loam, dark brown (7.5YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky structure; hard, firm, slightly sticky; shiny films on surfaces of peds; mildly alkaline; gradual wavy boundary.

B22t—12 to 19 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky structure; shiny films on all surfaces of peds; hard, firm, slightly sticky; strong effervescence; moderately alkaline; clear wavy boundary.

B3ca—19 to 27 inches; light brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to weak coarse subangular blocky structure; shiny films on vertical surfaces of peds; slightly hard, friable, slightly sticky; few fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C1ca—27 to 38 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; massive; hard, friable, slightly sticky; common medium accumulations of carbonate; violent effervescence; strongly alkaline; clear smooth boundary.

C2—38 to 60 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; few medium mottles of pinkish gray (7.5YR 7/2); massive; hard, friable, slightly sticky; violent effervescence; moderately alkaline.

The solum ranges from 19 to 41 inches in thickness. Depth to free carbonates is from 12 to 26 inches. The mollic epipedon is 7 to 20 inches thick.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 2 or 3 in hue of 7.5YR or 10YR. It is silt loam or very fine sandy loam and is 4 to 9 inches thick. The B2t horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4. It typically is silty clay loam, but in some pedons it is clay loam, or silt loam and has an average 25 to 35 percent clay content. The B3ca horizon and the Cca horizon are silty clay loam, loam, or silt loam.

Vanocker series

The Vanocker series consists of deep, well drained soils that formed in material weathered from sedimentary rock. These soils are on mountains. Permeability is moderate. Slopes range from 15 to 60 percent.

Vanocker soils commonly are adjacent to Citadel soils in the landscape. Citadel soils have more clay than Vanocker soils. They have an argillic horizon, and are on upper slopes generally above Vanocker soils.

Typical pedon of Vanocker loam in an area of Vanocker-Citadel association, steep, 1,428 feet north and 1,224 feet west of the southeast corner of sec. 28, T. 4 N., R. 1 E.:

O—1 inch to 0; forest litter and partially decomposed forest litter.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; 10 percent coarse fragments; many roots; neutral; clear smooth boundary.

B21—4 to 11 inches; brown (7.5YR 5/4) channery clay loam, dark brown (7.5YR 4/3) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, firm; 15 percent coarse fragments; neutral; clear wavy boundary.

B22—11 to 15 inches; brown (7.5YR 5/4) channery clay loam, dark brown (7.5YR 4/3) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; 35 percent coarse fragments; neutral; clear wavy boundary.

The thickness of the solum and depth to carbonates range from 10 to 25 inches. Depth to bedrock is 40 to more than 60 inches. Coarse fragments of limestone or sandstone, by volume, increase as depth increases and range from 10 to 20 percent in the A horizon and from 40 to 80 percent in the lower part of the C horizon.

The A1 horizon has value of 4 or 5 (2 to 4 moist) and chroma of 1 to 3 in hue of 10YR or 7.5YR. It is loam, gravelly loam, or channery loam. The B2 horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 to 5 in hue of 7.5YR or 5YR. It is channery loam or channery clay loam. The C horizon has hue of 10YR to 2.5YR. Color is determined by the source of the material.

Virkula series

The Virkula series consists of deep, well drained soils that formed in material weathered from igneous and metamorphic material. These soils are on mountains. Permeability is moderately slow. Slopes range from 6 to 35 percent.

Virkula soils commonly are adjacent to Citadel and Grizzly soils. Citadel soils have carbonates in the C horizon and generally are below Virkula soils. Grizzly soils have fewer coarse fragments in the solum than Virkula soils.

Typical pedon of Virkula silt loam, in an area of Virkula association, hilly, 1,100 feet west and 600 feet south of the northeast corner of sec. 19, T. 5 N., R. 3 E.:

O—1 inch to 0; decomposed and partially decomposed forest litter, mainly needles, twigs, and leaves.

A1—0 to 1 inch; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; common fine and medium roots; medium acid; abrupt smooth boundary.

A2—1 to 12 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak thin and medium platy structure; slightly hard, very friable; common fine and coarse roots; many pores; medium acid; clear smooth boundary.

B&A—12 to 15 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist (B2t) and very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist (A2); weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; common roots; common fine pores; medium acid; clear wavy boundary.

B2t—15 to 29 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; strong coarse prismatic structure parting to strong fine and medium blocky; very hard, firm, sticky and plastic; few fine and coarse roots; common fine pores; shiny film on surfaces of peds; medium acid; clear wavy boundary.

B3—29 to 36 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate subangular blocky; very hard, firm, sticky and plastic; few coarse roots; common fine pores; shiny films on surfaces of peds; medium acid; clear wavy boundary.

C—36 to 60 inches; pale brown (10YR 6/3) gravelly clay loam, yellowish brown (10YR 5/4) moist; massive; very hard, firm, slightly sticky and plastic; 15 percent fragments of igneous rock; slightly acid.

The solum ranges from 22 to 55 inches in thickness. Depth to igneous bedrock is more than 40 inches. In some pedons, rock fragments range to as much as 65 percent in the lower part of the C horizon.

The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3 in hue of 10YR or 7.5YR. It is loam or silt loam. Some pedons do not have an A1 horizon. The A2 horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 or 3 in hue of 7.5YR to 2.5Y. It is loam, silt loam, or very fine sandy loam. Some pedons do not have a B&A horizon. The B2t horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4 in hue of 2.5YR to 2.5Y. It has an average of 35 to 50 percent clay content.

Weber series

The Weber series consists of well drained, deep soils that formed in loamy outwash material overlying sandy and gravelly alluvium or outwash. These soils are on uplands and high terraces. Permeability is moderate through the solum and is very rapid in the underlying sand and gravel. Slopes are 0 to 2 percent.

Weber soils commonly are adjacent to and generally are above Swint soils in the landscape. Swint soils formed in silty alluvium, and do not have an argillic horizon.

Typical pedon of Weber loam, 0 to 2 percent slopes, 980 feet east and 1,490 feet south of the northwest corner of sec. 26, T. 6 N., R. 3 E.:

A11—0 to 2 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak thin platy structure parting to moderate very fine and fine granular; slightly hard, very friable; many roots; slightly acid; abrupt smooth boundary.

A12—2 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak very fine subangular blocky structure parting to weak fine and medium granular; slightly hard, very friable; many roots; slightly acid; clear irregular boundary.

B21t—7 to 15 inches; brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 4/3) moist; moderate medium and coarse prismatic structure parting to moderate very fine and fine subangular blocky; hard, friable; common roots; slightly acid; gradual smooth boundary.

B22t—15 to 23 inches; brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 4/3) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; common roots; slightly acid; gradual wavy boundary.

IICca—23 to 60 inches; light brown gravelly loamy sand; violent effervescence.

The solum ranges from 14 to 28 inches in thickness. Depth to free carbonates is from 13 to 25 inches. Depth to the underlying sand and gravel is from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3 in hue of 10YR or 7.5YR. It is loam or silt loam and is 3 to 8 inches thick. The B2t horizon has value of 5 to 7 (3 to 6 moist) and chroma of 2 or 3 in hue of 7.5YR or 5YR. It is silty clay loam or clay loam and has an average 18 to 35 percent clay content.

Winetti series

The Winetti series consists of deep, somewhat excessively drained soils that formed in alluvium derived from sedimentary rock. These soils are on narrow valley bottoms and on terraces. Permeability is moderately rapid. Slopes range from 2 to 6 percent. Winetti soils commonly are adjacent to Gypnevee, Nevee, and Swint soils. These soils contain more silt and clay and do not have fragments of rock. Swint soils are on similar landscapes. Gypnevee and Nevee soils are on steeper slopes at a higher elevation than Winetti soils.

Typical pedon of Winetti cobbly loam, 2,310 feet north and 825 feet west of the southeast corner of sec. 22, T. 6 N., R. 2 E.:

A1—0 to 5 inches; grayish brown (10YR 5/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many roots; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—5 to 8 inches; pale brown (10YR 6/3) gravelly sandy loam, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; 30 percent gravel; common roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

C2—8 to 60 inches; pale brown (10YR 6/3) gravelly sandy loam, brown (10YR 4/3) moist; massive; soft, very friable; 40 percent gravel; common roots; strong effervescence; moderately alkaline.

Rock fragments are 35 to as much as 50 percent by volume. Free carbonates are at the surface or within a depth of a few inches.

The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 to 4 in hue of 5YR to 10YR. It is cobbly loam or gravelly loamy sand. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 3 to 6 in hue of 5YR to 10YR. It is stratified gravelly and very gravelly sandy loam and cobbly loam.

Formation of the soils

In this section the five factors of soil formation are discussed as they apply to the soils in Lawrence County.

Factors of soil formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Climate

Climate is a factor in soil formation because of its direct influence on the rates at which the chemical and physical processes of weathering take place. Lawrence County has a continental climate characterized by hot summers and cold winters. The average annual air temperature is about 47 degrees F in the northern part and 42 degrees F in the southwestern part of the county. The average annual precipitation is 17 inches. Seventy percent of this precipitation falls during the growing season (April-September). Annual precipitation is about 7 inches more in the higher elevations of the mountains than in other parts of the county. Climate alone does not account for local differences among the soils. Its effects are modified by the influences of the other four factors of soil formation.

Plant and animal life

Plants, animals, insects, earthworms, bacteria, and fungi play an important part in soil formation.

Plants influence soil formation by furnishing organic matter, by opening up the soil, and by supplying a stable cover over the soil. Bacteria and fungi help break down the organic matter produced by plants. Earthworms and burrowing animals help to keep the soil open and porous. Man influences the formation of soil by mixing the soil, by adding water or draining, and by changing the plant community or its use.

Parent material

Most of the soils in Lawrence County are formed in material that was derived from limestone, sandstone, siltstone, and shale. Some of the soils on mountains in the Black Hills are formed in material weathered from igneous and metamorphic rock. The parent material affects many of the chemical and physical characteristics of the soil, for example, color, texture, reaction, and consistence.

Ten major geologic formations (*4, 7*) are at or near the surface in Lawrence County, together with several other formations of minor significance. These formations greatly influence the kinds of soils in the county. They range in age from the metamorphic and igneous rocks of the pre-Cambrian Series to the Niobrara Formation of the Upper Cretaceous Series. The formations are exposed in bands of varying width that extend from the higher elevations in the south-central and southwestern parts of the county in a generally radiating pattern. This pattern of exposure is a result of the Black Hills Uplift and subsequent erosion cycles (*3*).

The pre-Cambrian consists of metamorphic and igneous rocks of schist, slate, porphyry, and granite. Buska and Grizzly soils are formed in material weathered from these rocks.

The Pahasapa Limestone consists of massive light colored limestone. Stovho and Trebor soils formed in material weathered from Pahasapa Limestone. Discontinuous exposures of buff sandstone and greenish shale of the Deadwood Formation appear below the Pahasapa Limestone in places.

Massive gray laminated limestone of the Minnekahta Formation rings the outer edge of the Black Hills. Paunsaugunt soils are formed in material weathered from this limestone. Exposures of red shale and sandstone of the Opeche Formation and yellow to red sandstone of the Minnelusa Sandstone are below the Minnekahta Limestone in places. The Citadel and Vanocker soils are formed in material weathered from these formations.

The Spearfish Formation consists of red siltstone, sandy shale, and soft sandstone. It has layers of gypsum. This Formation extends from the foot slopes to the base of the outer rim of the Black Hills. Gypnevee and Rekop soils show many of the characteristics inherited from the Spearfish Formation.

The Sundance Formation is immediately above the Spearfish Formation. It is interbedded greenish gray shale and yellow fine grained sandstone that has thin lenses of limestone. Bridget and Canyon soils are formed in material weathered from the Sundance Formation. Small exposures of green to maroon shale of the Morrison Formation are above the Sundance Formation in places.

A conspicuous feature known as the Dakota Hogback forms an outer rim of the Black Hills uplift. Formations of the Dakota, or Inyan Kara Group, are exposed on this ridge. Lakota Sandstone and Fall River Sandstone are the main formations of this group in Lawrence County. The Lakota Formation is a coarse, hard, crossbedded, mostly buff to gray sandstone. The Fall River Formation is a massive, crossbedded, ripple-marked, iron-stained sandstone interbedded with thin beds of sandy shale and siltstone. Butche and Lakoa soils are formed in material weathered from these formations.

Exposures of the Graneros Shale Formation extend away from the Dakota Hogback to the plains to the northeast. This Formation consists of three distinct parts which are, from the lower part to the upper part, Skull Creek Shale, Mowry Shale, and Belle Fourche Shale. These shales are strongly acid to extremely acid and have a high resistance to slaking. Grummit and Snomo soils are among the soils that are formed in material weathered from the Graneros Formation.

The Greenhorn Formation is exposed in the northeast part of Lawrence County. It is dark gray calcareous shale. The Enning soils formed in material weathered from the Greenhorn formation.

Relief

Relief, or lay of the land, influences soil formation. Length of slope, steepness, and direction of slope influence drainage, runoff, erosion, plant cover, and soil temperature. Enning and Spearfish soils are examples of

soils that lose much rainfall because of excessive runoff. Excessive runoff decreases the amount of moisture that enters the soil and increases the amount of soil that is lost to erosion. Organic matter accumulates in thin layers, and the soils are calcareous at or near the surface. More moisture enters the Nunn, Satanta, and Vale soils because runoff is not as rapid as on the Enning and Spearfish soils. As a result, the layers of soil in which organic matter accumulates are thicker and they are leached of carbonates to a greater depth.

Time

The length of time that the soil has been exposed to the other four factors of soil formation is reflected in the kinds of soil that have formed.

The oldest soils are on those parts of the landscape that have been stable for the longest time. In Lawrence County, Stovho soils in the mountains and Nunn soils on high terraces are examples of old soils. The youngest soils are on those parts of the landscape where erosion takes place almost as rapidly as weathering or on active flood plains which receive new material each time the soils flood. Canyon and Spearfish soils are young soils that are subject to active natural erosion, and Barnum soil is a young alluvial soil.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*10*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 22, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Orthents (*Orth*, meaning common, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Torriorthents (*Torr*, meaning hot and dry, plus *Orthent*, the suborder of Entisols that have a aridic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Ustic* identifies the subgroup that is thought to typify the great group. An example is Ustic Torriorthents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is coarse-silty, mixed (calcareous), mesic, Ustic Torriorthent.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

References

(1) American Association of State Highway and Transportation Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D-2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Darton, N. H. 1925. Central Black Hills Folio, South Dakota Survey. U. S. Geol. Surv., no. 219, 34 pp.

(4) Knechtel, M. M. and S. H. Paterson. 1956. Bentonite Deposits of the Northern Black Hills District, Montana, Wyoming, and South Dakota. U. S. Dep. Inter. Geol. Surv., Miner. Invest. Field Stud. Map MF36.
(5) Meyer, W. H. 1938. Yield of even-aged stands of ponderosa pine. U.S. Dep. Agric. Tech. Bull. 630, 59 pp., illus.
(6) South Dakota Crop and Livestock Reporting Service. 1969. Lawrence Cty. Agric. Stat.
(7) South Dakota School of Mines and Technology, Department of Geology. 1957. General Outcrop Section of the Black Hills Area.
(8) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. Supplements replacing pp. 173-188 issued May 1962.
(9) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.
(10) United States Department of Agriculture. 1975. Soil Taxonomy: a basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U. S. Dep. Agric. Handbk. 436, 754 pp., illus.
(11) United States Department of Commerce, Bureau of Census. 1970. Census of Population.

Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

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 frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Crop residue management. A system of retaining crop residue on land between harvest and replanting to prevent erosion and insure future crop production.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and

to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

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.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

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.

Low strength. Inadequate strength for supporting loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Proper grazing use. Grazing rangeland at such intensity that the quality of the vegetation will improve and the amount of plant residue will be sufficient to conserve soil and water.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor*. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impaires growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

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.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

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 that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.
Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.
Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.
Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

ILLUSTRATIONS

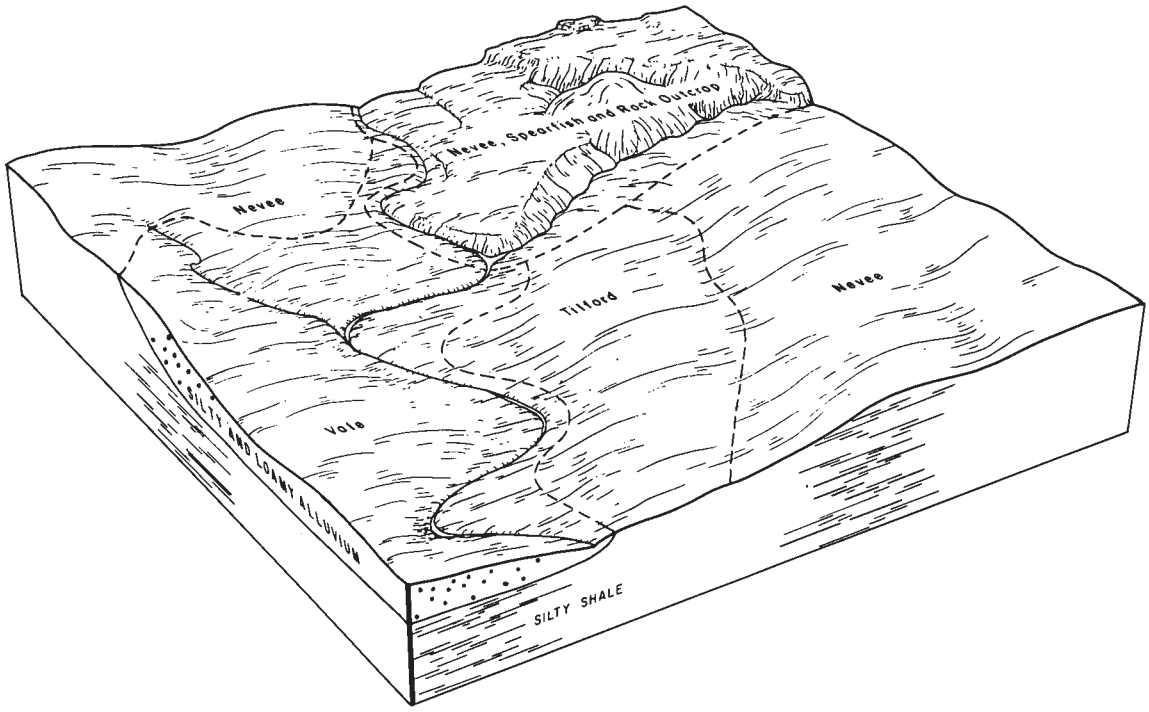


Figure 1.—Pattern of soil landscapes in map unit 1.

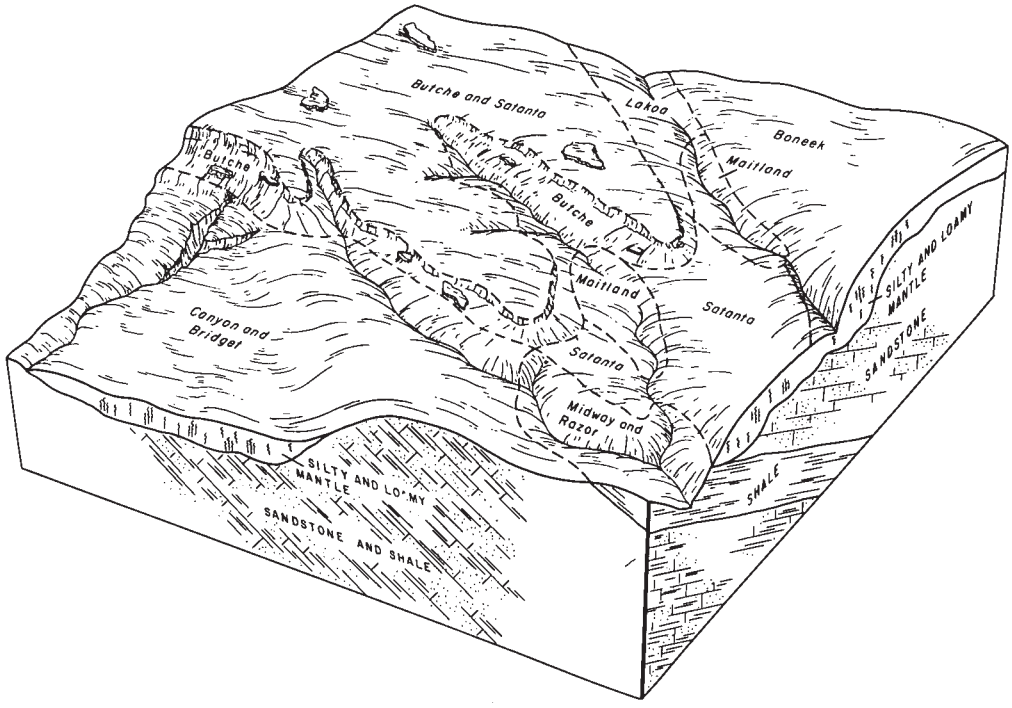


Figure 2.—Pattern of soil landscapes in map unit 2.

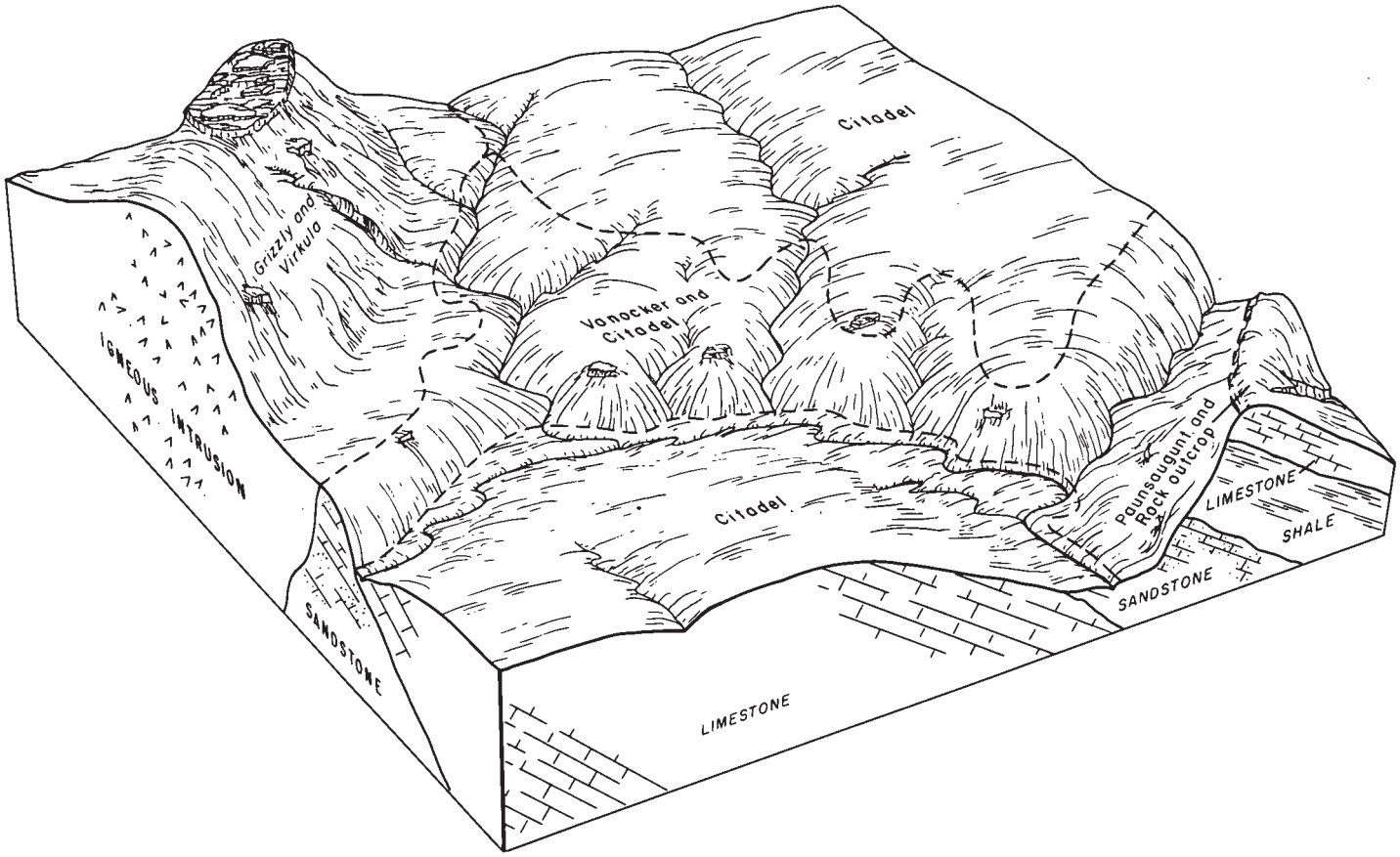


Figure 3.—Pattern of soil landscapes in map unit 8.

Figure 4.—Stones on the surface of Canyon-Bridget complex, 9 to 50 percent slopes.

Figure 5.—Ponderosa pine on Hisega-Rock outcrop association, steep.

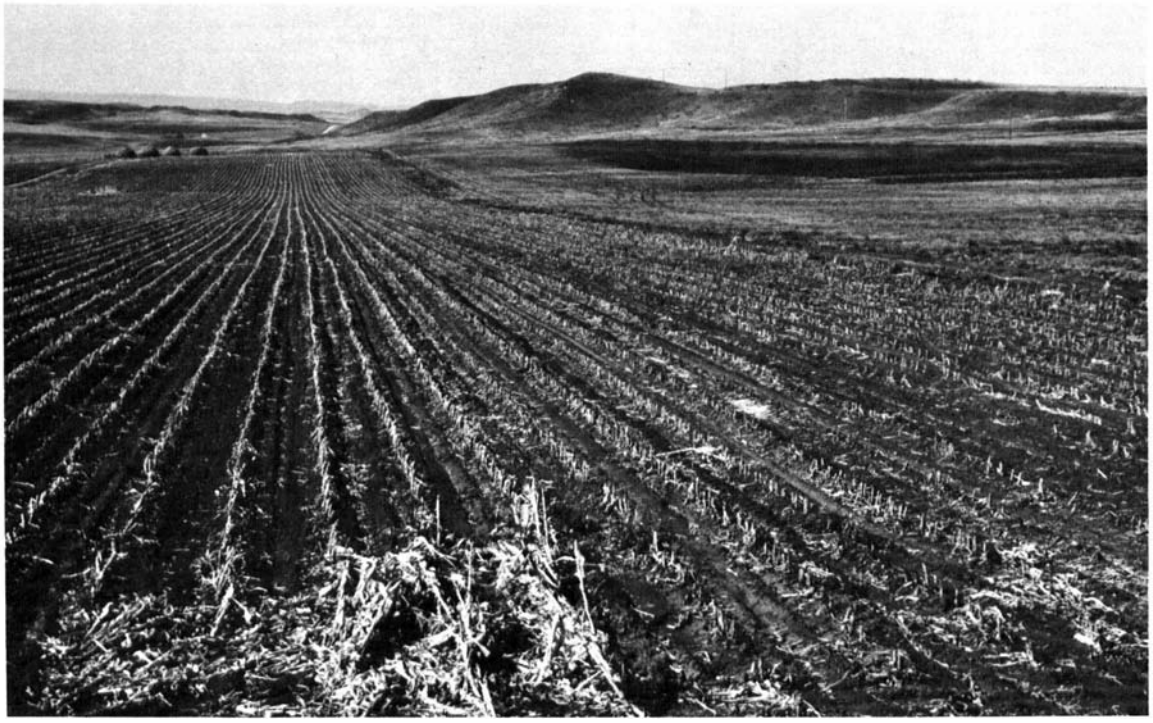


Figure 6.—Wind stripcropping on Nevee silt loam, 2 to 6 percent slopes.

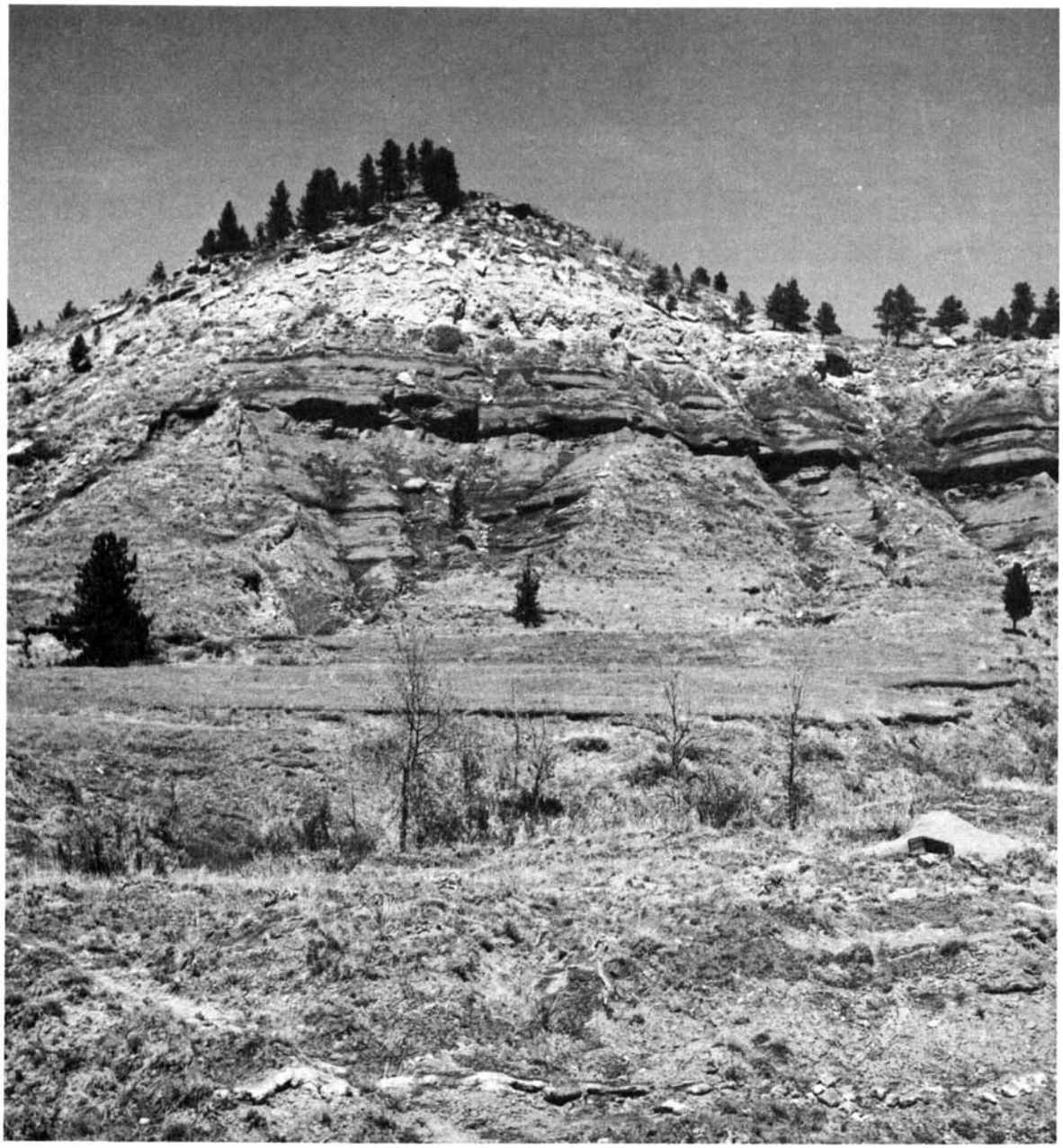


Figure 7.—Rock outcrop of gypsum above Rekop and Gypnevee in Rekop-Gypnevee-Rock outcrop complex, 15 to 50 percent slopes.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Data were recorded in the period 1951-74 at Lead, South Dakota]

Month	Temperature[1]						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[1]	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	33.0	14.1	23.6	60	-21	16	1.19	.52	1.72	5	15.3
February	36.1	17.4	26.8	60	-13	11	1.60	.76	2.28	6	21.8
March	39.7	20.4	30.1	67	-8	46	2.15	1.12	2.97	6	26.8
April	49.9	29.2	39.6	75	8	115	3.80	2.06	5.21	9	30.3
May	61.3	39.7	50.5	83	21	334	4.62	1.91	6.82	9	7.7
June	71.7	48.8	60.3	93	31	609	4.31	2.39	5.86	9	1.3
July	80.1	55.3	67.7	95	40	859	2.50	1.28	3.48	6	.0
August	79.4	54.8	67.1	93	38	840	2.24	.81	3.38	5	.0
September	68.0	44.4	56.2	90	23	493	1.93	.49	3.07	4	2.5
October	57.6	36.5	47.1	80	14	273	1.45	.65	2.11	4	9.1
November	42.8	24.4	33.6	67	-3	46	1.61	.70	2.35	5	17.9
December	35.8	18.4	27.2	59	-15	18	1.55	.91	2.11	6	19.9
Year	54.6	33.6	44.2	96	-22	3,660	28.95	23.64	33.97	74	152.6

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--TEMPERATURE AND PRECIPITATION DATA

[Data were recorded in the period 1951-74 at Spearfish, South Dakota]

Month	Temperature[1]						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[1]	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	36.3	13.4	24.9	64	-22	33	.54	.25	.77	2	9.0
February	39.7	16.6	28.2	67	-17	23	.79	.44	1.06	3	11.5
March	44.4	21.2	32.8	75	-12	77	1.31	.50	1.96	3	13.7
April	56.3	31.7	44.0	83	10	175	2.52	1.31	3.50	6	14.3
May	67.4	42.2	54.9	89	23	462	3.37	1.66	4.77	7	2.5
June	76.9	51.0	63.8	97	34	714	3.93	2.02	5.49	7	.5
July	85.7	57.0	71.3	101	42	970	1.87	.70	2.81	4	.0
August	85.3	55.7	70.5	100	41	946	1.94	.75	2.90	5	.0
September	74.1	44.9	59.5	95	26	585	1.55	.43	2.44	4	.5
October	63.6	36.0	49.8	86	13	333	1.27	.48	1.92	3	5.1
November	47.8	24.3	36.1	73	-5	77	.97	.42	1.41	3	9.1
December	39.4	17.8	28.6	66	-18	39	.81	.26	1.23	3	11.2
Year	59.7	34.3	47.0	102	-23	4,434	20.87	17.19	25.12	50	77.4

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 3.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-74 at Lead, South Dakota]

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 16	May 27	June 14
2 years in 10 later than--	May 10	May 21	June 8
5 years in 10 later than--	April 30	May 9	May 27
First freezing temperature in fall:			
1 year in 10 earlier than--	September 22	September 13	September 6
2 years in 10 earlier than--	September 29	September 19	September 11
5 years in 10 earlier than--	October 14	September 30	September 21

TABLE 4.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-74 at Spearfish, South Dakota]

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 7	May 19	June 2
2 years in 10 later than--	May 1	May 12	May 27
5 years in 10 later than--	April 20	April 30	May 13
First freezing temperature in fall:			
1 year in 10 earlier than--	October 1	September 21	September 9
2 years in 10 earlier than--	October 8	September 27	September 14
5 years in 10 earlier than--	October 21	October 9	September 24

TABLE 5.--GROWING SEASON LENGTH

[Data were recorded in the period 1951-74 at Lead, South Dakota]

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	139	123	96
8 years in 10	148	129	103
5 years in 10	166	143	116
2 years in 10	184	156	129
1 year in 10	194	163	135

TABLE 6.--GROWING SEASON LENGTH

[Data were recorded in the period 1951-74 at Spearfish, South Dakota]

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	159	135	114
8 years in 10	168	144	121
5 years in 10	183	161	133
2 years in 10	199	179	145
1 year in 10	207	188	151

TABLE 7.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AaB	Alice fine sandy loam, 0 to 6 percent slopes	1,040	0.2
Ba	Barnum silt loam	3,140	0.6
Bb	Barnum silt loam, channeled	2,160	0.4
BcA	Boneek silt loam, 0 to 2 percent slopes	530	0.1
BcB	Boneek silt loam, 2 to 6 percent slopes	3,420	0.7
BcC	Boneek silt loam, 6 to 9 percent slopes	2,570	0.5
BDE	Buska-Rock outcrop association, hilly	13,180	2.6
BeE	Butche stony loam, 6 to 50 percent slopes	4,800	0.9
BhE	Butche-Rock outcrop complex, 25 to 50 percent slopes	2,975	0.6
BkD	Butche-Satanta loams, 6 to 25 percent slopes	4,395	0.9
CaD	Canyon-Bridget complex, 6 to 25 percent slopes	2,305	0.5
CaE	Canyon-Bridget complex, 9 to 50 percent slopes	3,975	0.8
CBE	Citadel association, hilly	89,920	17.6
Cc	Dumps, mine	230	*
EaD	Enning-Minnequa silty clay loams, 6 to 25 percent slopes	355	0.1
GaD	Glenberg Variant fine sandy loam	1,335	0.3
GBE	Grizzly-Virkula association, steep	44,350	8.7
GcD	Grummit-Rock outcrop complex, 3 to 20 percent slopes	2,920	0.6
GdE	Grummit-Rock outcrop complex, 15 to 50 percent slopes	3,670	0.7
GeD	Gypnevee-Rekop loams, 6 to 25 percent slopes	2,735	0.5
Ha	Higgins silt loam	1,250	0.2
HBF	Hisega-Rock outcrop association, steep	12,685	2.5
HcA	Hisle silt loam, 0 to 3 percent slopes	810	0.2
HdA	Hisle-Slickspots complex, 0 to 3 percent slopes	2,070	0.4
KaA	Kyle clay, 0 to 2 percent slopes	630	0.1
KaB	Kyle clay, 2 to 6 percent slopes	2,275	0.4
LaE	Lakoa silt loam, 25 to 50 percent slopes	3,890	0.8
MaC	Maitland loam, 2 to 9 percent slopes	1,950	0.4
MaD	Maitland loam, 9 to 50 percent slopes	3,195	0.6
MBE	Marshdale-Maitland association, sloping	4,275	0.8
McD	Midway-Razor silty clay loams, 6 to 25 percent slopes	2,335	0.5
NaB	Nevee silt loam, 2 to 6 percent slopes	4,665	0.9
NaC	Nevee silt loam, 6 to 9 percent slopes	7,035	1.4
NbD	Nevee-Spearfish-Rock outcrop complex, 9 to 40 percent slopes	6,375	1.2
NcD	Nihill gravelly loam, 6 to 25 percent slopes	1,875	0.4
NdA	Nunn clay loam, 0 to 2 percent slopes	970	0.2
NdB	Nunn clay loam, 2 to 6 percent slopes	2,310	0.5
NdC	Nunn clay loam, 6 to 9 percent slopes	690	0.1
PAE	Pactola-Rock outcrop association, hilly	24,030	4.7
PbE	Paunsaugunt-Rock outcrop complex, 6 to 50 percent slopes	12,890	2.5
PcB	Pierre clay, 2 to 6 percent slopes	510	0.1
PcD	Pierre clay, 6 to 25 percent slopes	2,795	0.5
Pe	Pits, quarry	175	*
RaE	Rekop-Gypnevee-Rock outcrop complex, 15 to 50 percent slopes	2,615	0.5
RBF	Rock outcrop-Pactola association, steep	5,360	1.0
RCF	Rock outcrop-Vanocker association, very steep	10,195	2.0
SaA	Satanta loam, 0 to 2 percent slopes	1,600	0.3
SaB	Satanta loam, 2 to 6 percent slopes	1,090	0.2
SaC	Satanta loam, 6 to 9 percent slopes	790	0.2
SbA	Savo silt loam, 0 to 2 percent slopes	535	0.1
SbB	Savo silt loam, 2 to 6 percent slopes	790	0.2
ScD	Snomo-Rock outcrop complex, 6 to 25 percent slopes	8,550	1.7
Sd	Stetter Variant silty clay loam	1,270	0.2
SEE	Stovho association, rolling	51,245	10.0
SGF	Stovho-Trebor association, steep	13,410	2.6
ShA	St. Onge loam, 0 to 2 percent slopes	2,620	0.5
Sk	Swint silt loam	4,255	0.8
TaA	Tilford silt loam, 0 to 2 percent slopes	300	0.1
TaB	Tilford silt loam, 2 to 6 percent slopes	5,165	1.0
TaC	Tilford silt loam, 6 to 9 percent slopes	1,230	0.2
TBE	Trebor-Rock outcrop association, hilly	9,965	1.9
VaA	Vale silt loam, 0 to 2 percent slopes	3,805	0.7
VaB	Vale silt loam, 2 to 6 percent slopes	6,010	1.2
VaC	Vale silt loam, 6 to 9 percent slopes	2,255	0.4
VBF	Vanocker-Citadel association, steep	51,490	10.1
VCE	Virkula association, hilly	35,860	7.0
WaA	Weber loam, 0 to 2 percent slopes	620	0.1
Wb	Winetti cobbly loam	1,285	0.3
	Total	512,000	100.0

* Less than 0.1 percent.

TABLE 8.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. 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	Corn		Oats		Spring wheat		Winter wheat		Alfalfa hay		Bromegrass-alfalfa	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton	AUM*	AUM*
AaB---- Alice	30	---	34	---	16	---	26	---	1.6	---	2.7	---
Ba---- Barnum	35	125	42	100	23	40	---	---	1.8	5.0	3.0	8.0
Bb---- Barnum	---	---	---	---	---	---	---	---	---	---	---	---
BcA---- Boneek	31	---	43	---	26	---	35	---	1.6	---	2.7	---
BcB---- Boneek	29	---	41	---	24	---	32	---	1.5	---	2.4	---
BcC---- Boneek	25	---	37	---	20	---	28	---	1.3	---	2.2	---
BDE**: Buska----	---	---	---	---	---	---	---	---	---	---	---	---
Rock outcrop.												
BeE---- Butche	---	---	---	---	---	---	---	---	---	---	---	---
BhE---- Butche	---	---	---	---	---	---	---	---	---	---	---	---
BkD---- Butche	---	---	---	---	---	---	---	---	---	---	---	---
CaD, CaE---- Canyon	---	---	---	---	---	---	---	---	---	---	---	---
CBE**---- Citadel	---	---	---	---	---	---	---	---	---	---	---	---
Cc**. Dumps												
EaD---- Enning	---	---	---	---	---	---	---	---	---	---	---	---
GaD---- Glenberg Variant	30	---	34	---	14	---	23	---	1.8	---	3.0	---
GBE**: Grizzly----	---	---	---	---	---	---	---	---	---	---	---	---
Virkula----	---	---	---	---	---	---	---	---	---	---	---	---
GcD---- Grummit	---	---	---	---	---	---	---	---	---	---	---	---
GdE---- Grummit	---	---	---	---	---	---	---	---	---	---	---	---
GeD---- Gypnevee	---	---	---	---	---	---	---	---	---	---	---	---
Ha---- Higgins	---	---	---	---	---	---	---	---	---	---	---	---
HBF**: Hisega----	---	---	---	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 8.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn		Oats		Spring wheat		Winter wheat		Alfalfa hay		Bromegrass-alfalfa	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton	AUM*	AUM*
HBF**: Rock outcrop.												
HcA---------- Hisle	---	---	---	---	---	---	---	---	---	---	---	---
HdA---------- Hisle	---	---	---	---	---	---	---	---	---	---	---	---
KaA---------- Kyle	22	---	33	---	22	---	32	---	1.5	---	2.5	---
KaB---------- Kyle	19	---	32	---	20	---	30	---	1.4	---	2.3	---
LaE---------- Lakoa	---	---	---	---	---	---	---	---	---	---	---	---
MaC---------- Maitland	---	---	---	---	---	---	---	---	---	---	---	---
MaD---------- Maitland	---	---	---	---	---	---	---	---	---	---	---	---
MBE**: Marshdale.												
Maitland----------	---	---	---	---	---	---	---	---	---	---	---	---
McD---------- Midway	---	---	---	---	---	---	---	---	---	---	---	---
NaB---------- Nevee	32	75	37	---	19	---	---	---	1.6	4.0	2.7	6.4
NaC---------- Nevee	27	65	33	---	15	---	---	---	1.3	3.0	2.2	4.8
NbD---------- Nevee	---	---	---	---	---	---	---	---	---	---	---	---
NcD---------- Nihill	---	---	---	---	---	---	---	---	---	---	---	---
NdA---------- Nunn	31	---	43	---	26	---	35	---	1.6	---	2.7	---
NdB---------- Nunn	29	---	41	---	24	---	32	---	1.5	---	2.4	---
NdC---------- Nunn	25	---	37	---	20	---	28	---	1.3	---	2.2	---
PAE**---------- Pactola	---	---	---	---	---	---	---	---	---	---	---	---
Rock outcrop												
PbE---------- Paunsaugunt	---	---	---	---	---	---	---	---	---	---	---	---
PcB---------- Pierre	17	---	32	---	18	---	28	---	1.0	---	1.6	---
PcD---------- Pierre	---	---	---	---	---	---	---	---	---	---	---	---
Pe**. Pits												

See footnotes at end of table.

TABLE 8.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn		Oats		Spring wheat		Winter wheat		Alfalfa hay		Bromegrass-alfalfa	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton	AUM*	AUM*
RaE---------- Rekop	---	---	---	---	---	---	---	---	---	---	---	---
RBF**: Rock outcrop.												
Pactola----------	---	---	---	---	---	---	---	---	---	---	---	---
RCF**: Rock outcrop.												
Vanocker----------	---	---	---	---	---	---	---	---	---	---	---	---
SaA---------- Satanta	34	120	45	---	26	---	33	50	1.6	5.0	2.7	8.0
SaB---------- Satanta	32	105	43	---	24	---	32	---	1.5	4.5	2.5	7.2
SaC---------- Satanta	28	---	39	---	20	---	27	---	1.3	---	2.2	---
SbA---------- Savo	29	---	40	---	23	---	32	---	1.5	---	2.5	---
SbB---------- Savo	28	---	38	---	22	---	30	---	1.4	---	2.4	---
ScD---------- Snomo	---	---	---	---	---	---	---	---	---	---	---	---
Sd---------- Stetter Variant	---	---	---	---	---	---	---	---	1.4	---	2.3	---
SEE**---------- Stovho	---	---	---	---	---	---	---	---	---	---	---	---
SGF**: Stovho----------	---	---	---	---	---	---	---	---	---	---	---	---
Trebor.												
ShA---------- St. Onge	40	135	47	---	30	---	39	---	2.2	5.2	3.7	8.3
Sk---------- Swint	38	135	46	100	30	---	37	---	2.1	5.2	3.5	8.3
TaA---------- Tilford	33	110	43	---	27	---	33	---	2.1	4.5	3.5	7.2
TaB---------- Tilford	31	85	41	---	25	---	32	---	2.0	4.2	3.3	6.7
TaC---------- Tilford	28	60	37	---	20	---	27	---	1.7	3.0	2.8	4.8
TBE**: Trebor----------	---	---	---	---	---	---	---	---	---	---	---	---
Rock outcrop.												
VaA---------- Vale	33	120	43	100	27	---	33	---	2.1	5.2	3.5	8.3
VaB---------- Vale	31	95	41	90	25	---	32	---	2.0	5.0	3.3	8.0

See footnotes at end of table.

TABLE 8.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn		Oats		Spring wheat		Winter wheat		Alfalfa hay		Bromegrass-alfalfa	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton	AUM*	AUM*
VaC---------- Vale	28	65	37	---	20	---	27	---	1.7	3.2	2.8	5.1
VBF**: Vanocker----------	---	---	---	---	---	---	---	---	---	---	---	---
VBF**: Citadel----------	---	---	---	---	---	---	---	---	---	---	---	
VCE**---------- Virkula	---	---	---	---	---	---	---	---	---	---	---	---
WaA---------- Weber	---	---	---	---	---	---	---	---	1.0	5.0	1.6	---
Wb---------- Winetti	---	---	---	---	---	---	---	---	---	---	---	---

* 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 9.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation are listed]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
AaB---------- Alice	Sandy----------	Favorable	2,280	Prairie sandreed----------	30
		Normal	1,900	Little bluestem----------	15
		Unfavorable	1,330	Needleandthread----------	10
				Western wheatgrass----------	10
				Sand sagebrush----------	10
				Sedge----------	10
				Blue grama----------	5
Ba, Bb---------- Barnum	Silty----------	Favorable	3,000	Western wheatgrass----------	30
		Normal	2,500	Green needlegrass----------	20
		Unfavorable	1,750	Needleandthread----------	15
				Blue grama----------	15
				Big bluestem----------	15
BcA, BcB, BcC------ Boneek	Silty----------	Favorable	2,160	Western wheatgrass----------	50
		Normal	1,800	Green needlegrass----------	15
		Unfavorable	1,260	Needleandthread----------	15
				Blue grama----------	15
BeE---------- Butche	Shallow----------	Favorable	1,800	Little bluestem----------	30
		Normal	1,500	Prairie sandreed----------	15
		Unfavorable	1,050	Western wheatgrass----------	10
				Sideoats grama----------	10
				Needleandthread----------	10
				Big bluestem----------	5
BhE*:					
Butche----------	Shallow----------	Favorable	1,800	Little bluestem----------	30
		Normal	1,500	Prairie sandreed----------	15
		Unfavorable	1,050	Western wheatgrass----------	10
				Sideoats grama----------	10
				Needleandthread----------	10
				Big bluestem----------	5
Rock outcrop.					
BkD*:					
Butche----------	Shallow----------	Favorable	1,800	Little bluestem----------	30
		Normal	1,500	Prairie sandreed----------	15
		Unfavorable	1,050	Western wheatgrass----------	10
				Sideoats grama----------	10
				Needleandthread----------	10
				Big bluestem----------	5
Satanta----------	Silty----------	Favorable	2,760	Western wheatgrass----------	40
		Normal	2,300	Blue grama----------	5
		Unfavorable	1,610	Needleandthread----------	10
				Green needlegrass----------	10
				Prairie sandreed----------	5
				Big bluestem----------	15
				Little bluestem----------	10
CaD*:					
Canyon----------	Shallow----------	Favorable	1,800	Little bluestem----------	40
		Normal	1,500	Sideoats grama----------	15
		Unfavorable	1,050	Needleandthread----------	10
				Blue grama----------	10
				Threadleaf sedge----------	5
Bridget----------	Silty----------	Favorable	2,400	Western wheatgrass----------	35
		Normal	2,000	Little bluestem----------	20
		Unfavorable	1,400	Big bluestem----------	15
				Sideoats grama----------	10
				Needleandthread----------	5
				Blue grama----------	5

See footnote at end of table.

TABLE 9.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
CaE*:					
Canyon	Shallow	Favorable	1,560	Little bluestem	40
		Normal	1,300	Sideoats grama	15
		Unfavorable	910	Needleandthread	10
				Blue grama	10
				Threadleaf sedge	5
Bridget	Silty	Favorable	2,400	Western wheatgrass	35
		Normal	2,000	Little bluestem	20
		Unfavorable	1,400	Big bluestem	15
				Sideoats grama	10
				Needleandthread	5
				Blue grama	5
EaD*:					
Enning	Shallow	Favorable	2,040	Little bluestem	35
		Normal	1,700	Sideoats grama	20
		Unfavorable	1,190	Needleandthread	10
				Blue grama	10
				Sedge	10
				Big bluestem	5
Minnequa	Thin Upland	Favorable	1,800	Little bluestem	35
		Normal	1,500	Sideoats grama	20
		Unfavorable	1,050	Needleandthread	10
				Blue grama	10
				Sedge	10
				Big bluestem	5
GaD	Overflow	Favorable	3,240	Little bluestem	20
Glenberg Variant		Normal	2,700	Big bluestem	20
		Unfavorable	1,890	Prairie sandreed	20
				Needlegrass	10
				Western wheatgrass	10
				Blue grama	5
				Sedge	5
GcD*:					
Grummit	Shallow	Favorable	1,800	Little bluestem	30
		Normal	1,500	Sideoats grama	25
		Unfavorable	1,050	Blue grama	15
				Needleandthread	10
				Sedge	10
Rock outcrop.					
GdE*:					
Grummit	Shallow	Favorable	1,680	Little bluestem	30
		Normal	1,400	Sideoats grama	20
		Unfavorable	980	Blue grama	15
				Needleandthread	15
				Sedge	10
Rock outcrop.					
GeD*:					
Gypnevee	Thin Upland	Favorable	2,040	Needleandthread	30
		Normal	1,700	Blue grama	15
		Unfavorable	1,190	Little bluestem	15
				Threadleaf sedge	15
				Western wheatgrass	10
				Green needlegrass	5
				Sideoats grama	5

See footnote at end of table.

TABLE 9.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
GeD*:					
Rekop	Shallow	Favorable	1,680	Little bluestem	40
		Normal	1,400	Sideoats grama	15
		Unfavorable	980	Blue grama	10
				Needleandthread	10
				Threadleaf sedge	5
				Western wheatgrass	5
Ha	Subirrigated	Favorable	4,180	Big bluestem	30
Higgins		Normal	3,800	Indiangrass	20
		Unfavorable	3,040	Switchgrass	20
				Little bluestem	15
				Bluegrass	10
				Inland saltgrass	5
HcA	Thin Claypan	Favorable	1,800	Blue grama	45
Hisle		Normal	700	Buffalograss	25
		Unfavorable	540	Western wheatgrass	10
				Sedge	10
HdA*:					
Hisle	Thin Claypan	Favorable	1,080	Blue grama	45
		Normal	900	Buffalograss	25
		Unfavorable	540	Western wheatgrass	10
				Sedge	10
Slickspots.					
KaA	Clayey	Favorable	2,280	Western wheatgrass	65
Kyle		Normal	1,900	Green needlegrass	15
		Unfavorable	1,300	Blue grama	10
				Buffalograss	5
KaB	Clayey	Favorable	2,040	Western wheatgrass	60
Kyle		Normal	1,700	Green needlegrass	15
		Unfavorable	1,190	Blue grama	5
				Buffalograss	5
MBE*:					
Marshdale	Subirrigated	Favorable	3,360	Reedgrasses	50
		Normal	4,200	Bluegrass	20
		Unfavorable	4,600	Sedges	15
				Big bluestem	5
Maitland.					
McD*:					
Midway	Shallow clay	Favorable	1,680	Little bluestem	40
		Normal	1,400	Sideoats grama	15
		Unfavorable	980	Western wheatgrass	10
				Green needlegrass	10
				Blue grama	10
Razor	Clayey	Favorable	2,280	Western wheatgrass	55
		Normal	1,990	Green needlegrass	30
		Unfavorable	1,330	Blue grama	5
NaB, NaC	Thin Upland	Favorable	2,040	Sedge	25
Nevee		Normal	1,700	Blue grama	20
		Unfavorable	1,190	Needleandthread	15
				Western wheatgrass	15
				Green needlegrass	10

See footnote at end of table.

TABLE 9.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
NbD*:					
Nevee	Thin Upland	Favorable	2,400	Sedge	25
		Normal	1,700	Blue grama	20
		Unfavorable	1,190	Needleandthread	15
				Western wheatgrass	15
				Green needlegrass	10
Spearfish	Shallow	Favorable	1,800	Little bluestem	30
		Normal	1,500	Prairie sandreed	15
		Unfavorable	1,050	Needleandthread	10
				Western wheatgrass	10
Rock outcrop.				Big bluestem	5
				Prairie dropseed	5
				Sideoats grama	5
NcD	Thin Upland	Favorable	1,440	Needleandthread	30
Nihill		Normal	1,200	Western wheatgrass	15
		Unfavorable	840	Little bluestem	15
				Blue grama	15
				Threadleaf sedge	15
				Sideoats grama	5
				Green needlegrass	5
NdA	Clayey	Favorable	2,160	Western wheatgrass	50
Nunn		Normal	1,800	Green needlegrass	25
		Unfavorable	1,260	Blue grama	10
				Buffalograss	5
NdB, NdC	Clayey	Favorable	1,920	Western wheatgrass	40
Nunn		Normal	1,600	Green needlegrass	25
		Unfavorable	1,120	Blue grama	15
				Buffalograss	10
PcB, PcD	Clayey	Favorable	2,040	Western wheatgrass	60
Pierre		Normal	1,700	Green needlegrass	15
		Unfavorable	1,190	Blue grama	15
				Buffalograss	5
RaE*:					
Rekop	Shallow	Favorable	1,680	Little bluestem	40
		Normal	1,400	Sideoats grama	15
		Unfavorable	980	Blue grama	10
				Needleandthread	10
				Threadleaf sedge	5
				Western wheatgrass	5
Gypnevee	Thin Upland	Favorable	2,040	Needleandthread	30
		Normal	1,700	Blue grama	15
		Unfavorable	1,190	Little bluestem	15
				Threadleaf sedge	15
				Western wheatgrass	10
				Green needlegrass	5
				Sideoats grama	5
Rock outcrop.					
SaA, SaB, SaC	Silty	Favorable	2,760	Western wheatgrass	40
Satanta		Normal	2,300	Blue grama	5
		Unfavorable	1,610	Needleandthread	10
				Green needlegrass	10
				Prairie sandreed	5
				Big bluestem	15
				Little bluestem	10

See footnote at end of table.

TABLE 9.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
SbA, SbB---------- Savo	Silty----------	Favorable	2,280	Western wheatgrass----------	45
		Normal	1,900	Green needlegrass----------	15
		Unfavorable	1,330	Needleandthread----------	15
				Blue grama----------	15
				Big bluestem----------	5
				Sideoats grama----------	5
ScD*:					
Snomo----------	Clay Savannah----------	Favorable	1,680	Little bluestem----------	20
		Normal	1,400	Western wheatgrass----------	20
		Unfavorable	840	Sedge----------	20
				Bur oak----------	15
				Big bluestem----------	10
				Ponderosa pine----------	10
				Blue grama----------	5
Rock outcrop.					
Sd---------- Stetter Variant	Overflow----------	Favorable	3,240	Western wheatgrass----------	45
		Normal	2,700	Big bluestem----------	20
		Unfavorable	1,890	Green needlegrass----------	10
				Switchgrass----------	10
				Sedge----------	5
ShA---------- St. Onge	Overflow----------	Favorable	3,600	Western wheatgrass----------	35
		Normal	3,000	Big bluestem----------	25
		Unfavorable	2,100	Prairie sandreed----------	15
				Green needlegrass----------	5
				Sideoats grama----------	5
				Leadplant----------	5
				Sedge----------	5
Sk---------- Swint	Silty----------	Favorable	3,600	Big bluestem----------	35
		Normal	3,000	Western wheatgrass----------	25
		Unfavorable	2,100	Green needlegrass----------	15
				Sideoats grama----------	10
				Little bluestem----------	10
TaA---------- Tilford	Silty----------	Favorable	3,000	Little bluestem----------	25
		Normal	2,500	Western wheatgrass----------	20
		Unfavorable	1,750	Big bluestem----------	15
				Green needlegrass----------	15
				Needleandthread----------	5
				Blue grama----------	5
				Kentucky bluegrass----------	5
				Leadplant----------	5
TaB, TaC---------- Tilford	Silty----------	Favorable	2,760	Little bluestem----------	35
		Normal	2,300	Western wheatgrass----------	15
		Unfavorable	1,610	Big bluestem----------	10
				Green needlegrass----------	10
				Needleandthread----------	10
				Blue grama----------	5
				Kentucky bluegrass----------	5
				Leadplant----------	5
VaA---------- Vale	Silty----------	Favorable	2,760	Western wheatgrass----------	45
		Normal	2,300	Green needlegrass----------	15
		Unfavorable	1,610	Needleandthread----------	15
				Blue grama----------	15
				Prairie sandreed----------	5

See footnote at end of table.

TABLE 9.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
VaB---------- Vale	Silty----------	Favorable	2,400	Western wheatgrass----------	40
		Normal	2,000	Needleandthread----------	20
		Unfavorable	1,400	Blue grama----------	20
				Green needlegrass----------	10
				Prairie sandreed----------	5
VaC---------- Vale	Silty----------	Favorable	2,160	Western wheatgrass----------	35
		Normal	1,800	Needleandthread----------	25
		Unfavorable	1,260	Blue grama----------	25
				Green needlegrass----------	5
				Prairie sandreed----------	5
WaA---------- Weber	Silty----------	Favorable	2,280	Western wheatgrass----------	30
		Normal	1,900	Green needlegrass----------	15
		Unfavorable	1,330	Blue grama----------	5
				Big bluestem----------	20
				Little bluestem----------	15
Wb---------- Winetti	Shallow to gravel----------	Favorable	1,400	Little bluestem----------	40
		Normal	1,200	Needleandthread----------	10
		Unfavorable	720	Prairie dropseed----------	20
				Sideoats grama----------	15
				Bluegrass----------	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
BDE*:								
Buska	5r	Moderate	Slight	Moderate	Slight	Ponderosa pine	65	Ponderosa pine.
						Black Hills spruce	---	
						Quaking aspen	---	
						Bur oak	---	
Rock outcrop.								
CBE*	5r	Moderate	Slight	Moderate	Slight	Ponderosa pine	65	Ponderosa pine.
Citadel						Bur oak	---	
						Quaking aspen	---	
						Paper birch	---	
						Black Hills spruce	---	
GBE*:								
Grizzly	5f	Severe	Severe	Moderate	Slight	Ponderosa pine	60	Ponderosa pine.
						Black Hills spruce	---	
						Quaking aspen	---	
						Bur oak	---	
Virkula	5r	Moderate	Slight	Moderate	Slight	Ponderosa pine	60	Ponderosa pine.
						Black Hills spruce		
						Quaking aspen		
						Bur oak		
						Paper birch		
HBF*:								
Hisega	5f	Severe	Severe	Moderate	Slight	Ponderosa pine	60	Ponderosa pine.
						Black Hills spruce	---	
						Quaking aspen	---	
						Paper birch	---	
						Bur oak		
Rock outcrop.								
LaE	5r	Severe	Severe	Moderate	Slight	Ponderosa pine	60	Ponderosa pine.
Lakoa						Bur oak	---	
						Quaking aspen	---	
						Paper birch	---	
						Black Hills spruce	---	
MaC, MaD	5r	Moderate	Slight	Moderate	Slight	Ponderosa pine	65	Ponderosa pine.
Maitland						Bur oak	---	
MBE*:								
Marshdale.								
Maitland	5r	Moderate	Slight	Moderate	Slight	Ponderosa pine	65	Ponderosa pine.
						Bur oak	---	
PAE								
Pactola	5f	Moderate	Moderate	Moderate	Slight	Ponderosa pine	60	Ponderosa pine.
						Black Hills spruce		
						Quaking aspen		
						Paper birch		
Rock outcrop.								
PbE*:								
Paunsaugunt	6d	Moderate	Moderate	Severe	Moderate	Ponderosa pine	45	Ponderosa pine.
Rock outcrop.								

See footnote at end of table.

TABLE 10.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
RBF:								
Rock outcrop.								
Pactola	5f	Moderate	Severe	Moderate	Slight	Ponderosa pine Black Hills spruce Quaking aspen Paper birch	60	Ponderosa pine.
RCF*:								
Rock outcrop.								
Vanocker	5f	Severe	Severe	Moderate	Slight	Ponderosa pine Bur oak Quaking aspen Black Hills spruce	60 --- --- 	Ponderosa pine.
SEE* Stovho	5r	Moderate	Slight	Moderate	Slight	Ponderosa pine Black Hills spruce Quaking aspen Paper birch Bur oak	65 --- --- --- 	Ponderosa pine, Black Hills spruce.
SGF*:								
Stovho	5r	Severe	Severe	Moderate	Slight	Ponderosa pine Black Hills spruce Quaking aspen Paper birch	60 --- --- ---	Ponderosa pine, Black Hills spruce.
Trebor.	6r	Severe	Severe	Moderate	Slight	Bur oak Ponderosa pine	55	Ponderosa pine.
TBE*:								
Trebor	6r	Moderate	Slight	Moderate	Slight	Ponderosa pine	55	Ponderosa pine.
Rock outcrop.								
VBF*:								
Vanocker	5f	Severe	Severe	Moderate	Slight	Ponderosa pine Bur oak Quaking aspen Black Hills spruce	60 --- --- 	Ponderosa pine.
Citadel	5r	Severe	Severe	Moderate	Slight	Ponderosa pine Bur oak Quaking aspen Paper birch Black Hills spruce	60 --- --- --- ---	Ponderosa pine.
VCE* Virkula	5r	Severe	Severe	Moderate	Slight	Ponderosa pine Black Hills spruce Quaking aspen Bur oak Paper birch	60	Ponderosa pine.
Wb Winetti	6f	Moderate	Slight	Moderate	Slight	Ponderosa pine	55	Ponderosa pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; the symbol > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	<8	8-15	16-25	26-35
AaB---------- Alice	American plum, silver buffaloberry, lilac.	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub.	Siberian elm, ponderosa pine, bur oak, Russian-olive.	---
Ba, Bb---------- Barnum	Lilac----------	Russian-olive, Rocky Mountain juniper, Siberian peashrub, American plum.	Ponderosa pine, blue spruce, Black Hills spruce, green ash, common hackberry.	Plains cottonwood, golden willow.
BcA, BcB, BcC----- Boneek	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
BDE*: Buska.				
Rock outcrop.				
BeE. Butche				
BhE*: Butche.				
Rock outcrop.				
BkD*: Butche.				
Satanta----------	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
CaD*, CaE*: Canyon.				
Bridget.				
CBE*. Citadel				
Cc*. Dumps				

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	<8	8-15	16-25	26-35
EaD*:				
Enning.				
Minnequa.				
GaD---------- Glenberg Variant	Lilac----------	Russian-olive, Rocky Mountain juniper, Siberian peashrub, American plum.	Ponderosa pine, blue spruce, Black Hills spruce, green ash, common hackberry.	Plains cottonwood, golden willow.
GBE*:				
Grizzly.				
Virkula.				
GcD, GdE:				
Grummit.				
Rock outcrop.				
GeD:				
Gypnevee.				
Rekop.				
Ha---------- Higgins	American plum, lilac.	Common hackberry, Russian-olive, Rocky Mountain juniper, Siberian peashrub.	Golden willow, blue spruce, Black Hills spruce, green ash, ponderosa pine.	Plains cottonwood.
HBF*:				
Hisega.				
Rock outcrop.				
HcA.				
Hisle				
HdA*:				
Hisle.				
Slickspots.				
KaA, KaB---------- Kyle	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
LaE.				
Lakoa				
MaC, MaD.				
Maitland				

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	<8	8-15	16-25	26-35
MBE*:				
Marshdale	American plum, lilac.	Common hackberry, Russian-olive, Rocky Mountain juniper, Siberian peashrub.	Golden willow, blue spruce, Black Hills spruce, green ash, ponderosa pine.	Plains cottonwood.
Maitland.				
McD*:				
Midway.				
Razor.				
NaB, NaC	Rocky Mountain juniper, eastern redcedar, Siberian peashrub, silver buffaloberry.	Ponderosa pine, Siberian elm, green ash, Russian-olive.	---	---
Nevee				
NbD:				
Nevee.				
Spearfish.				
Rock outcrop.				
NcD.				
Nihill				
NdA, NdB, NdC	Lilac	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
Nunn				
PAE*.				
Pactola.				
Rock outcrop.				
PbE*:				
Paunsaugunt.				
Rock outcrop.				
PcB	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
Pierre				
PcD.				
Pierre				
Pe*.				
Pits				

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	<8	8-15	16-25	26-35
RaE*: Rekop. Gypnevee. Rock outcrop. RBF*: Rock outcrop. Pactola. RCF*: Rock outcrop. Vanocker.				
SaA, SaB, SaC----- Satanta	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
SbA, SbB---------- Savo	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
ScD*: Snomo. Rock outcrop.				
Sd---------- Stetter Variant	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
SEE*. Stovho SGF*: Stovho. Trebor.				
ShA---------- St. Onge	Lilac----------	Russian-olive, Rocky Mountain juniper, Siberian peashrub, American plum.	Ponderosa pine, blue spruce, Black Hills spruce, green ash, common hackberry.	Plains cottonwood, golden willow.

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	<8	8-15	16-25	26-35
Sk---------- Swint	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
TaA, TaB, TaC----- Tilford	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
TBE*: Trebor.				
Rock outcrop.				
VaA, VaB, VaC----- Vale	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
VBF: Vanocker.				
Citadel.				
VCE*. Virkula				
WaA---------- Weber	Siberian peashrub-	Siberian elm, ponderosa pine, common hackberry, green ash, Russian-olive, eastern redcedar.	---	---
Wb. Winetti				

See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
AaB---------- Alice	Fair	Fair	Good	Fair	Very poor	Very poor	Very poor	Fair	Very poor	Very poor	Good
Ba---------- Barnum	Good	Good	Good	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor	Good
Bb---------- Barnum	Very poor	Good	Fair	Poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor	Fair
BcA, BcB---------- Boneek	Good	Good	Good	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor	Good
BcC---------- Boneek	Fair	Good	Good	Fair	Very poor	Very poor	Very poor	Fair	Very poor	Very poor	Good
BDE*:											
Buska----------	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
Rock outcrop.											
BeE---------- Butche	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair
BhE*:											
Butche----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair
Rock outcrop.											
BkD*:											
Butche----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair
Satanta----------	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Good
CaD*, CaE*:											
Canyon----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair
Bridget----------	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Good
CBE*---------- Citadel	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
Cc*. Dumps											
EaD*:											
Enning----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair
Minnequa----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair
GaD---------- Glenberg Variant	Fair	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Very poor	Fair
GBE*:											
Grizzly----------	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
Virkula----------	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
GcD*, GdE*:											
Grummit	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair
Rock outcrop.											
GeD*:											
Gypnevee	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair
Rekop	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair
Ha	Very poor	Poor	Fair	Good	Very poor	Fair	Fair	Poor	Very poor	Fair	Fair
Higgins											
HBF*:											
Hisega	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
Rock outcrop.											
HcA	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Poor
Hisle											
HdA*:											
Hisle	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Poor
Slickspots.											
KaA, KaB	Poor	Fair	Good	Fair	Very poor	Very poor	Very poor	Poor	Very poor	Very poor	Good
Kyle											
LaE	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
Lakoa											
MaC	Poor	Good	Very poor	Poor	Good	Very poor	Very poor	Poor	Good	Very poor	Very poor
Maitland											
MaD	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
Maitland											
MBE*:											
Marshdale.	Poor	Poor	Fair	Good	Very poor	Fair	Fair	Poor	Very poor	Fair	Fair
Maitland	Poor	Poor	Fair	Good	Good	Very poor	Very poor	Poor	Good	Very poor	Fair
McD*:											
Midway	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair
Razor	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Good
NaB	Poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor	Fair
Nevee											
NaC	Poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor	Fair
Nevee											
NbD*:											
Nevee	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair
Spearfish.	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Fair

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
NbD*:											
Rock outcrop.											
NcD-----	Very	Very	Fair	Poor	Very	Very	Very	Very	Very	Very	Fair
Nihill	poor	poor			poor	poor	poor	poor	poor	poor	
NdA, NdB-----	Fair	Good	Good	Good	Very	Very	Very	Good	Very	Very	Good
Nunn					poor	poor	poor		poor	poor	
NdC-----	Poor	Good	Good	Fair	Very	Very	Very	Fair	Very	Very	Good
Nunn					poor	poor	poor		poor	poor	
PAE*-----	Very	Very	Very	Poor	Good	Very	Very	Very	Good	Very	Very
Pactola	poor	poor	poor			poor	poor	poor		poor	poor
Rock outcrop.											
PbE*:											
Paunsaugunt-----	Very	Very	Poor	Poor	Very	Very	Very	Very	Poor	Very	Poor
	poor	poor			poor	poor	poor	poor		poor	
Rock outcrop.											
PcB-----	Poor	Fair	Good	Poor	Very	Very	Very	Poor	Very	Very	Good
Pierre					poor	poor	poor		poor	poor	
PcD-----	Very	Very	Good	Poor	Very	Very	Very	Very	Very	Very	Good
Pierre	poor	poor			poor	poor	poor	poor	poor	poor	
Pe*.											
Pits											
RaE*:											
Rekop-----	Very	Very	Fair	Poor	Very	Very	Very	Very	Very	Very	Fair
	poor	poor			poor	poor	poor	poor	poor	poor	
Gypnevee-----	Very	Very	Fair	Poor	Very	Very	Very	Very	Very	Very	Fair
	poor	poor			poor	poor	poor	poor	poor	poor	
Rock outcrop.											
RBF*:											
Rock outcrop.											
Pactola-----	Very	Very	Very	Poor	Good	Very	Very	Very	Good	Very	Very
	poor	poor	poor			poor	poor	poor		poor	poor
RCF*:											
Rock outcrop.											
Vanocker-----	Very	Very	Very	Poor	Good	Very	Very	Very	Good	Very	Very
	poor	poor	poor			poor	poor	poor		poor	poor
SaA, SaB-----	Fair	Good	Good	Good	Very	Very	Very	Fair	Very	Very	Good
Satanta					poor	poor	poor		poor	poor	
SaC-----	Poor	Good	Good	Fair	Very	Very	Very	Fair	Very	Very	Good
Satanta					poor	poor	poor		poor	poor	
SbA, SbB-----	Fair	Good	Good	Good	Very	Very	Very	Fair	Very	Very	Good
Savo					poor	poor	poor		poor	poor	
ScD*:											
Snomo-----	Very	Very	Good	Poor	Poor	Very	Very	Very	Poor	Very	Good
	poor	poor				poor	poor	poor		poor	
Rock outcrop.											

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Sd---------- Stetter Variant	Poor	Fair	Fair	Fair	Very poor	Very poor	Very poor	Poor	Very poor	Very poor	Fair
SEE*---------- Stovho	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
SGF*: Stovho----------	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
Trebor----------	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
ShA---------- St. Onge	Good	Good	Fair	Good	Very poor	Very good	Very poor	Good	Very poor	Very poor	Fair
Sk---------- Swint	Good	Good	Good	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor	Good
TaA, TaB---------- Tilford	Good	Good	Good	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor	Good
TaC---------- Tilford	Fair	Good	Good	Fair	Very poor	Very poor	Very poor	Fair	Very poor	Very poor	Good
TBE*: Trebor----------	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
Rock outcrop.											
VaA, VaB---------- Vale	Good	Good	Good	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor	Good
VaC---------- Vale	Fair	Good	Good	Fair	Very poor	Very poor	Very poor	Fair	Very poor	Very poor	Good
VBF*: Vanocker----------	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
Citadel----------	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
VCE*---------- Virkula	Very poor	Very poor	Very poor	Poor	Good	Very poor	Very poor	Very poor	Good	Very poor	Very poor
WaA---------- Weber	Poor	Fair	Good	Poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor	Good
Wb---------- Winetti	Very poor	Very poor	Fair	Poor	Poor	Very poor	Very poor	Very poor	Poor	Very poor	Fair

* See description of the map unit for compositon and behavior characteristics of the map unit.

TABLE 13.--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
AaB-- Alice	Slight	Slight	Moderate: slope.	Slight.
Ba, Bb-- Barnum	Severe: floods.	Slight	Moderate: floods.	Slight.
BcA-- Boneek	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
BcB-- Boneek	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
BcC-- Boneek	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
BDE*: Buska-- Rock outcrop.	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
BeE-- Butche	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock, small stones.	Severe: slope.
BhE*: Butche-- Rock outcrop.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock, small stones.	Severe: slope.
BkD*: Butche-- Satanta--	Severe: slope, depth to rock. Slight	Severe: slope. Slight	Severe: slope, depth to rock, small stones. Severe: slope.	Moderate: slope, small stones. Slight.
CaD*: Canyon-- Bridget--	Severe: slope. Moderate: slope.	Severe: slope. Moderate: slope.	Severe: depth to rock, slope. Severe: slope.	Moderate: slope. Slight.
CaE*: Canyon-- Bridget--	Severe: slope. Severe: slope.	Severe: slope. Severe: slope.	Severe: depth to rock, slope. Severe: slope.	Severe: slope. Moderate: slope.
CBE*-- Citadel	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Cc*. Dumps				
EaD*: Enning	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Moderate: slope, dusty.
Minnequa	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
GaD Glenberg Variant	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
GBE*: Grizzly	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Virkula	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
GcD*: Grummit	Moderate: too clayey.	Moderate: slope, too clayey.	Severe: slope, too clayey, depth to rock.	Moderate: too clayey.
Rock outcrop.				
GdE*: Grummit	Severe: slope.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope.
Rock outcrop.				
GeD*: Gypnevee	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Rekop	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Ha Higgins	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
HBF*: Hisega	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
HcA Hisle	Moderate: dusty, percs slowly.	Moderate: dusty.	Moderate: depth to rock, percs slowly, dusty.	Moderate: dusty.
HdA*: Hisle	Moderate: dusty, percs slowly.	Moderate: dusty.	Moderate: depth to rock, percs slowly, dusty.	Moderate: dusty.
Slickspots.				

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
KaA, KaB---------- Kyle	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.
LaE---------- Lakoa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MaC---------- Maitland	Slight----------	Slight----------	Severe: slope.	Slight.
MaD---------- Maitland	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MBE*:				
Marshdale----------	Severe: floods, wetness.	Moderate: floods.	Severe: floods, wetness.	Moderate: floods, wetness.
Maitland----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
McD*:				
Midway----------	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Moderate: slope.
Razor----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
NaB---------- Nevee	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
NaC---------- Nevee	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
NbD*:				
Nevee----------	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Spearfish----------	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop.				
NcD---------- Nihill	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.
NdA---------- Nunn	Slight----------	Slight----------	Slight----------	Slight.
NdB---------- Nunn	Slight----------	Slight----------	Moderate: slope.	Slight.
NdC---------- Nunn	Slight----------	Slight----------	Severe: slope.	Slight.
PAE*---------- Pactola	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
PbE*:				
Paunsaugunt	Severe: slope.	Severe: slope.	Severe: slope, small stones, depth to rock.	Severe: slope.
Rock outcrop.				
PcB	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.
Pierre				
PcD	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Moderate: too clayey, slope.
Pierre				
Pe*.				
Pits				
RaE*:				
Rekop	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gypnevee	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Rock outcrop.				
RBF*:				
Rock outcrop.				
Pactola	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
RCF*:				
Rock outcrop.				
Vanocker	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, large stones.
SaA	Slight	Slight	Slight	Slight.
Satanta				
SaB	Slight	Slight	Moderate: slope.	Slight.
Satanta				
SaC	Slight	Slight	Severe: slope.	Slight.
Satanta				
SbA, SbB	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
Savo				
ScD*:				
Snomo	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Moderate: too clayey, slope.
Rock outcrop.				
Sd	Severe: floods.	Moderate: floods,	Severe: floods.	Moderate: floods.
Stetter Variant				
SEE*	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Stovho				

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SGF*:				
Stovho	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Trebor	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
ShA St. Onge	Severe: floods.	Slight	Moderate: floods.	Slight.
Sk Swint	Severe: floods.	Slight	Slight	Slight.
TaA Tilford	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
TaB Tilford	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
TaC Tilford	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
TBE*:				
Trebor	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Rock outcrop.				
VaA Vale	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
VaB Vale	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
VaC Vale	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
VBF*:				
Vanocker	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, large stones.
Citadel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VCE* Virkula	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
WaA Weber	Slight	Slight	Slight	Slight.
Wb Winetti	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
AaB---------- Alice	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Moderate: low strength, frost action.
Ba, Bb---------- Barnum	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
BcA---------- Boneek	Slight----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Severe: low strength.
BcB, BcC---------- Boneek	Slight----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.
BDE*:					
Buska----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
BeE---------- Butche	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
BhE*:					
Butche----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
Rock outcrop.					
BkD*:					
Butche----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
Satanta----------	Slight----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength, slope.	Moderate: low strength.
CaD*:					
Canyon----------	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bridget----------	Moderate: slope.	Moderate: slope, low strength.	Moderate: low strength, slope.	Severe: slope.	Moderate: low strength, slope, frost action.
CaE*:					
Canyon----------	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bridget----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
CBE*---------- Citadel	Severe: slope.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, low strength, shrink-swell.
Cc*. Dumps					
EaD*: Enning-----------	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, low strength.
Minnequa---------	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: low strength, slope.
GaD---------- Glenberg Variant	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
GBE*: Grizzly----------	Severe: slope.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope.
Virkula----------	Severe: slope.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, low strength, shrink-swell.
GcD*: Grummit----------	Severe: depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swell, low strength.
Rock outcrop.					
GdE*: Grummit----------	Severe: slope, depth to rock.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
Rock outcrop.					
GeD*: Gypnevee---------	Moderate: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.
Rekop----------	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Ha---------- Higgins	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, frost action.
HBF*: Hisega-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
HcA---------- Hisle	Moderate: too clayey, depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
HdA: Hisle----------	Moderate: too clayey, depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Slickspots.					
KaA, KaB---------- Kyle	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
LaE---------- Lakoa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
MaC---------- Maitland	Slight----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, slope, low strength.	Severe: low strength.
MaD---------- Maitland	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
MBE*: Marshdale--------	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods, low strength, frost action.
Maitland---------	Slight----------	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: low strength.
McD*: Midway----------	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Razor----------	Moderate: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.
NaB, NaC---------- Nevee	Slight----------	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
NbD*: Nevee----------	Moderate: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.
Spearfish--------	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Rock outcrop.					
NcD---------- Nihill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
NdA, NdB, NdC----- Nunn	Slight----------	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
PAE*---------- Pactola	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
Rock outcrop.					
PbE*: Paunsaugunt------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Rock outcrop.					
PcB---------- Pierre	Moderate: too clayey, depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
PcD---------- Pierre	Severe: slope.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, low strength, shrink-swell.
Pe*. Pits					
RaE*: Rekop----------	Severe: slope, depth to rock.	Severe: slope,	Severe: slope. depth to rock.	Severe: slope.	Severe: slope.
Gypnevee---------	Moderate: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.
Rock outcrop.					
RBF*: Rock outcrop.					
Pactola----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
RCF*: Rock outcrop.					
Vanocker---------	Severe: slope, large stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
SaA---------- Satanta	Slight----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Moderate: low strength.
SaB, SaC---------- Satanta	Slight----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength, slope.	Moderate: low strength.
SbA, SbB---------- Savo	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
ScD*:					
Snomo	Severe: slope.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
Rock outcrop.					
Sd Stetter Variant	Severe: floods.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: shrink-swell, low strength, floods.
SEE* Stovho	Severe: slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope, low strength, shrink-swell.
SGF*:					
Stovho	Severe: slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope, low strength, shrink-swell.
Trebor	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: low strength, slope.
ShA St. Onge	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
Sk Swint	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength, frost action.
TaA Tilford	Slight	Slight	Slight	Slight	Moderate: frost action, low strength.
TaB, TaC Tilford	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
TBE*:					
Trebor	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: low strength, slope.
Rock outcrop.					
VaA Vale	Slight	Slight	Slight	Slight	Moderate: low strength.
VaB, VaC Vale	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
VBF*:					
Vanocker	Severe: slope, large stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.
Citadel	Severe: slope.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, low strength, shrink-swell.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
VCE* Virkula	Severe: slope.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, low strength, shrink-swell.
WaA Weber	Moderate: large stones.	Slight	Slight	Slight	Moderate: low strength, frost action.
Wb Winetti	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, frost action.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," and "fair." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AaB Alice	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Ba, Bb Barnum	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
BcA Boneek	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
BcB Boneek	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
BcC Boneek	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
BDE*: Buska	Severe: slope.	Severe: slope.	Moderate: large stones, slope.	Severe: slope.	Poor: slope, large stones.
Rock outcrop.					
BeE Butche	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: area reclaim, slope.
BhE*: Butche	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: area reclaim, slope.
Rock outcrop.					
BkD*: Butche	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Poor: area reclaim, slope.
Satanta	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
CaD*: Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Bridget	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
CaE*: Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Bridget	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 15.--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
CBE*---------- Citadel	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
Cc*. Dumps					
EaD*: Enning----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Poor: slope, area reclaim.
Minnequa----------	Severe: depth to rock.	Severe: slope.	Severe: depth to rock.	Moderate: slope, depth to rock.	Poor: area reclaim.
GaD---------- Glenberg Variant	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: too sandy.
GBE*: Grizzly----------	Severe: percs slowly, slope.	Severe: slope, seepage.	Severe: slope.	Severe: seepage, slope.	Poor: slope.
Virkula----------	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope,	Poor: slope, small stones.
GcD*: Grummit----------	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey, area reclaim.
Rock outcrop.					
GdE*: Grummit----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey, area reclaim.
Rock outcrop.					
GeD*: Gypnevee----------	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.	Fair: slope.
Rekop----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope, area reclaim.
Ha---------- Higgins	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
HBF*: Hisega----------	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.	Poor: slope, large stones.
Rock outcrop.					

See footnote at end of table.

TABLE 15.--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
HcA Hisle	Severe: percs slowly, depth to rock.	Moderate: depth to rock.	Severe: too clayey, depth to rock.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
HdA*: Hisle	Severe: percs slowly, depth to rock.	Moderate: depth to rock.	Severe: too clayey, depth to rock.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
Slickspots.					
KaA Kyle	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
KaB Kyle	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
LaE Lakoa	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope.
MaC Maitland	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
MaD Maitland	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
MBE*: Marshdale	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Maitland	Moderate: percs slowly, slope.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
McD*: Midway	Severe: slope, depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey, area reclaim.
Razor	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: area reclaim.
NaB Nevee	Moderate: percs. slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
NaC Nevee	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
NbD*: Nevee	Moderate: percs slowly, slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
Spearfish	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope, area reclaim.
Rock outcrop.					

See footnote at end of table.

TABLE 15.--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
NcD Nihill	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope, seepage.	Poor: slope, small stones.
NdA Nunn	Severe: percs slowly.	Slight	Slight	Slight	Fair: too clayey.
NdB Nunn	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Fair: too clayey.
NdC Nunn	Severe: percs slowly.	Severe: slope.	Slight	Slight	Fair: too clayey.
PAE* Pactola	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Rock outcrop.					
PbE*: Paunsaugunt	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, depth to rock.	Severe: slope, seepage.	Poor: slope, area reclaim, small stones.
Rock outcrop.					
PcB Pierre	Severe: percs slowly, depth to rock.	Moderate: slope, depth to rock.	Severe: too clayey, depth to rock.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
PcD Pierre	Severe: slope, percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey, area reclaim.
Pe*. Pits					
RaE*: Rekop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, area reclaim.
Gypnevee	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
Rock outcrop.					
RBF: Rock outcrop.					
Pactola	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
RCF*: Rock outcrop.					
Vanocker	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: slope, large stones.
SaA Satanta	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
SaB Satanta	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 15.--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
SaC Satanta	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
SbA, SbB Savo	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Fair: too clayey.
ScD*: Snomo	Severe: slope, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Severe: slope.	Poor: slope, too clayey.
Rock outcrop.					
Sd Stetter Variant	Severe: percs slowly, floods.	Severe: floods.	Severe: too clayey, floods.	Severe: floods.	Poor: too clayey.
SEE* Stovho	Severe: slope, percs slowly.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: slope, too clayey.
SGF*: Stovho	Severe: slope, percs slowly.	Severe: slope.	Severe: too clayey, slope.	Severe: slope.	Poor: slope, too clayey.
Trebor	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, area reclaim.
ShA St. Onge	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Sk Swint	Moderate: floods.	Severe: floods.	Moderate: floods.	Moderate: floods.	Good.
TaA Tilford	Slight	Moderate: seepage.	Slight	Slight	Good.
TaB Tilford	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
TaC Tilford	Slight	Severe: slope.	Slight	Slight	Good.
TBE*: Trebor	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: slope, area reclaim.
Rock outcrop.					
VaA Vale	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
VaB Vale	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
VaC Vale	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
VBF*: Vanocker	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: slope, large stones.

See footnote at end of table.

TABLE 15.--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
VBF*: Citadel	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
VCE*: Virkula	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope, small stones.
WaA: Weber	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: area reclaim.
Wb: Winetti	Moderate: floods.	Severe: seepage, floods.	Severe: seepage.	Severe: seepage.	Fair: area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AaB---------- Alice	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.
Ba, Bb---------- Barnum	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
BcA, BcB, BcC--------- Boneek	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
BDE*: Buska----------	Fair: slope, low strength, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
Rock outcrop.				
BeE---------- Butche	Poor: slope, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones, thin layer.
BhE*: Butche----------	Poor: slope, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones, thin layer.
Rock outcrop.				
BkD*: Butche----------	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones, thin layer.
Satanta----------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
CaD*: Canyon----------	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim, slope.
Bridget----------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
CaE*: Canyon----------	Poor: thin layer, area reclaim, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim, slope.
Bridget----------	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
CBE*---------- Citadel	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 16.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Cc*. Dumps				
EaD*: Enning	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim, slope.
Minnequa	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, slope.
GaD Glenberg Variant	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
GBE*: Grizzly	Poor: low strength, shrink-swell, slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
Virkula	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
GcD*: Grummit	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, area reclaim.
Rock outcrop.				
GdE*: Grummit	Poor: slope, thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey, area reclaim.
Rock outcrop.				
GeD*: Gypnevee	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Rekop	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer, area reclaim.
Ha Higgins	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
HBF*: Hisega	Poor: slope, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
Rock Outcrop.				
HcA Hisle:	Poor: shrink-swell, low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess salt, thin layer, excess sodium.

See footnote at end of table.

TABLE 16.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HdA*:				
Hisle	Poor: shrink-swell, low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess salt, thin layer, excess sodium.
Slickspots.				
KaA, KaB Kyle	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
LaE Lakoa	Poor: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
MaC Maitland	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
MaD Maitland	Poor: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
MBE*:				
Marshdale	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Maitland	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
McD*:				
Midway	Poor: shrink-swell, low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, area reclaim.
Razor	Poor: shrink-swell, low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey.
NaB, NaC Nevee	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
NbD*:				
Nevee	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Spearfish	Poor: slope, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, area reclaim.
Rock outcrop.				
NcD Nihill	Fair: slope.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope, small stones.
NdA, NdB, NdC Nunn	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.

See footnote at end of table.

TABLE 16.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
PAE*-------- Pactola	Poor: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones, thin layer.
Rock outcrop.				
PbE*: Paunsaugunt----------	Poor: slope, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones, area reclaim.
Rock outcrop.				
PcB-------- Pierre	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
PcD-------- Pierre	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey.
Pe*. Pits				
RaE*: Rekop----------	Poor: slope, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer, area reclaim.
Gypnevee----------	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Rock outcrop.				
RBF*: Rock outcrop.				
Pactola----------	Poor: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones, thin layer.
RCF*: Rock outcrop.				
Vanocker----------	Poor: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer.
SaA, SaB, SaC--------- Satanta	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
SbA, SbB---------- Savo	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
ScD*: Snomo----------	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, too clayey.
Rock outcrop.				
Sd---------- Stetter Variant	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 16.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SEE* Stovho	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
SGF*: Stovho	Poor: slope, slow strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Trebor	Poor: low strength, thin layer, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer.
ShA St. Onge	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Sk Swint	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
TaA, TaB, TaC Tilford	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
TBE*: Trebor	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer.
Rock outcrop.				
VaA, VaB, VaC Vale	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
VBF*: Vanocker	Poor: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer.
Citadel	Poor: slope, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
VCE* Virkula	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
WaA Weber	Good	Poor: excess fines.	Fair: excess fines.	Fair: thin layer.
Wb Winetti	Good	Poor: excess fines.	Poor: excess fines.	Poor: small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AaB---- Alice	Seepage	Piping	Not needed	Soil blowing	Soil blowing	Favorable.
Ba, Bb----	Seepage	Favorable	Floods	Floods	Not needed	Erodes easily.
BcA---- Boneek	Seepage	Favorable	Not needed	Favorable	Not needed	Erodes easily.
BcB---- Boneek	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
BcC---- Boneek	Seepage, slope.	Favorable	Not needed	Slope	Erodes easily	Erodes easily.
BDE*: Buska----	Slope, seepage.	Large stones	Not needed	Slope	Slope, large stones.	Slope, large stones.
Rock outcrop.						
BeE---- Butche	Slope, depth to rock.	Thin layer	Not needed	Large stones, rooting depth, slope.	Depth to rock, large stones, slope.	Slope, large stones, rooting depth.
BhE*: Butche----	Slope, depth to rock.	Thin layer	Not needed	Large stones, rooting depth, slope.	Depth to rock, large stones, slope.	Slope, large stones, rooting depth.
Rock outcrop.						
BkD: Butche----	Slope, depth to rock.	Thin layer	Not needed	Large stones, rooting depth, slope.	Depth to rock, large stones, slope.	Slope, large stones, rooting depth.
Satanta----	Seepage	Piping	Not needed	Slope	Favorable	Slope.
CaD*: Canyon----	Depth to rock, slope.	Thin layer	Not needed	Rooting depth, droughty, slope.	Slope, depth to rock.	Droughty, slope, rooting depth.
Bridget----	Slope, seepage.	Piping	Not needed	Slope	Erodes easily	Slope, erodes easily.
CaE*: Canyon----	Depth to rock, slope.	Thin layer	Not needed	Rooting depth, droughty, slope.	Slope, depth to rock.	Droughty, slope, rooting depth.
Bridget----	Slope, seepage.	Piping	Not needed	Slope	Slope, erodes easily.	Slope, erodes easily.
CBE*---- Citadel	Slope	Favorable	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
Cc*. Dumps						
EaD*: Enning----	Slope, depth to rock.	Thin layer, hard to pack, piping.	Not needed	Slope, rooting depth, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
EaD*: Minnequa	Depth to rock, seepage.	Thin layer, piping.	Not needed	Rooting depth, slope.	Depth to rock, slope.	Rooting depth, slope.
GaD--- Glenberg variant	Seepage	Seepage	Not needed	Floods, soil blowing.	Not needed	Favorable.
GBE*: Grizzly	Slope, seepage.	Large stones, hard to pack.	Not needed	Slope, percs slowly.	Slope, large stones, percs slowly.	Slope, large stones, percs slowly.
Virkula	Slope, seepage.	Hard to pack	Not needed	Slope, percs slowly.	Slope	Slope, erodes easily, percs slowly.
GcD*, GdE*: Grummit	Slope, depth to rock.	Hard to pack, thin layer.	Not needed	Slow intake, rooting depth, slope.	Slope, depth to rock.	Slope, rooting depth, depth to rock.
Rock outcrop.						
GeD*: Gypnevee	Slope, seepage.	Low strength, piping.	Slope	Slope, erodes easily.	Erodes easily, piping.	Erodes easily.
Rekop	Slope, depth to rock.	Thin layer, piping.	Not needed	Droughty, rooting depth, slope.	Slope, depth to rock.	Slope, rooting depth.
Ha--- Higgins	Seepage	Piping, wetness.	Floods, frost action.	Floods, wetness.	Not needed	Wetness.
HBF*: Hisega	Slope, seepage.	Large stones	Not needed	Slope, erodes easily.	Slope, large stones, erodes easily.	Slope, erodes easily.
Rock outcrop.						
HcA--- Hisle	Depth to rock	Hard to pack, thin layer, piping.	Not needed	Droughty, slow intake, percs slowly.	Not needed	Excess salt, excess sodium.
HdA: Hisle	Depth to rock	Hard to pack, thin layer, piping.	Not needed	Droughty, slow intake, percs slowly.	Not needed	Excess salt, excess sodium.
Slickspots.						
KaA--- Kyle	Favorable	Hard to pack	Not needed	Slow intake, percs slowly.	Not needed	Percs slowly.
KaB--- Kyle	Favorable	Hard to pack	Not needed	Slow intake, percs slowly.	Percs slowly	Percs slowly.
LaE--- Lakoa	Slope	Favorable	Not needed	Slope	Slope	Slope.
MaC--- Maitland	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
MaD--- Maitland	Seepage, slope.	Favorable	Not needed	Slope	Slope	Slope.

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
MBE*:						
Marshdale	Slope	Hard to pack, piping.	Frost action, floods.	Wetness, floods.	Wetness	Wetness.
Maitland	Seepage, slope.	Favorable	Not needed	Slope	Favorable	Slope.
McD*:						
Midway	Slope, depth to rock.	Thin layer, hard to pack.	Not needed	Slope, rooting depth, slow intake.	Slope, depth to rock, erodes easily.	Slope, erodes easily.
Razor	Slope, depth to rock.	Thin layer	Not needed	Slope, rooting depth, percs slowly.	Slope, percs slowly, depth to rock.	Slope, percs slowly.
NaB---- Nevee	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
NaC---- Nevee	Seepage, slope.	Favorable	Not needed	Slope	Erodes easily	Erodes easily.
NbD*:						
Nevee	Seepage, slope.	Favorable	Not needed	Slope	Erodes easily, slope.	Slope, erodes easily.
Spearfish	Seepage, depth to rock, slope.	Thin layer, piping.	Not needed	Slope, rooting depth.	Depth to rock, slope.	Slope, rooting depth, depth to rock.
Rock outcrop.						
NcD---- Nihill	Seepage, slope.	Seepage	Not needed	Slope, droughty.	Slope	Slope, droughty.
NdA---- Nunn	Favorable	Hard to pack	Not needed	Percs slowly	Percs slowly	Favorable.
NdB---- Nunn	Favorable	Hard to pack	Not needed	Percs slowly	Percs slowly	Slope.
NdC---- Nunn	Slope	Hard to pack	Not needed	Percs slowly, slope.	Percs slowly	Slope.
PAE*---- Pactola	Seepage, slope.	Large stones	Not needed	Slope, large stones.	Slope, large stones.	Slope, large stones, erodes easily.
Rock outcrop.						
PbE*:						
Paunsaugunt	Depth to rock, slope, seepage.	Thin layer, seepage, piping.	Not needed	Rooting depth, droughty.	Slope, depth to rock.	Slope, rooting depth.
Rock outcrop.						
PcB---- Pierre	Depth to rock	Hard to pack, thin layer.	Not needed	Slow intake, percs slowly, rooting depth.	Percs slowly	Percs slowly, depth to rock.
PcD---- Pierre	Slope, depth to rock.	Hard to pack, thin layer.	Not needed	Slow intake, percs slowly, rooting depth.	Slope, percs slowly, depth to rock.	Slope, percs slowly, depth to rock.
Pe*. Pits						

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
RaE*:						
Rekop	Slope, depth to rock.	Thin layer, piping.	Not needed	Droughty, rooting depth, slope.	Slope, depth to rock.	Slope, rooting depth.
Gypnevee	Slope, seepage.	Low strength, piping.	Slope	Slope, erodes easily.	Erodes easily, piping.	Erodes easily.
Rock outcrop.						
RBF*:						
Rock outcrop.						
Pactola	Seepage, slope.	Large stones	Not needed	Slope	Slope, large stones.	Slope, large stones, erodes easily.
RCF*:						
Rock outcrop.						
Vanocker	Slope, seepage.	Large stones	Not needed	Slope, large stones.	Slope, large stones.	Slope, large stones.
SaA Satanta	Seepage	Piping	Not needed	Favorable	Not needed	Favorable.
SaB Satanta	Seepage	Piping	Not needed	Favorable	Favorable	Favorable.
SaC Satanta	Seepage	Piping	Not needed	Slope	Favorable	Favorable.
SbA, SbB Savo	Favorable	Hard to pack	Not needed	Favorable	Favorable	Favorable.
ScD*:						
Snomo	Seepage, depth to rock, slope.	Hard to pack	Not needed	Slope, slow intake.	Slope	Slope.
Rock outcrop.						
Sd Stetter Variant	Favorable	Hard to pack	Not needed	Slow intake, percs slowly, floods.	Not needed	Percs slowly.
SEE* Stovho	Slope, seepage.	Hard to pack	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
SGF*:						
Stovho	Slope, seepage.	Hard to pack	Not needed	Slope, erodes easily.	Slope	Slope, erodes easily.
Trebor	Depth to rock, slope.	Thin layer, large stones.	Not needed	Slope, large stones, erodes easily.	Slope, large stones.	Slope, erodes easily, large stones.
ShA St. Onge	Seepage	Piping	Not needed	Floods	Not needed	Favorable.
Sk Swint	Seepage	Piping	Not needed	Floods	Not needed	Favorable.
TaA Tilford	Seepage	Piping	Not needed	Favorable	Not needed	Erodes easily.
TaB Tilford	Seepage	Piping	Not needed	Favorable	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
TaC---------- Tilford	Slope, seepage.	Piping---------	Not needed-----	Slope----------	Erodes easily	Erodes easily.
TBE*: Trebor----------	Depth to rock, slope.	Thin layer, large stones.	Not needed-----	Slope, large stones, erodes easily.	Slope, large stones.	Slope, erodes easily, large stones.
Rock outcrop.						
VaA---------- Vale	Seepage--------	Piping---------	Not needed-----	Favorable------	Not needed-----	Favorable.
VaB---------- Vale	Seepage--------	Piping---------	Not needed-----	Favorable------	Favorable------	Favorable.
VaC---------- Vale	Slope, seepage.	Piping---------	Not needed-----	Slope----------	Favorable------	Favorable.
VBF*: Vanocker---------	Slope----------	Large stones---	Not needed-----	Slope, large stones.	Slope, large stones.	Slope, large stones.
Citadel----------	Slope----------	Favorable------	Not needed-----	Slope, erodes easily.	Slope----------	Slope, erodes easily.
VCE*---------- Virkula	Slope, seepage.	Hard to pack---	Not needed-----	Slope, percs slowly.	Slope----------	Slope, erodes easily, percs slowly.
WaA---------- Weber	Seepage--------	Piping---------	Not needed-----	Favorable------	Piping---------	Favorable.
Wb---------- Winetti	Slope, seepage.	Piping---------	Not needed-----	Droughty-------	Slope, large stones.	Slope, large stones, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[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		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AaB---------- Alice	0-8	Fine sandy loam	SM, SC, ML, CL	A-4, A-6	0	100	100	95-100	40-60	20-35	2-11
	8-28	Fine sandy loam, sandy loam.	SM, ML	A-4	0	100	95-100	65-95	35-55	20-30	NP-7
	28-43	Fine sandy loam, sandy loam.	SM	A-4	0	100	95-100	65-95	35-50	20-30	NP-7
	43-60	Gravelly loamy sand.	SM, SW-SM, SP-SM	A-2, A-1, A-3	0	100	50-85	40-75	5-15	<25	NP-4
Ba, Bb---------- Barnum	0-3	Silt loam-------	ML	A-4	0	85-100	85-100	90-100	70-90	30-35	5-10
	3-60	Stratified clay loam to fine sandy loam.	CL, ML CL-ML	A-4	0	85-100	85-100	70-95	50-75	25-35	5-10
BcA, BcB, BcC------ Boneek	0-8	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
	8-22	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	100	85-100	35-50	11-25
	22-47	Silty clay loam, silt loam, loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	80-100	30-45	5-20
	47-60	Weathered bedrock.									
BDE*: Buska----------	0-15	Silt loam-------	ML	A-4, A-6	0-10	80-100	70-100	60-80	50-65	30-40	5-15
	15-37	Channery silt loam, channery loam, very channery clay loam.	ML, SM	A-6, A-7	10-40	70-100	70-100	50-85	40-75	30-45	5-15
	37-60	Very channery silt loam, very channery loam.	ML, SM	A-6, A-7	30-60	70-100	60-95	55-85	40-75	30-45	5-15
Rock outcrop.											
BeE---------- Butche	0-3	Stony loam------	ML, CL, CL-ML	A-4, A-6	0-40	80-90	80-90	80-90	60-75	20-40	3-20
	3-13	Stony loam------	ML, CL, CL-ML	A-4, A-6	20-50	80-90	80-90	80-90	60-75	20-40	3-20
	13-20	Unweathered bedrock.									
BhE*: Butche----------	0-3	Stony loam------	ML, CL, CL-ML	A-4, A-6	0-40	80-90	80-90	80-90	60-75	20-40	3-20
	3-13	Stony loam------	ML, CL, CL-ML	A-4, A-6	20-50	80-90	80-90	80-90	60-75	20-40	3-20
	13-20	Unweathered bedrock.									
Rock outcrop.											
BkD*: Butche----------	0-3	Loam------------	ML, CL, CL-ML	A-4, A-6	0-40	90-100	85-100	80-90	60-75	20-40	3-20
	3-13	Stony loam------	ML, CL, CL-ML	A-4, A-6	20-50	80-90	80-90	80-90	60-75	20-40	3-20
	13-20	Unweathered bedrock.									

See footnote at end of table.

TABLE 18.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BkD*:											
Satanta	0-7	Loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-85	22-36	2-15
	7-60	Loam, clay loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-7, A-6, A-4	0	100	95-100	50-100	40-75	25-45	5-25
CaD*, CaE*:											
Canyon	0-3	Fine sandy loam	SM, GM	A-4	0-5	60-80	50-75	45-60	35-50	---	NP
	3-16	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, CL	A-4	0-5	60-100	50-100	45-95	35-75	<20	NP-10
	16-35	Weathered bedrock.									
Bridget	0-10	Loam	ML, CL-ML, CL	A-4	0	95-100	95-100	85-95	80-95	20-35	2-10
	10-60	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-95	80-95	20-35	2-10
CBE* Citadel	0-11	Loam, fine sandy loam.	CL-ML, ML	A-4	0	100	100	85-100	50-80	15-25	NP-7
	11-25	Clay loam, clay	CL, CH, ML	A-6, A-7	0-10	95-100	90-100	85-100	70-95	35-60	12-30
	25-60	Loam, cobbly loam. Gravelly clay loam.	CL	A-4, A-6	0-30	95-100	90-100	85-100	65-95	25-40	10-18
Cc*. Dumps											
EaD*:											
Enning	0-4	Silty clay loam	ML, MH, CL, CH	A-7	0	95-100	95-100	90-100	85-100	40-55	15-25
	4-17	Silt loam, silty clay loam.	ML, MH, CL, CH	A-7	0	95-100	95-100	90-100	90-100	40-55	15-25
	17-60	Weathered bedrock.									
Minnequa	0-3	Silty clay loam	ML, CL	A-4, A-6	0	100	100	95-100	85-95	25-40	5-15
	3-26	Silty clay loam	ML	A-6, A-7	0-5	95-100	95-100	90-100	80-90	25-45	10-20
	26-60	Weathered bedrock.									
GaD Glenberg Variant	0-7	Fine sandy loam	SM	A-4, A-2	0-5	95-100	90-100	80-95	30-45	<30	NP-5
	7-60	Stratified loamy sand to fine sandy loam.	SM	A-2, A-4	0-5	95-100	85-100	50-70	25-40	<30	NP-5
GBE*:											
Grizzly	0-20	Very gravelly silt loam, gravelly silt loam.	GM, GC, SM, SC	A-4, A-2	5-40	45-70	40-65	35-55	25-50	15-30	NP-10
	20-32	Gravelly clay loam, very gravelly silt loam, very gravelly clay loam.	GM, GC, SC, SM	A-4, A-6	10-30	50-90	50-85	45-75	35-60	30-40	5-15
	32-51	Very cobbly clay loam, very gravelly clay loam.	CL, CH, SC	A-7	10-40	45-90	40-85	35-65	35-60	40-60	15-30
	51-60	Very channery clay loam, very channery loam.	SC, CL CH	A-6, A-7	20-50	50-85	45-75	40-65	35-60	35-50	11-25

See footnote at end of table.

TABLE 18.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
GBE*:											
Virkula	0-12	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
	12-29	Clay loam, clay, silty clay loam.	CL, CH	A-7	0	95-100	85-100	80-100	60-95	40-60	15-30
	29-36	Clay loam, clay, gravelly clay loam.	CL, CH	A-6, A-7	0	95-100	75-95	60-85	50-75	35-55	11-27
	36-60	Gravelly clay loam, very gravelly clay loam, clay loam.	CL, SC	A-6, A-7, A-2	0-5	90-100	40-85	35-75	25-60	35-50	11-25
GcD*, GdE*:											
Grummit	0-4	Clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-65	20-35
	4-13	Shaly clay	CH, MH, ML, CL	A-7	0	100	85-100	75-100	65-100	40-60	10-30
	13-60	Unweathered bedrock.	ML, CL								
Rock outcrop.											
GeD*:											
Gypnevee	0-7	Silt loam	CL-ML, CL	A-4	0	100	100	95-100	75-85	20-25	5-10
	7-60	Silt loam	CL-ML, CL	A-4	0	100	100	95-100	75-85	20-25	5-10
Rekop	0-4	Loam	ML	A-4	0-5	95-100	95-100	85-95	60-75	30-35	5-10
	4-18	Loam	ML	A-4	0-10	95-100	90-100	75-95	50-60	30-35	5-10
	18-60	Unweathered bedrock.									
Ha	0-3	Silt loam	ML	A-4	0	100	100	95-100	90-100	20-35	NP-10
Higgins	3-35	Silt, silt loam	ML	A-4	0	100	100	95-100	90-100	20-30	NP-7
	35-60	Silt, silt loam	ML	A-4	0	100	100	95-100	90-100	20-30	NP-7
HBF*:											
Hisega	0-4	Loam	ML	A-4	0-5	95-100	90-100	70-95	55-90	25-35	NP-10
	4-19	Channery loam, channery silt loam.	ML, SM, GM	A-6, A-7, A-4	10-40	65-90	60-85	55-75	45-60	30-45	5-15
	19-30	Very channery loam, channery loam.	SM, GM	A-4, A-2	15-50	25-60	20-50	20-45	15-40	30-45	5-15
	30-60	Very channery loam, very flaggy loam.	SM, GM	A-4, A-2	30-80	25-60	20-50	20-45	15-40	30-45	5-15
Rock outcrop.											
HcA	0-2	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
Hisle	2-36	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	36-60	Unweathered bedrock.									
HdA*:											
Hisle	0-2	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	2-36	Clay, silty clay, shaly clay.	CH, CL	A-7	0	95-100	90-100	85-100	80-100	45-85	20-55
	36-60	Unweathered bedrock.									
Slickspots.											

See footnote at end of table.

TABLE 18.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
KaA, KaB---------- Kyle	0-5 5-60	Clay---------- Clay----------	CH, MH CH, MH	A-7 A-7	0 0	100 100	100 100	90-100 90-100	80-100 80-100	50-75 50-85	20-45 25-60
LaE---------- Lakoa	0-6 6-30 30-42 42-60	Silt loam, loam Clay loam, sandy clay loam. Loam, clay loam, sandy loam. Weathered bedrock.	CL, CL-ML CL CL, SC	A-4, A-6 A-6, A-7 A-6, A-4	0 0-5 0-15	100 95-100 90-100	100 90-100 85-100	85-95 85-100 75-95	60-75 50-80 45-90	25-35 35-45 30-40	5-15 12-20 8-15
MaC, MaD---------- Maitland	0-11 11-44 44-60	Loam, very fine sandy loam. Loam, clay loam Loam, fine sandy loam.	CL, CL-ML CL CL, CL-ML	A-4, A-6 A-6, A-7 A-4, A-6	0 0 0-5	100 100 95-100	100 100 90-100	85-100 85-100 80-100	50-90 60-80 50-80	25-40 30-45 25-40	5-20 10-25 5-20
MBE*: Marshdale--------- Maitland---------- McD*: Midway---------- Razor---------- NaB, NaC---------- Nevee NbD*: Nevee---------- Spearfish--------- Rock outcrop. NcD---------- Nihill 	0-35 35-60 0-11 11-44 44-60 0-16 16-30 0-3 3-34 34-60 0-6 6-60 0-6 6-60 0-7 7-12 12-60 0-8 8-60	Clay loam, loam Clay loam, loam Loam, very fine sandy loam. Loam, clay loam Loam, fine sandy loam. Silty clay loam, silty clay. Weathered bedrock. Silty clay loam Silty clay loam, clay. Unweathered bedrock. Silt loam------- Silt loam, loam, very fine sandy loam. Silt loam------- Silt loam, loam, very fine sandy loam. Silt loam------- Loam, very fine sandy loam, silt loam. Unweathered bedrock. Gravelly loam--- Very gravelly sandy loam, gravelly loam.	ML, MH ML, MH CL, CL-ML CL CL, CL-ML CL, CH CL CL ML CL-ML, CL ML CL-ML, CL ML, CL, CL-ML ML, CL, CL-ML GM-GC, GM, SM-SC, SM GM	A-4, A-5, A-7 A-4, A-5, A-7 A-4, A-6 A-6, A-7 A-4, A-6 A-7 A-6 A-6, A-7 A-4 A-4, A-6 A-4 A-4, A-6 A-4, A-6 A-4, A-6 A-2, A-4 A-2, A-1	0 0-5 0 0 0-5 0 0 0 0 0 0 0 0 0 0-5 0-5	100 95-100 100 100 95-100 100 100 100 100 100 100 100 100 95-100 45-80 30-60	100 90-100 100 100 90-100 100 100 100 100 100 100 100 100 80-100 35-75 20-50	90-100 85-95 85-100 85-100 80-100 90-100 95-100 90-100 95-100 95-100 95-100 95-100 85-100 70-100 30-70 15-45	65-85 60-85 50-90 60-80 50-80 80-95 85-95 75-85 80-100 80-100 80-100 80-100 65-90 50-90 20-50 10-35	35-60 35-60 25-40 30-45 25-40 45-60 30-40 35-45 20-30 20-35 20-30 20-35 25-40 25-40 25-35 20-35	5-25 5-25 5-20 10-25 5-20 20-35 10-20 20-30 NP-5 5-15 NP-5 5-15 NP-15 NP-15 5-10 NP-10

See footnote at end of table.

TABLE 18.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
NdA, NdB, NdC------	0-5	Clay loam-------	CL, SC	A-6	0-5	95-100	80-95	70-95	45-75	30-40	10-20
Nunn	5-25	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	25-60	Clay loam, loam, gravelly sandy loam.	CL, SC	A-4, A-6, A-7	0-5	80-100	80-100	60-90	35-75	30-45	8-20
PAE*----------	0-9	Channery silt loam, loam.	ML, CL, SM	A-4, A-6 A-2	0-15	60-95	50-90	35-70	30-55	25-40	3-15
Pactola	9-22	Channery clay loam, channery loam, very channery clay loam.	CL, SC	A-6, A-7 A-4	15-45	60-90	45-90	45-75	40-65	30-45	8-20
	22-45	Very channery clay loam, very channery loam, very flaggy clay loam.	ML, CL, SC, SM	A-4, A-6, A-7	15-45	60-90	55-85	45-70	35-60	30-45	5-20
	45-60	Very flaggy silt loam, very flaggy loam.	ML, CL, SC, SM	A-4, A-6, A-7	15-60	60-90	55-85	45-70	35-60	30-45	5-20
Rock outcrop.											
PbE*:											
Paunsaugunt-------	0-5	Gravelly silt loam.	GM-GC	A-4	0-5	50-60	50-60	45-55	40-50	20-30	5-10
	5-17	Channery loam.	SM	A-1, A-2	30-45	75-85	70-80	40-50	20-30	15-20	NP-5
	17-30	Unweathered bedrock.									
Rock outcrop.											
PcB, PcD----------	0-3	Clay------------	CH, MH	A-7	0	100	100	90-100	80-100	50-75	22-45
Pierre	3-29	Clay------------	CH, MH	A-7	0	100	100	90-100	80-100	50-80	22-55
	29-60	Unweathered bedrock.									
Pe*.											
Pits											
RaE*:											
Rekop------------	0-4	Loam------------	ML	A-4	0-5	95-100	95-100	85-95	60-75	30-35	5-10
	4-18	Loam------------	ML	A-4	0-10	95-100	90-100	75-95	50-60	30-35	5-10
	18-60	Unweathered bedrock.									
Gypnevee----------	0-7	Silt loam-------	CL-ML, CL	A-4	0	100	100	95-100	75-85	20-25	5-10
	7-60	Silt loam-------	CL-ML, CL	A-4	0	100	100	95-100	75-85	20-25	5-10
Rock outcrop.											
RBF*:											
Rock outcrop.											
Pactola----------	0-9	Channery silt loam, loam.	ML, CL, SM	A-4, A-6 A-2	0-15	60-95	50-90	35-70	30-55	25-40	3-15
	9-22	Channery clay loam, channery loam, very channery clay loam.	CL, SC	A-6, A-7 A-4	15-45	60-90	55-90	45-75	40-65	35-50	8-20
	22-45	Very channery clay loam, very channery loam, very flaggy clay loam.	ML, CL, SC, SM	A-4, A-6, A-7	15-45	60-90	55-85	45-70	35-60	30-45	5-20
	45-60	Very flaggy silt loam, very flaggy loam.	ML, CL, SC, SM	A-4, A-6, A-7	15-60	60-90	55-85	45-70	35-60	30-45	5-20

See footnote at end of table.

TABLE 18.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RCF*:											
Rock outcrop.											
Vanocker	0-4	Loam	ML, CL	A-4, A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-45	5-20
	4-60	Channery loam, channery clay loam, very channery clay loam.	CL	A-6, A-7	45-75	90-95	75-90	65-80	50-65	30-45	10-25
SaA, SaB, SaC	0-7	Loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-85	22-36	2-15
Satanta	7-60	Loam, clay loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-7, A-6, A-4	0	100	95-100	50-100	40-75	25-45	5-25
SbA, SbB	0-7	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-90	30-45	5-15
Savo	7-18	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	35-65	15-40
	18-60	Silty clay loam, silt loam, clay loam.	CL, CH	A-6, A-7	0	100	100	90-100	70-95	30-55	10-35
ScD*:											
Snomo	0-6	Clay	MH, CH	A-7	0	100	95-100	95-100	90-100	55-70	25-38
	6-45	Clay	MH, CH	A-7	0	95-100	95-100	95-100	90-100	50-70	20-38
	45-49	Shaly clay	MH, CH	A-7	0	60-75	55-75	55-75	50-70	50-70	20-38
	49-60	Weathered bedrock.									
Rock outcrop.											
Sd	0-60	Silty clay loam, clay.	CH	A-7	0	100	100	90-100	75-100	50-90	25-65
Stetter Variant											
SEE*	0-7	Silt loam	ML, CL	A-4, A-6	0	100	95-100	95-100	85-100	25-40	3-15
Stovho	7-28	Silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	80-100	40-60	15-30
	28-36	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-100	35-50	11-25
	36-60	Silt loam, silty clay loam, cobbly silt loam.	ML, CL, SM, SC	A-4, A-6, A-7	0-50	60-95	50-90	45-85	35-80	30-50	5-25
SGF*:											
Stovho	0-7	Silt loam	ML, CL	A-4, A-6	0	100	95-100	95-100	85-100	25-40	3-15
	7-28	Silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	80-100	40-60	15-30
	28-36	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-100	35-50	11-25
	36-60	Silt loam, silty clay loam, cobbly silt loam.	ML, CL, SM, SC	A-4, A-6, A-7	0-50	60-95	50-90	45-85	35-80	30-50	5-25

See footnote at end of table.

TABLE 18.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SGF*:											
Trebor	0-2	Silt loam	ML, CL	A-4, A-6	0-5	95-100	95-100	90-100	60-80	30-40	5-15
	2-6	Channery clay loam, channery silty clay, clay loam.	CL	A-6, A-7	5-20	80-100	75-90	60-80	50-75	35-50	11-25
	6-10	Channery clay loam, channery silty clay loam, channery silt loam.	CL, SC, GC	A-6, A-7, A-4	10-40	70-95	65-80	50-70	40-60	30-45	8-20
	10-30	Very channery silt loam, very channery clay loam, channery silt loam.	CL, SC, GC	A-6, A-7, A-4	30-60	65-90	55-80	45-65	35-55	30-45	8-20
	30-40	Unweathered bedrock.									
ShA	0-24	Loam, silt loam	CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	50-100	25-45	5-25
St. Onge	24-60	Stratified fine sandy loam to clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	50-100	25-45	5-25
Sk	0-14	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-15
Swint	14-60	Loam, silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0-5	95-100	95-100	90-100	60-85	20-35	3-12
TaA, TaB, TaC	0-6	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	60-95	25-35	5-15
Tilford	6-20	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	70-95	25-35	5-15
	20-60	Loam, silt loam	CL, CL-ML	A-4, A-6	0	95-100	95-100	95-100	70-95	25-35	5-15
TBE*:											
Trebor	0-2	Silt loam	ML, CL	A-4, A-6	0-5	95-100	95-100	90-100	60-80	30-40	5-15
	2-6	Channery clay loam, channery silty clay, clay loam.	CL	A-6, A-7	5-20	80-100	75-90	60-80	50-75	35-50	11-25
	6-10	Channery clay loam, channery silty clay loam, channery silt loam.	CL, SC, GC	A-6, A-7, A-4	10-40	70-95	65-80	50-70	40-60	30-45	8-20
	10-30	Very channery silt loam, very channery clay loam, channery silt loam.	CL, SC, GC	A-6, A-7, A-4	30-60	65-90	55-80	45-65	35-55	30-45	8-20
	30-40	Unweathered bedrock.									
Rock outcrop.											
VaA, VaB, VaC	0-6	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-15
Vale	6-19	Silty clay loam, clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
	19-60	Loam, silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-95	25-40	5-20

See footnote at end of table.

TABLE 18.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
VBF*:											
Vanocker	0-4	Loam	ML, CL	A-4, A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-45	5-20
	4-60	Channery loam, channery clay loam, very channery clay loam.	CL	A-6, A-7	45-75	90-95	75-90	65-80	50-65	30-45	10-25
Citadel	0-11	Loam	Cl-ML, ML	A-4	0	100	100	85-100	50-80	15-25	NP-7
	11-25	Clay loam, clay	CL, CH, ML	A-6, A-7	0-10	95-100	90-100	85-100	70-95	35-60	12-30
	25-60	Loam, gravelly clay loam, cobbly loam.	CL	A-4, A-6	0-30	95-100	90-100	85-100	65-95	25-40	10-18
VCE*	0-12	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
Virkula	12-29	Clay loam, clay, silty clay loam.	CL, CH	A-7	0	95-100	85-100	80-100	60-95	40-60	15-30
	29-36	Clay loam, clay, gravelly clay loam.	CL, CH	A-6, A-7	0	95-100	75-95	60-85	50-75	35-55	11-27
	36-60	Gravelly clay loam, very gravelly clay loam, clay loam.	CL, SC	A-6, A-7, A-2	0-5	90-100	40-85	35-75	25-60	35-50	11-25
WaA	0-7	Loam	ML	A-4	0-5	95-100	90-100	80-95	50-85	20-30	NP-5
Weber	7-23	Clay loam, loam, silty clay loam.	CL	A-6	0-5	95-100	90-100	80-95	60-90	25-40	10-20
	23-60	Very gravelly sand, gravelly loamy sand.	GP, GP-GM	A-1	10-50	30-50	20-50	15-30	0-10	---	NP
Wb	0-5	Cobbly loam	SM-SC, SC	A-2	15-30	65-75	60-70	40-50	25-35	20-30	5-10
Winetti	5-60	Gravelly sandy loam.	GM, SM	A-1	0-5	35-60	25-40	10-30	5-15	15-25	NP-5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under erosion factors--"T" apply to the entire profile. Entries under "wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
AaB----------	0-8	0.6-6.0	0.14-0.18	6.1-7.3	<2	Low-------	0.20	5	3
Alice	8-28	2.0-6.0	0.10-0.15	6.1-7.8	<2	Low-------	0.20		
	28-43	2.0-6.0	0.09-0.15	7.4-8.4	<2	Low-------	0.20		
	43-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low-------	0.10		
Ba, Bb----------	0-3	0.6-2.0	0.19-0.21	7.4-9.0	4-8	Low-------	0.37	5	4L
Barnum	3-60	0.6-2.0	0.16-0.18	7.4-9.0	4-8	Moderate	0.28		
BcA, BcB, BcC----	0-8	0.6-2.0	0.19-0.22	6.1-7.3	<2	Low-------	0.32	5	6
Boneek	8-22	0.2-0.6	0.11-0.17	6.1-7.8	<2	Moderate	0.43		
	22-47	0.6-2.0	0.16-0.20	7.4-9.0	<4	Moderate	0.43		
	47-60	---	---	---	---	----------	---		
BDE*:									
Buska----------	0-15	0.6-2.0	0.12-0.15	6.1-7.3	<2	Low-------	0.24	3	8
	15-37	0.6-2.0	0.09-0.13	6.1-7.3	<2	Moderate	0.24		
	37-60	0.6-2.0	0.09-0.13	6.1-7.8	<2	Low-------	0.24		
Rock outcrop.									
BeE----------	0-3	0.6-6.0	0.14-0.20	6.1-7.8	<2	Moderate	0.24	2	8
Butche	3-13	0.6-2.0	0.16-0.18	6.1-7.8	<2	Moderate	0.24		
	13-20	---	---	---	---	----------	---		
BhE*:									
Butche----------	0-3	0.6-6.0	0.14-0.20	6.1-7.8	<2	Moderate	0.24	2	8
	3-13	0.6-2.0	0.16-0.18	6.1-7.8	<2	Moderate	0.24		
	13-20	---	---	---	---	----------	---		
Rock outcrop.									
BkD*:									
Butche----------	0-3	0.6-6.0	0.14-0.20	6.1-7.8	<2	Moderate	0.24	2	6
	3-13	0.6-2.0	0.16-0.18	6.1-7.8	<2	Moderate	0.24		
	13-20	---	---	---	---	----------	---		
Satanta---------	0-7	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low-------	0.28	5	5
	7-60	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28		
CaD*, CaE*:									
Canyon----------	0-3	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low-------	0.24	2	8
	3-16	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-------	0.32		
	16-35	---	---	---	---	----------	---		
Bridget---------	0-10	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low-------	0.32	5	5
	10-60	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low-------	0.43		
CBE*----------	0-11	0.6-2.0	0.16-0.18	5.6-6.5	<2	Low-------	0.37	5	8
Citadel	11-25	0.2-0.6	0.11-0.17	5.1-6.5	<2	High------	0.37		
	25-60	0.2-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.37		
Cc*.									
Dumps									
EaD*:									
Enning----------	0-4	0.6-2.0	0.14-0.17	6.6-7.8	<2	Low-------	0.43	2	4L
	4-17	0.6-2.0	0.14-0.17	7.4-8.4	<2	Low-------	0.43		
	17-60	---	---	---	---	----------	---		
Minnequa---------	0-3	0.2-2.0	0.18-0.21	7.4-8.4	<2	Low-------	0.28	2	6
	3-26	0.6-2.0	0.16-0.18	7.4-8.4	<4	Low-------	0.32		
	26-60	---	---	---	---	----------	---		

See footnote at end of table.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
GaD----------	0-7	2.0-6.0	0.12-0.15	6.1-7.3	<2	Low-------	0.24	5	3
Glenberg Variant	7-60	2.0-6.0	0.08-0.15	3.6-6.5	<2	Low-------	0.17		
GBE*:									
Grizzly----------	0-20	2.0-6.0	0.12-0.15	5.6-7.3	<2	Low-------	0.28	5	8
	20-32	2.0-6.0	0.09-0.13	5.6-7.3	<2	Low-------	0.28		
	32-51	0.06-0.6	0.09-0.13	5.6-7.3	<2	High------	0.28		
	51-60	0.2-2.0	0.09-0.13	6.1-7.3	<2	Moderate--	0.28		
Virkula----------	0-12	0.6-2.0	0.17-0.20	5.6-6.5	<2	Low-------	0.37	5	8
	12-29	0.06-0.6	0.12-0.17	5.6-6.5	<2	High------	0.37		
	29-36	0.2-2.0	0.11-0.17	5.6-6.5	<2	High------	0.37		
	36-60	0.2-2.0	0.12-0.17	6.1-7.3	<2	Moderate	0.37		
GcD*, GdE*:									
Grummit----------	0-4	0.6-2.0	0.08-0.12	3.6-5.5	<2	High------	0.28	2	4
	4-13	0.6-2.0	0.08-0.12	3.6-5.5	<2	High------	0.28		
	13-60	---	---	---	---	----------	---		
Rock outcrop.									
GeD*:									
Gypnevee---------	0-7	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low-------	0.37	5	4L
	7-60	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low-------	0.37		
Rekop------------	0-4	0.6-2.0	0.16-0.18	7.9-9.0	2-4	Low-------	0.37	2	4L
	4-18	0.6-2.0	0.12-0.18	7.9-9.0	2-4	Low-------	0.43		
	18-60	---	---	---	---	----------	---		
Ha----------	0-3	0.6-2.0	0.17-0.20	6.6-7.8	<2	Low-------	0.43	5	8
Higgins	3-35	0.6-2.0	0.17-0.20	7.4-8.4	2-4	Low-------	0.43		
	35-60	0.6-2.0	0.17-0.20	6.6-8.4	2-4	Low-------	0.43		
HBF*:									
Hisega-----------	0-4	0.6-2.0	0.17-0.20	6.1-7.3	<2	Low-------	0.43	3	6
	4-19	0.6-2.0	0.09-0.13	6.1-7.3	<2	Low-------	0.43		
	19-30	0.6-2.0	0.09-0.13	6.1-7.8	<2	Low-------	0.43		
	30-60	0.6-2.0	0.09-0.13	6.1-7.8	<2	Low-------	0.43		
Rock outcrop.									
HcA----------	0-2	0.6-2.0	0.16-0.20	2 .1-7.3	<2	Low-------	0.28	1	7
Hisle	2-36	<0.06	.0.05-0.12	7.4-9.0	2-16	High------	0.28		
	36-60	---	---	---	---	----------	---		
HdA*:									
Hisle----------	0-2	0.6-2.0	0.16-0.20	6.1-7.3	<2	Low-------	0.28	1	7
	2-36	<0.06	0.05-0.12	7.4-9.0	2-16	High------	0.28		
	36-60	---	---	---	---	----------	---		
Slickspots.									
KaA, KaB---------	0-5	<0.06	0.08-0.12	6.6-7.8	<2	High------	0.37	5	4
Kyle	5-60	<0.06	0.08-0.12	7.4-8.4	<4	High------	0.37		
LaE----------	0-6	0.6-2.0	0.17-0.20	5.1-7.3	<2	Low-------	0.32	5	6
Lakoa	6-30	0.6-2.0	0.17-0.20	5.6-7.3	<2	Moderate	0.32		
	30-42	0.6-2.0	0.16-0.20	5.6-7.8	<2	Moderate	0.32		
	42-60	---	---	---	---	----------	---		
MaC, MaD---------	0-11	0.6-2.0	0.16-0.19	5.1-6.5	<2	Low-------	0.28	5	6
Maitland	11-44	0.6-2.0	0.16-0.20	5.1-6.5	<2	Moderate	0.28		
	44-60	0.6-2.0	0.12-0.18	5.6-7.8	<2	Moderate	0.28		
MBE*:									
Marshdale--------	0-35	0.06-0.6	0.19-0.21	6.1-7.8	<2	Moderate	0.32	5	6
	35-60	0.06-0.6	0.17-0.19	7.4-8.4	<2	Moderate	0.32		

See footnote at end of table.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
MBE*:									
Maitland--------	0-11	0.6-2.0	0.16-0.19	5.1-6.5	<2	Low-------	0.28	5	6
	11-44	0.6-2.0	0.16-0.20	5.1-6.5	<2	Moderate	0.28		
	44-60	0.6-2.0	0.12-0.18	5.6-7.8	<2	Moderate	0.28		
McD*:									
Midway----------	0-16	0.06-0.2	0.12-0.17	7.9-9.0	2-8	High------	0.37	2	4
	16-30	---	---	---	---	----------	---		
Razor-----------	0-3	0.06-0.2	0.12-0.18	7.4-8.4	<2	Moderate	0.37	2	7
	3-34	0.06-0.2	0.12-0.18	7.4-8.4	<4	High------	0.37		
	34-60	---	---	---	---	----------	---		
NaB, NaC---------	0-6	0.6-2.0	0.17-0.20	6.6-7.8	<2	Low-------	0.32	5	4L
Nevee	6-60	0.6-2.0	0.12-0.20	7.4-9.0	2-4	Low-------	0.43		
NbD*:									
Nevee-----------	0-6	0.6-2.0	0.17-0.20	6.6-7.8	<2	Low-------	0.32	5	4L
	6-60	0.6-2.0	0.12-0.20	7.4-9.0	2-4	Low-------	0.43		
Spearfish-------	0-7	0.6-2.0	0.16-0.22	6.6-8.4	<2	Low-------	0.32	2	4L
	7-12	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low-------	0.32		
	12-60	---	---	---	---	----------	---		
Rock outcrop.									
NcD---------------	0-8	0.6-2.0	0.12-0.16	7.4-7.8	<2	Low-------	0.24	2	5
Nihill	8-60	2.0-6.0	0.07-0.09	7.4-8.4	<4	Low-------	0.20		
NdA, NdB, NdC----	0-5	0.2-2.0	0.15-0.20	6.1-7.8	<2	Moderate	0.24	5	6
Nunn	5-25	0.06-0.6	0.15-0.18	6.6-8.4	<2	High------	0.28		
	25-60	0.2-2.0	0.10-0.18	7.4-8.4	<2	Moderate	0.24		
PAE*--------------	0-9	0.6-2.0	0.12-0.15	5.5-7.3	<2	Low-------	0.28	5	8
Pactola	9-22	0.6-2.0	0.09-0.13	5.5-7.3	<2	Moderate	0.37		
	22-45	0.6-2.0	0.09-0.13	5.5-7.3	<2	Moderate	0.37		
	45-60	0.6-2.0	0.09-0.13	6.1-7.3	<2	Moderate	0.37		
Rock outcrop.									
PbE*:									
Paunsaugunt------	0-5	0.6-2.0	0.13-0.15	7.4-8.4	<2	Low-------	0.20	1	8
	5-17	2.0-6.0	0.06-0.08	7.4-8.4	<2	Low-------	0.17		
	17-30	---	---	---	---	----------			
Rock outcrop.									
PcB, PcD----------	0-3	<0.06	0.08-0.12	6.1-7.3	<2	High------	0.37	4	4
Pierre	3-29	<0.06	0.08-0.12	6.6-8.4	<2	High------	0.37		
	29-60	---	---	---	---	----------	---		
Pe*.									
Pits									
RaE:									
Rekop------------	0-4	0.6-2.0	0.16-0.18	7.9-9.0	2-4	Low-------	0.37	2	4L
	4-18	0.6-2.0	0.12-0.18	7.9-9.0	2-4	Low-------	0.43		
	18-60	---	---	---	---	----------	---		
Gypnevee---------	0-7	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low-------	0.37	5	4L
	7-60	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low-------	0.37		
Rock outcrop.									
RBF*:									
Rock outcrop.									

See footnote at end of table.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
RBF*:									
Pactola	0-9	0.6-2.0	0.12-0.15	6.1-7.3	<2	Low	0.28	5	8
	9-22	0.6-2.0	0.09-0.13	6.1-7.3	<2	Moderate	0.37		
	22-45	0.6-2.0	0.09-0.13	6.1-7.3	<2	Moderate	0.37		
	45-60	0.6-2.0	0.09-0.13	6.1-7.3	<2	Moderate	0.37		
RCF*:									
Rock outcrop.									
Vanocker	0-4	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.24	5	8
	4-60	0.6-2.0	0.09-0.11	5.6-7.8	<2	Moderate	0.24		
SaA, SaB, SaC	0-7	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low	0.28	5	5
Satanta	7-60	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28		
SbA, SbB	0-7	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	6
Savo	7-18	0.2-2.0	0.11-0.19	6.6-7.3	<2	High	0.43		
	18-60	0.2-2.0	0.11-0.17	7.4-8.4	<2	High	0.43		
ScD*:									
Snomo	0-6	0.6-2.0	0.10-0.14	5.1-6.5	<2	High	0.28	5	8
	6-45	0.6-2.0	0.08-0.12	3.6-5.5	<2	High	0.28		
	45-49	0.6-2.0	0.08-0.12	3.6-5.0	<2	High	0.28		
	49-60	---	---	---	---	---	---		
Rock outcrop.									
Sd	0-60	<0.2	0.08-0.16	5.1-6.5	<2	High	0.37	5	4
Stetter Variant									
SEE*	0-7	0.6-2.0	0.17-0.20	5.6-6.5	<2	Low	0.37	5	5
Stovho	7-28	0.2-0.6	0.14-0.17	5.6-7.3	<2	High	0.37		
	28-36	0.2-2.0	0.14-0.17	5.6-7.8	<2	Moderate	0.37		
	36-60	0.2-2.0	0.12-0.15	7.4-8.4	<2	Moderate	0.37		
SGF*:									
Stovho	0-7	0.6-2.0	0.17-0.20	5.6-6.5	<2	Low	0.37	5	5
	7-28	0.2-0.6	0.14-0.17	5.6-7.3	<2	High	0.37		
	28-36	0.2-2.0	0.14-0.17	5.6-7.8	<2	Moderate	0.37		
	36-60	0.2-2.0	0.12-0.15	7.4-8.4	<2	Moderate	0.37		
Trebor	0-2	0.6-2.0	0.16-0.18	5.6-6.5	<2	Low	0.37	3	8
	2-6	0.2-0.6	0.10-0.17	6.1-7.3	<2	High	0.37		
	6-10	0.2-0.6	0.09-0.13	6.6-7.8	<2	Moderate	0.37		
	10-30	0.6-2.0	0.08-0.10	7.4-8.4	<2	Moderate	0.37		
	30-40	---	---	---	---	---	---		
ShA	0-24	0.6-2.0	0.17-0.22	6.6-7.8	<2	Moderate	0.24	5	6
St. Onge	24-60	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	0.32		
Sk	0-14	0.6-2.0	0.18-0.22	6.6-8.4	<2	Low	0.32	5	6
Swint	14-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low	0.43		
TaA, TaB, TaC	0-6	0.6-2.0	0.19-0.22	6.6-7.8	<2	Low	0.32	5	6
Tilford	6-20	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low	0.43		
	20-60	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	0.43		
TBE*:									
Trebor	0-2	0.6-2.0	0.16-0.18	5.6-6.5	<2	Low	0.37	3	8
	2-6	0.2-0.6	0.10-0.17	6.1-7.3	<2	High	0.37		
	6-10	0.2-0.6	0.09-0.13	6.6-7.8	<2	Moderate	0.37		
	10-30	0.6-2.0	0.08-0.10	7.4-8.4	<2	Moderate	0.37		
	30-40	---	---	---	---	---	---		
Rock outcrop.									

See footnote at end of table.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
VaA, VaB, VaC----	0-6	0.6-2.0	0.19-0.22	6.1-7.8	<2	Moderate	0.32	5	6
Vale	6-19	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.43		
	19-60	0.6-2.0	0.13-0.20	7.4-9.0	<2	Low-------	0.43		
VBF*:									
Vanocker--------	0-4	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.24	5	6
	4-60	0.6-2.0	0.09-0.11	5.6-7.8	<2	Moderate	0.24		
Citadel---------	0-11	0.6-2.0	0.16-0.18	5.6-6.5	<2	Low-------	0.37	5	6
	11-25	0.2-0.6	0.11-0.17	5.1-6.5	<2	High------	0.37		
	25-60	0.2-2.0	0.17-0.20	6.6-7.8	<2	Moderate	0.37		
VCE*----------	0-12	0.6-2.0	0.17-0.20	5.6-6.5	<2	Low-------	0.37	5	6
Virkula	12-29	0.06-0.6	0.12-0.17	5.6-6.5	<2	High------	0.37		
	29-36	0.2-2.0	0.11-0.17	5.6-6.5	<2	High------	0.37		
	36-60	0.2-2.0	0.12-0.17	6.1-7.3	<2	Moderate	0.37		
WaA----------	0-7	0.6-2.0	0.16-0.19	6.1-7.8	<2	Low-------	0.24	3	5
Weber	7-23	0.6-2.0	0.16-0.20	6.1-8.4	<2	Moderate	0.28		
	23-60	>20	0.03-0.06	7.4-8.4	<2	Low-------	0.10		
Wb----------	0-5	2.0-6.0	0.08-0.10	7.4-7.8	<2	Low-------	0.10	3	8
Winetti	5-60	2.0-6.0	0.04-0.08	7.9-8.4	<2	Low-------	0.20		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 20.--SOIL AND WATER FEATURES

[The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AaB---------- Alice	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Ba, Bb---------- Barnum	B	Occasional	Brief-----	May-Jul	>6.0	---	---	>60	---	Low-------	High-----	High.
BcA, BcB, BcC----- Boneek	B	None----------	---	---	>6.0	---	---	40-60	Rippable	Low-------	High-----	Low.
BDE*: Buska----------	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Rock outcrop.												
BeE---------- Butche	D	None----------	---	---	>6.0	---	---	7-20	Hard	Low-------	Moderate	Low.
BhE*: Butche----------	D	None----------	---	---	>6.0	---	---	7-20	Hard	Low-------	Moderate	Low.
Rock outcrop.												
BkD*: Butche----------	D	None----------	---	---	>6.0	---	---	7-20	Hard	Low-------	Moderate	Low.
Satanta----------	B	None----------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	Low.
CaD*, CaE*: Canyon----------	D	None----------	---	---	>6.0	---	---	6-20	Rippable	Low-------	Low-------	Low.
Bridget----------	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
CBE*---------- Citadel	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Cc*: Dumps												
EaD*: Enning----------	D	None----------	---	---	>6.0	---	---	10-20	Rippable	Low-------	Moderate	Moderate.
Minnequa----------	B	None----------	---	---	>6.0	---	---	20-40	Rippable	Low-------	High-----	Moderate.
GaD---------- Glenberg Variant	B	Frequent----	Brief-----	Apr-Aug	4.0-6.0	Apparent	Apr-Jun	>60	---	Low-------	High-----	High.
GBE*: Grizzly----------	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Virkula----------	B	None----------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.

See footnote at end of table.

TABLE 20.--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				
GcD*, GdE*:												
Grummit	D	None	---	---	>6.0	---	---	5-20	Rippable	Low	High	High.
Rock outcrop.												
GeD*:												
Gypnevee	B	None	---	---	>6.0	---	---	>60	---	Low	High	High.
Rekop	D	None	---	---	>6.0	---	---	10-20	Rippable	Low	High	High.
Ha	D	Common	Very brief to brief.	Mar-Oct	0-2.0	Apparent	Oct-Jul	>60	---	High	High	High.
Higgins												
HBF*:												
Hisega	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Rock outcrop.												
HcA	D	None	---	---	>6.0	---	---	20-40	Rippable	Low	High	Moderate.
Hisle												
HdA*:												
Hisle	D	None	---	---	>6.0	---	---	20-40	Rippable	Low	High	Moderate.
Slickspots.												
KaA, KaB	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Kyle												
LaE	B	None	---	---	>6.0	---	---	>40	Rippable	Moderate	High	Moderate.
Lakoa												
MaC, MaD	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Maitland												
MBE*:												
Marshdale	C	Common	Very brief	Apr-Oct	1.0-2.0	Apparent	Apr-Oct	>60	---	High	High	Low.
Maitland	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
McD*:												
Midway	D	None	---	---	>6.0	---	---	10-20	Rippable	Low	High	Low.
Razor	C	None	---	---	>6.0	---	---	20-40	Rippable	Low	High	Low.
NaB, NaC	B	None	---	---	>6.0	---	---	40-60	Rippable	Low	High	Moderate.
Nevee												
NbD*:												
Nevee	B	None	---	---	>6.0	---	---	40-60	Rippable	Low	High	Moderate.
Spearfish	D	None	---	---	>6.0	---	---	6-20	Rippable	Low	High	Moderate.
Rock outcrop.												

See footnote at end of table.

TABLE 20.--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				
NcD---------- Nihill	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
NdA, NdB, NdC----- Nunn	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
PAE*---------- Pactola	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Rock outcrop.												
PbE*: Paunsaugunt------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	Moderate.
Rock outcrop.												
PcB, PcD---------- Pierre	D	None--------	---	---	>6.0	---	---	20-40	Rippable	Low------	High-----	Moderate.
Pe*. Pits												
RaE*: Rekop----------	D	None--------	---	---	>6.0	---	---	10-20	Rippable	Low------	High-----	High.
Gypnevee---------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
Rock outcrop.												
RBF*: Rock outcrop.												
Pactola----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
RCF*: Rock outcrop.												
Vanocker---------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
SaA, SaB, SaC----- Satanta	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
SbA, SbB---------- Savo	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
ScD*: Snomo----------	C	None--------	---	---	>6.0	---	---	40-60	Rippable	Low------	Moderate	High.
Rock outcrop.												
Sd---------- Stetter Variant	D	Common------	Brief-----	Mar-Oct	>6.0	---	---	>60	---	Low------	High-----	Low.
SEE---------- Stovho	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.

See footnote at end of table.

TABLE 20.--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				
SGF*:												
Stovho	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Trebor	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High	Moderate.
ShA St. Onge	B	Common	Very brief	Sep-Jun	>6.0	---	---	>60	---	Moderate	High	Low.
Sk Swint	B	Rare to occasional.	Brief	Apr-Oct	>6.0	---	---	>60	---	Moderate	High	Low.
TaA, TaB, TaC Tilford	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
TBE*:												
Trebor	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High	Low.
Rock outcrop.												
VaA, VaB, VaC Vale	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
VBF*:												
Vanocker	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Citadel	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
VCE* Virkula	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
WaA Weber	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Wb Winetti	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.

* See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 21.--ENGINEERING TEST DATA

[Dashes indicate data were not available]

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution								Liquid limit	Plasticity index	Moisture density	
			>3	Percentage passing sieve--				Percentage smaller than--					Moisture density	Optimum moisture
	AASHTO	Unified		3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			
			Pct									Pct		Lb/Ft	Pct
Buska channery silt loam (S76SD-081-003)															
A2------- 2 to 14	A-6 (07)	ML	0	100	98	96	77	65	--	17	--	39	12	111	16
B21t-----23 to 39	A-6 (09)	ML	0	100	99	98	80	68	--	23	--	39	14	116	14
Citadel loam (S76SD-081-004)															
A2------- 1 to 6	A-4 (00)	ML	0	100	100	100	99	55	--	14	--	19	3	112	16
B21t-----11 to 25	A-7-6(20)	ML	10	100	100	100	100	92	--	54	--	47	19	108	18
B3-------25 to 40	A-6 (09)	CL	20	100	93	93	92	77	--	31	--	31	14	116	14
C--------40 to 60	A-4 (04)	CL	30	100	97	96	93	69	--	31	--	25	10	121	12
Grizzly silt loam (S76SD-081-001)															
A22------10 to 28	A-4 (00)	GM	7	100	69	62	51	43	--	10	--	23	3	112	16
B2t------48 to 60	A-7-6(14)	CH	27	100	88	82	64	56	--	29	--	51	30	106	19
Hisega loam (S76SD-081-002)															
B2------- 4 to 19	A-4 (02)	SM	0	100	84	80	64	48	--	13	--	34	9	111	16
Pactola loam (S76SD-081-005)															
A2------- 2 to 9	A-2-4(00)	SM	9	100	69	55	38	33	--	6	--	37	10	111	16
B&A------ 9 to 22	A-6 (03)	SC	36	100	68	61	50	46	--	17	--	34	13	115	15
B21t-----22 to 45	A-7-6(10)	CL	40	100	83	77	65	60	--	23	--	42	20	111	16
C--------45 to 60	A-4 (01)	SC	40	100	72	65	47	41	--	12	--	33	10	119	13

TABLE 22.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alice	Coarse-loamy, mixed, mesic Aridic Haplustolls
Barnum	Fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Boneek	Fine, montmorillonitic, mesic Aridic Argiustolls
Bridget	Coarse-silty, mixed, mesic Torriorthentic Haplustolls
Buska	Loamy-skeletal, micaceous Typic Eutroboralfs
Butche	Loamy, mixed, nonacid, mesic Lithic Ustic Torriorthents
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Citadel	Fine, montmorillonitic Typic Eutroboralfs
Enning	Loamy, carbonatic, mesic, shallow Ustic Torriorthents
Glenberg Variant	Coarse-loamy, mixed, nonacid, mesic Ustic Torrifluvents
Grizzly	Loamy-skeletal, mixed Typic Eutroboralfs
Grummit	Clayey, montmorillonitic, acid, mesic, shallow Ustic Torriorthents
Gypnevee	Coarse-silty, gypsic, mesic Ustic Torriorthents
Higgins	Coarse-silty, gypsic, mesic Typic Haplaquepts
Hisega	Loamy-skeletal, micaceous, frigid Dystric Eutrochrepts
Hisle	Fine, montmorillonitic, mesic Ustollic Natrargids
Kyle	Very-fine, montmorillonitic, mesic Ustertic Camborthids
Lakoa	Fine-loamy, mixed Typic Eutroboralfs
Maitland	Fine-loamy, mixed Mollic Eutroboralfs
Marshdale	Fine-loamy, mixed, frigid Cumulic Haplaquolls
Midway	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Minnequa	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Nevee	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Nihill	Loamy-skeletal, mixed (calcareous), mesic Ustic Torriorthents
Nunn	Fine, montmorillonitic, mesic Aridic Argiustolls
Pactola	Loamy-skeletal, mixed Typic Eutroboralfs
Paunsaugunt	Loamy-skeletal, mixed Lithic Haploborolls
Pierre	Very-fine, montmorillonitic, mesic Ustertic Camborthids
Razor	Fine, montmorillonitic, mesic Ustollic Camborthids
Rekop	Loamy, gypsic, mesic, shallow Ustic Torriorthents
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Savo	Fine, montmorillonitic, mesic Aridic Argiustolls
Snomo	Very-fine, montmorillonitic, mesic Ustollic Camborthids
Spearfish	Loamy, mixed, (calcareous), mesic, shallow Ustic Torriorthents
St. Onge	Fine-loamy, mixed, mesic Cumulic Haplustolls
Stetter Variant	Fine, montmorillonitic, nonacid, mesic Ustertic Torrifluvents
Stovho	Fine, montmorillonitic Mollic Cryoboralfs
Swint	Fine-loamy, mixed, mesic Fluventic Haplustolls
Tilford	Fine-silty, mixed, mesic Torriorthentic Haplustolls
Trebor	Loamy-skeletal, mixed Typic Cryoboralfs
Vale	Fine-silty, mixed, mesic Aridic Argiustolls
Vanocker	Loamy-skeletal, mixed, frigid Typic Eutrochrepts
Virkula	Fine, montmorillonitic Typic Eutroboralfs
Weber	Fine-silty over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Winetti	Loamy-skeletal, mixed (calcareous), frigid Typic Ustifluvents

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