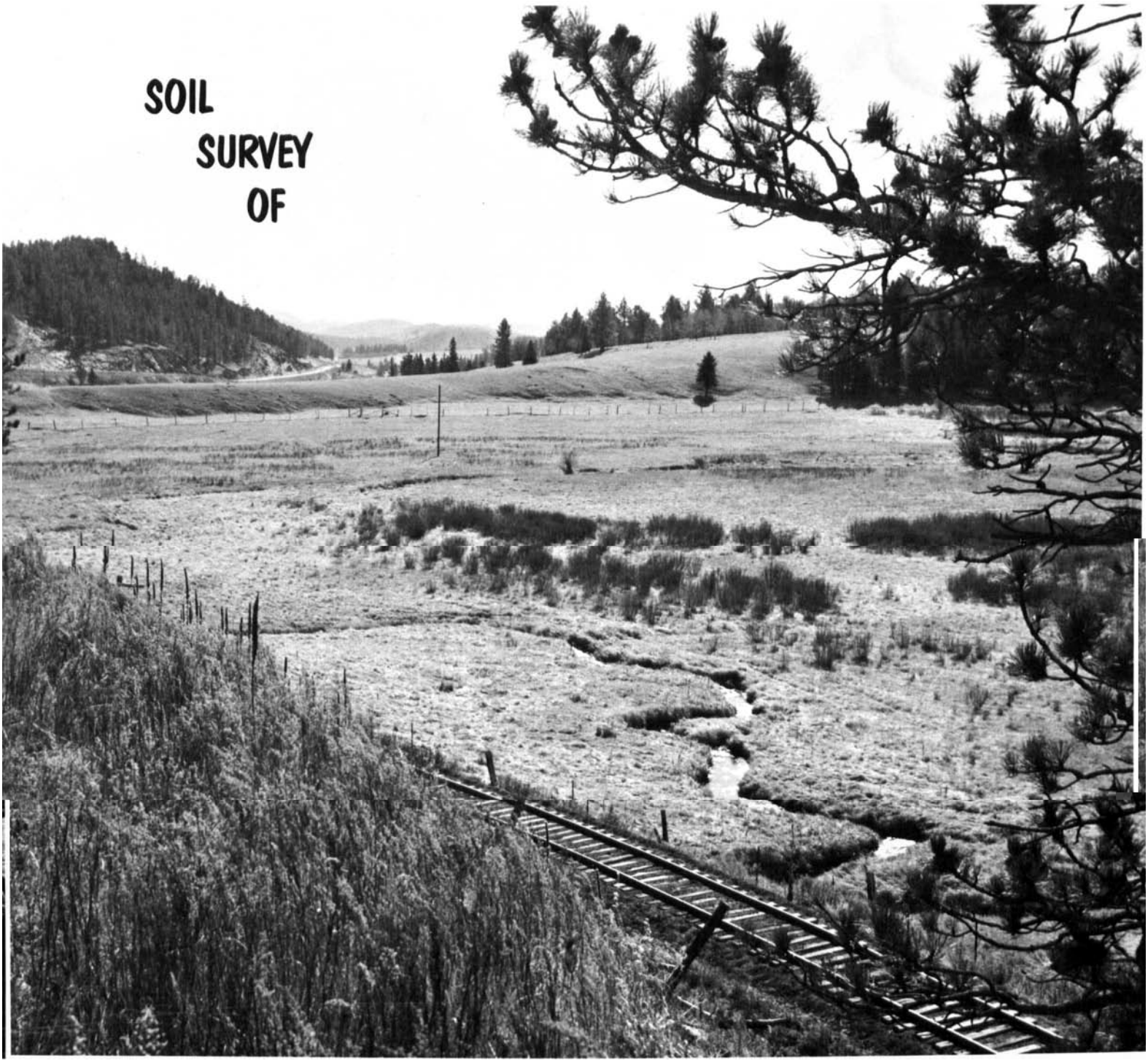
SOIL
SURVEY
OF

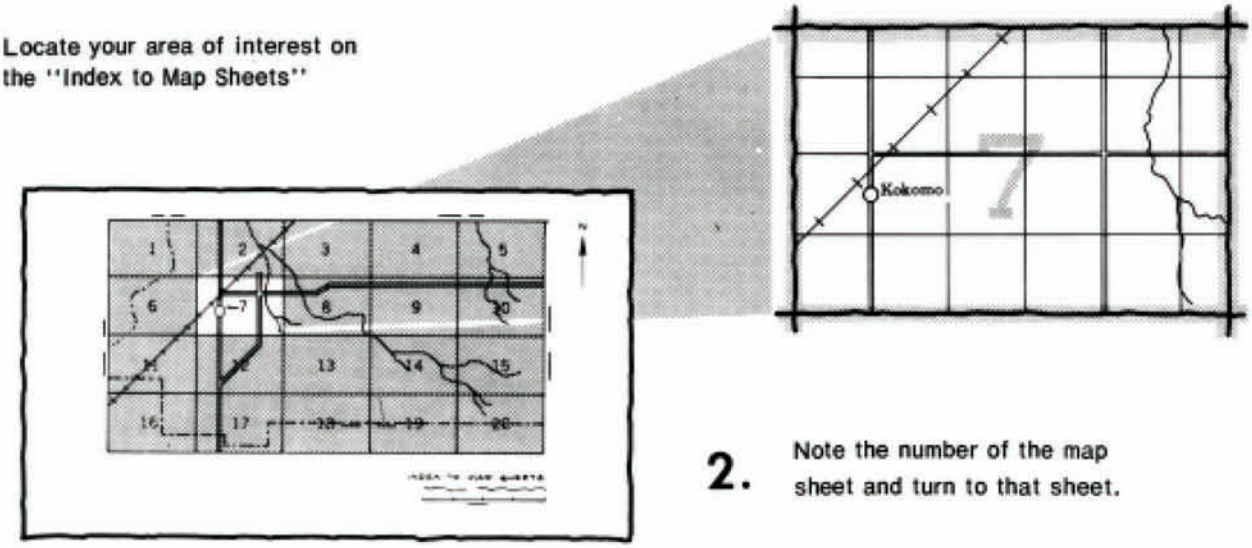


LAWRENCE COUNTY, SOUTH DAKOTA

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

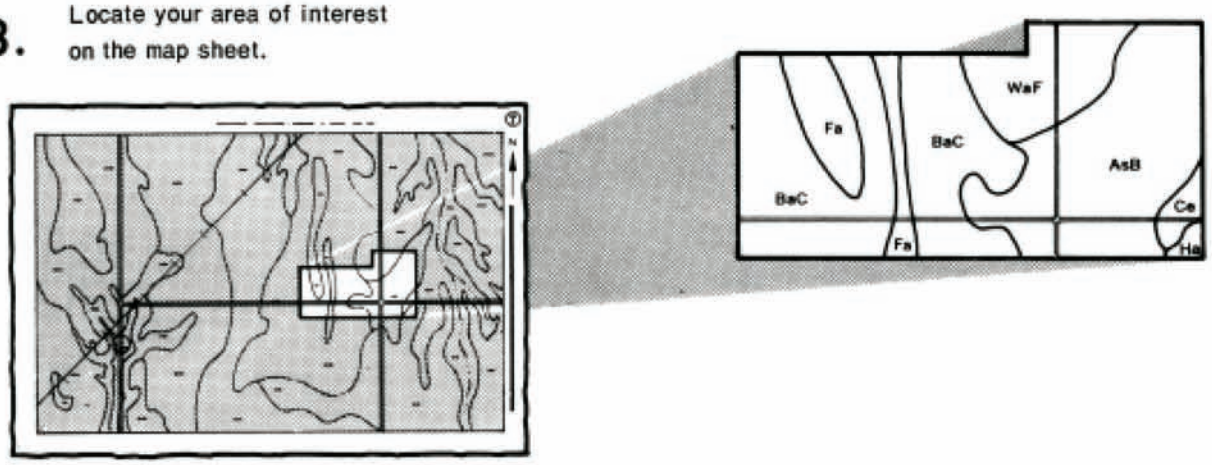
HOW TO USE

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

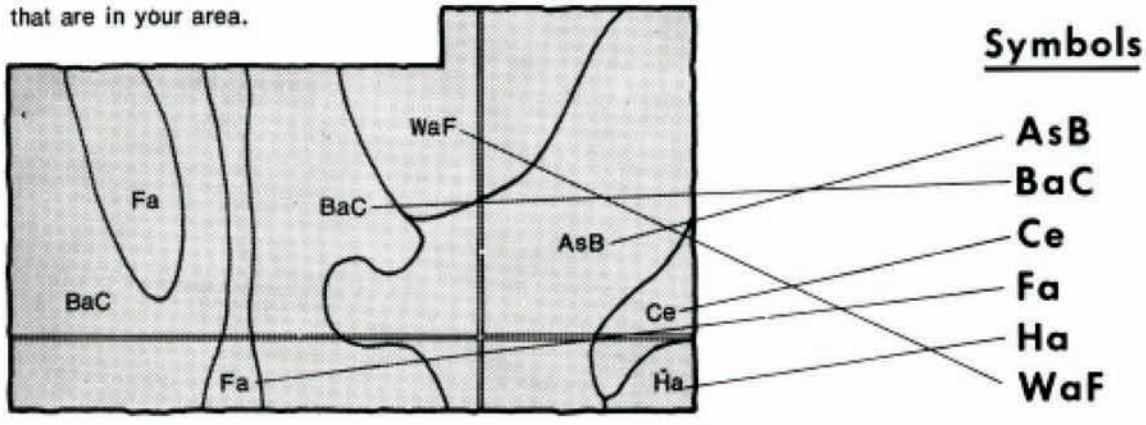


2. Note the number of the map sheet and turn to that sheet.

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

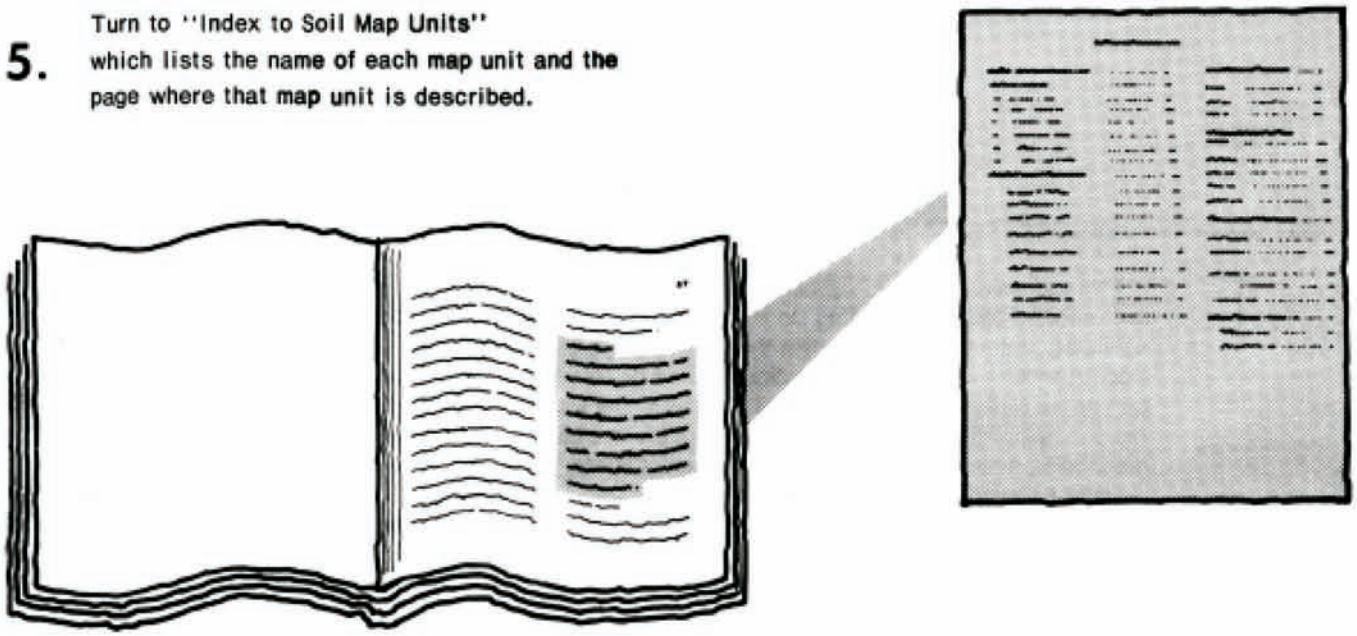


4. List the map unit symbols that are in your area.

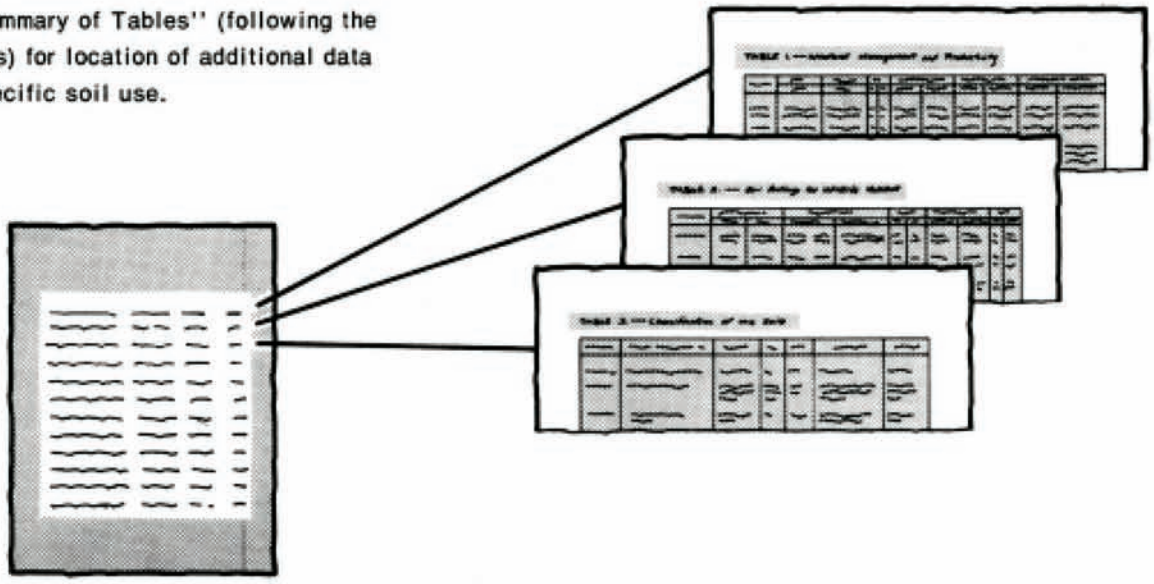


THIS SOIL SURVEY

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.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Valley of Marshdale-Maitland association, sloping.

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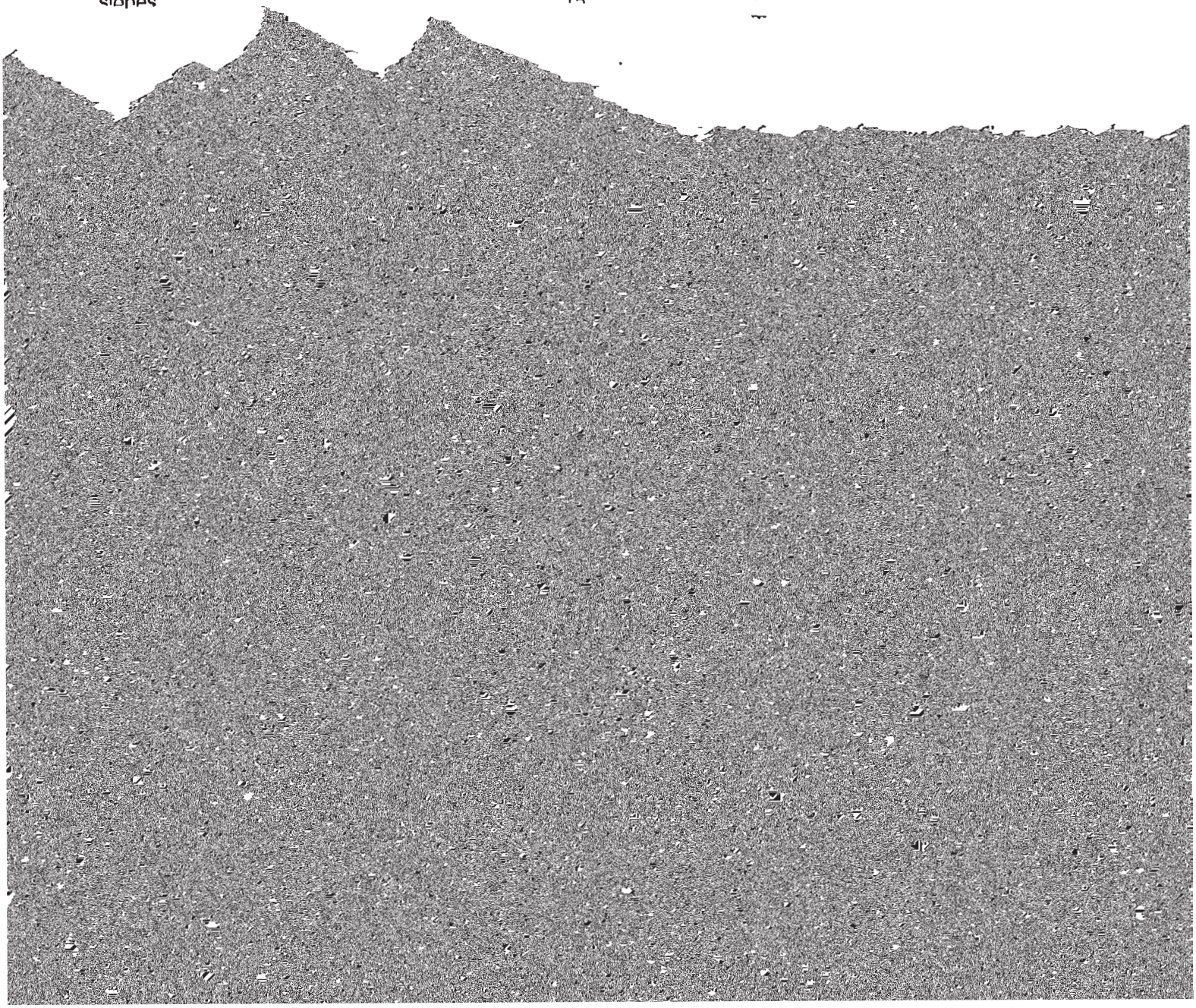

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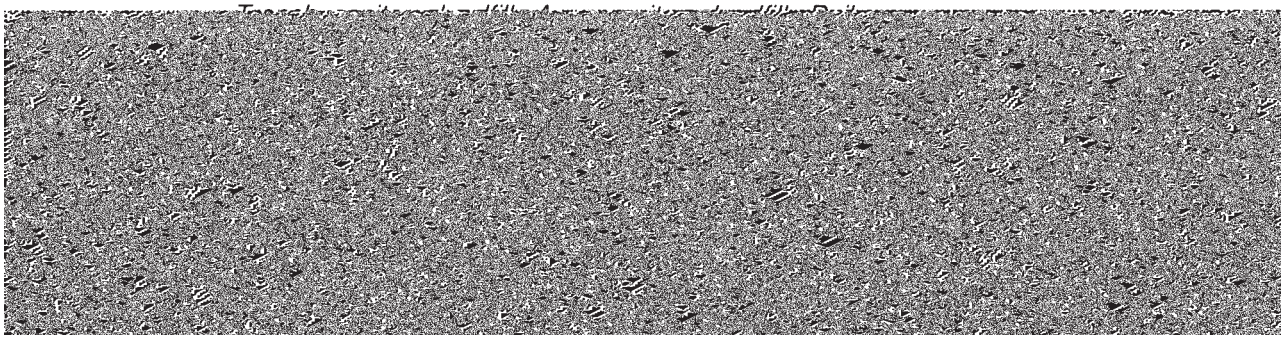

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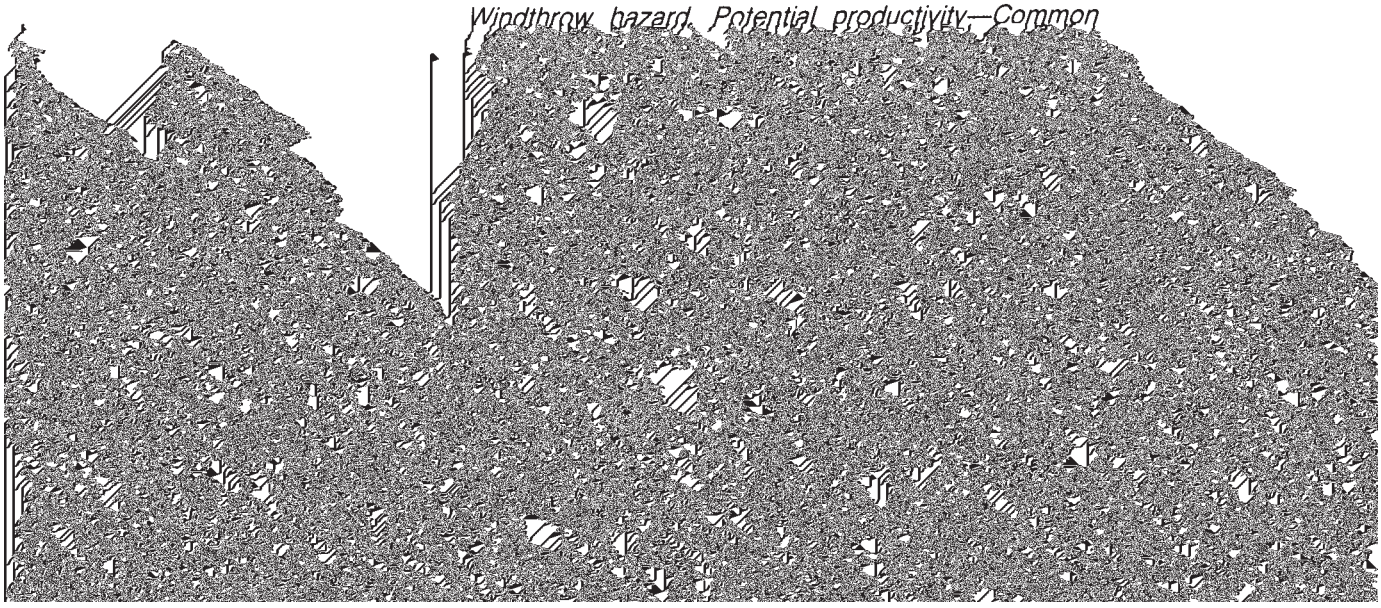
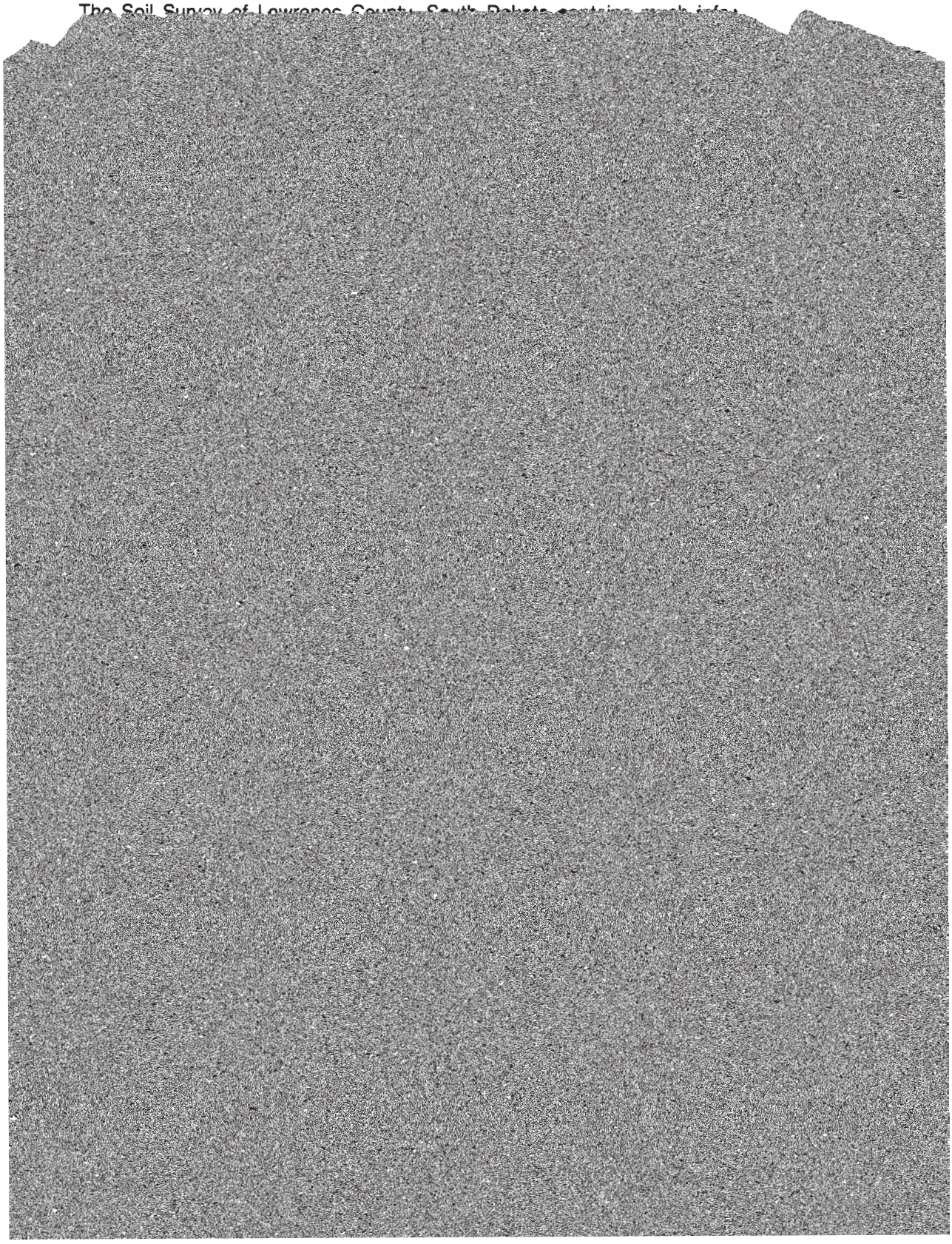
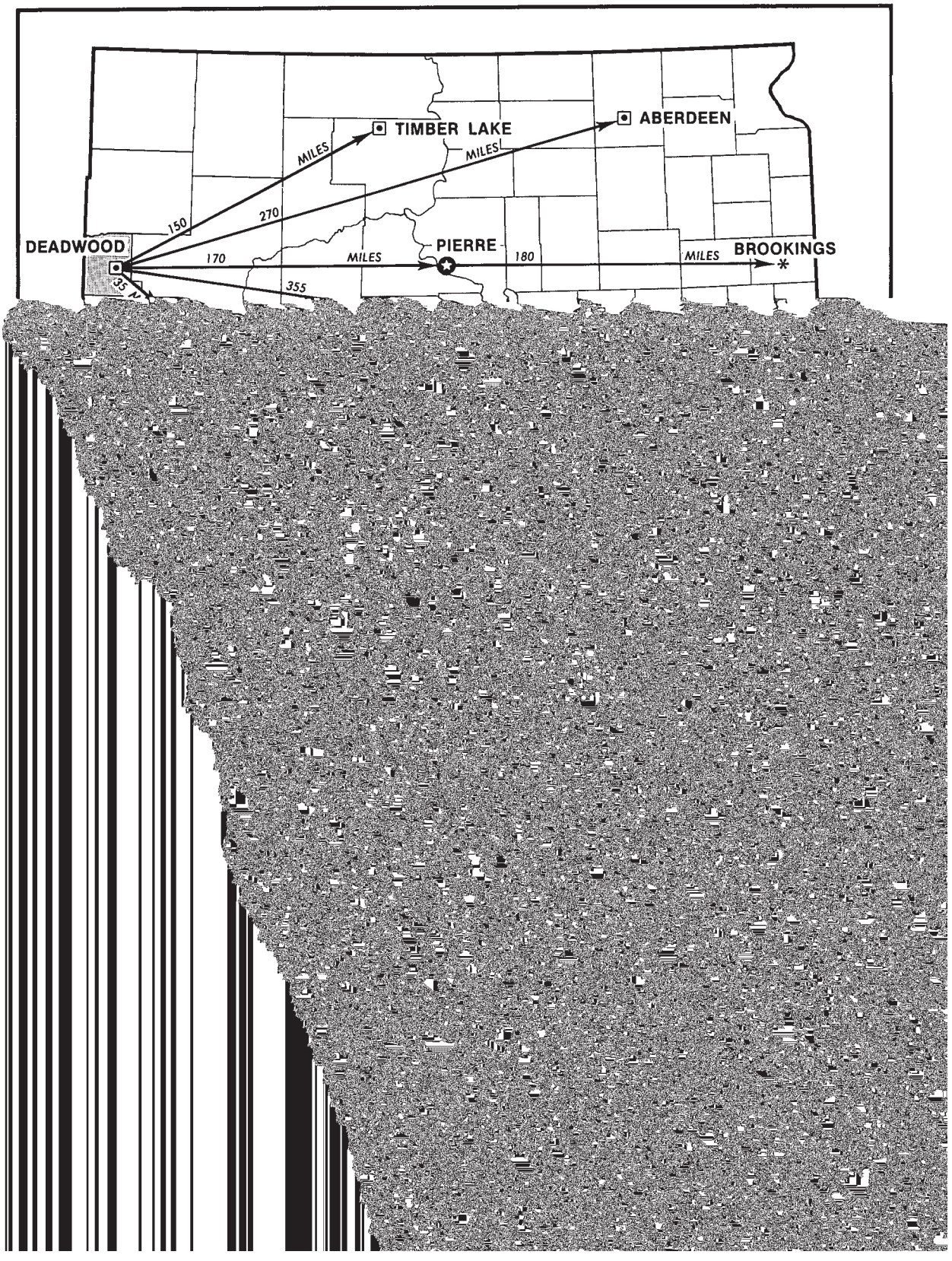


Foreword

The Soil Survey of Lawrence County, South Dakota, contains much infor

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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

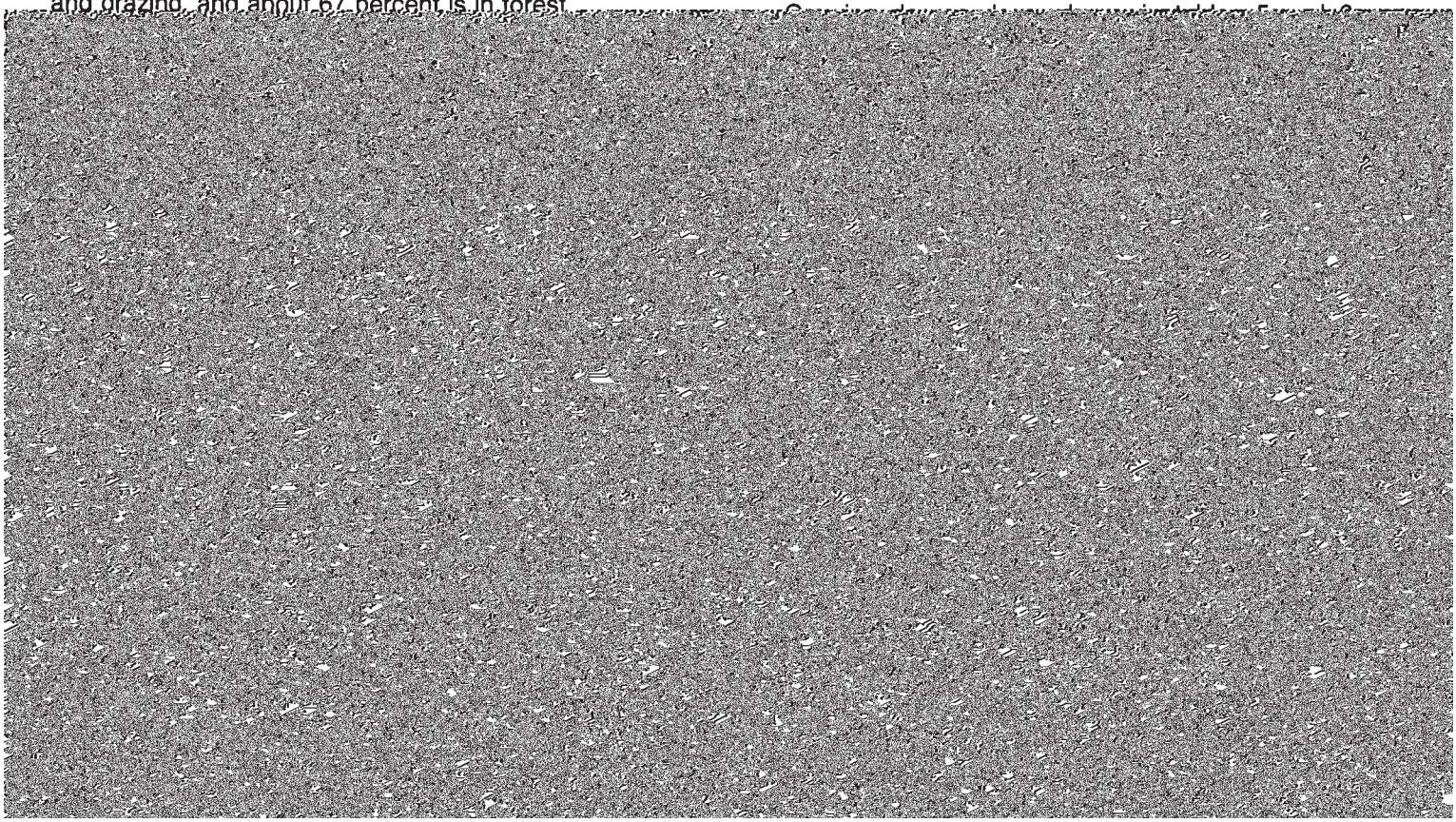
United States Department of Agriculture, Soil Conservation Service, in cooperation with the Forest Service and the South Dakota Agricultural Experiment Station

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.

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.



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

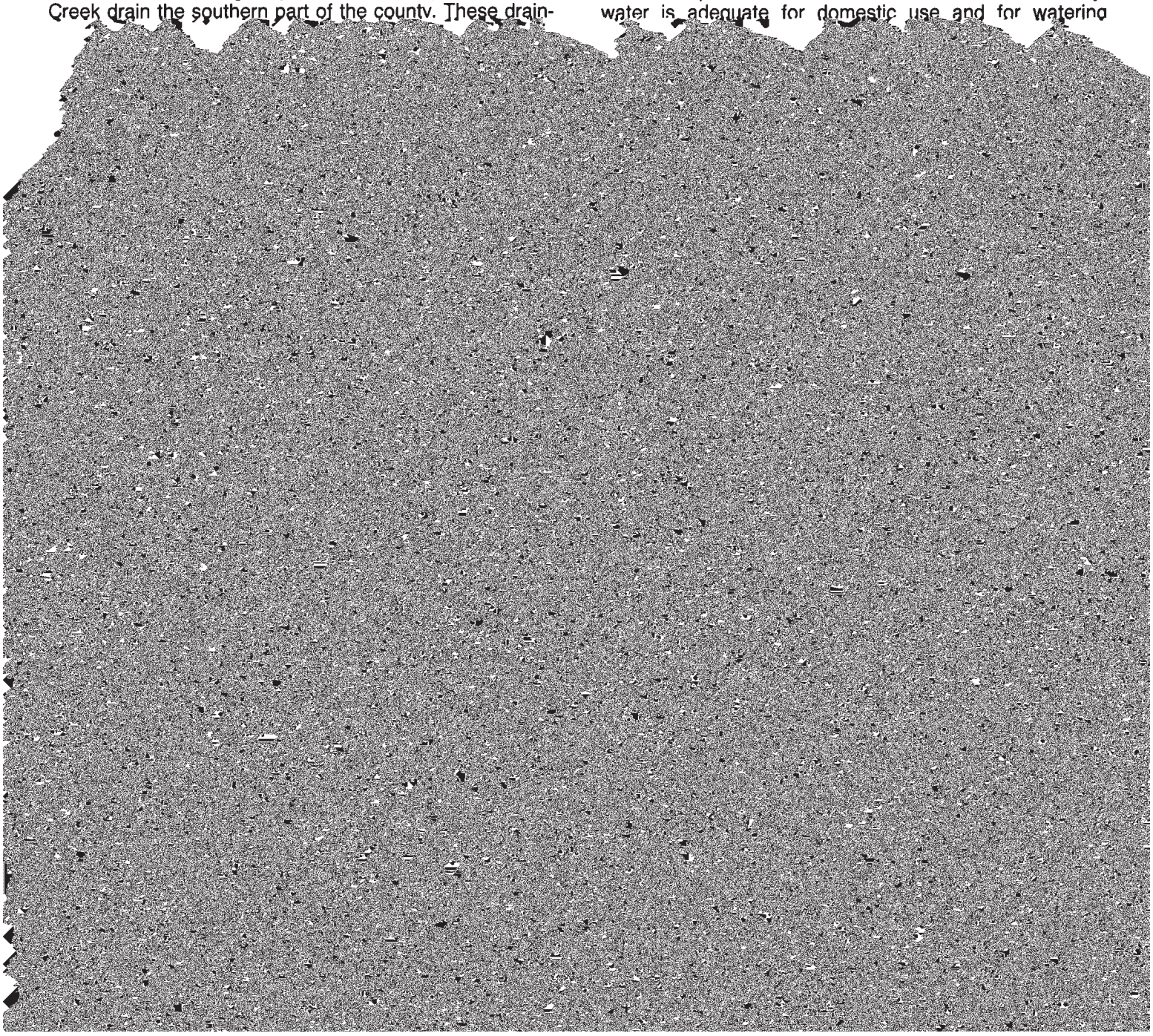
Lawrence County is in the northern part of the Black Hills. Spearfish and Whitewood Creeks and their tributaries drain the northern part of Lawrence County. They flow into the Belle Fourche and Redwater Rivers. Numerous small drainageways that eventually enter Rapid Creek drain the southern part of the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

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



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 select-

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

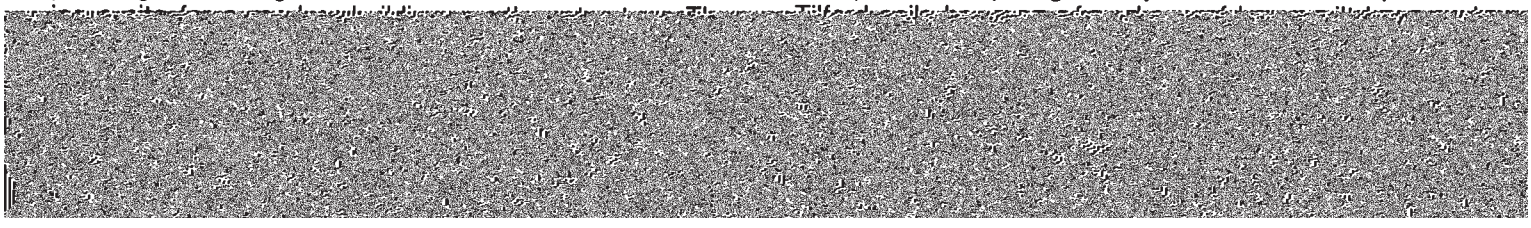
This map unit consists of upland plains and high terraces. It is in a valley between a sandstone ridge and the Black Hills. Slopes generally are long and are mostly nearly level to moderately sloping but are steeper on the sides of some ridges and along entrenched drainageways (fig. 1).

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.

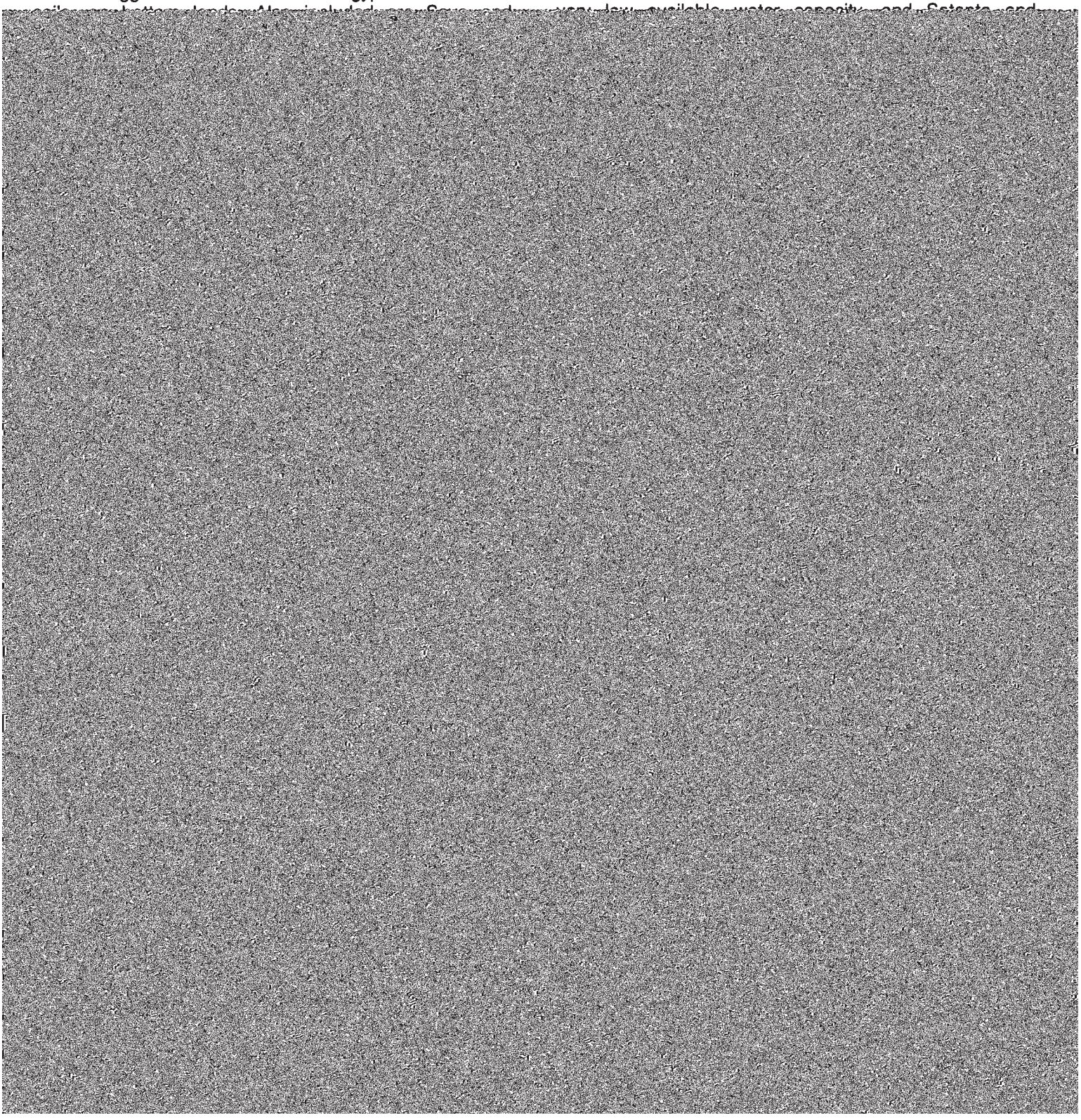
Tilford soils are on rises above the lower side slopes on uplands. Slopes generally are less than 9 percent.



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

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



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.

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.

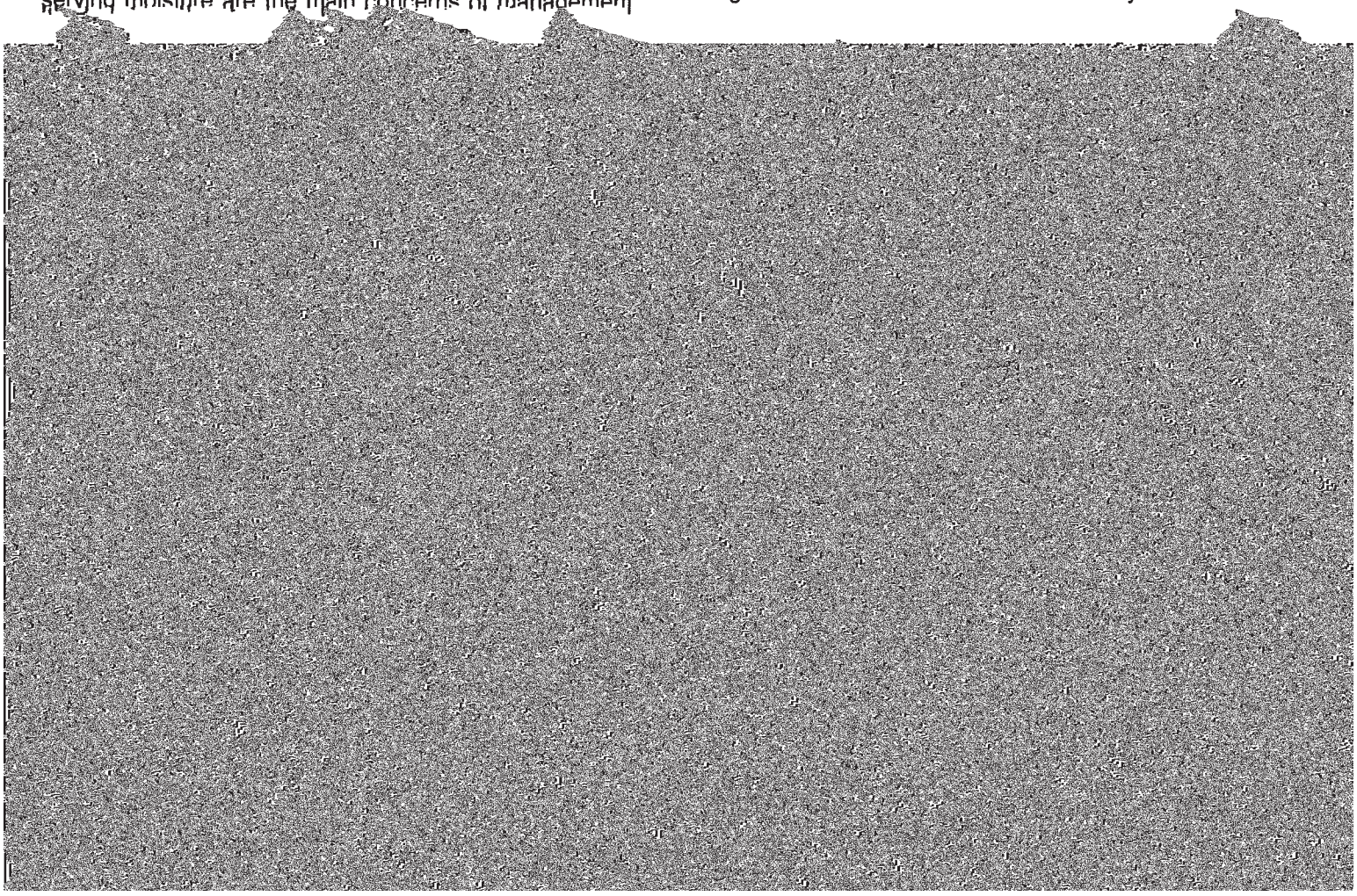
Barnum soils are on bottom lands. Some areas are dissected by deep stream channels. Barnum soils have a surface layer of brown silt loam that is underlain by very friable, brown loam.

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



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

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

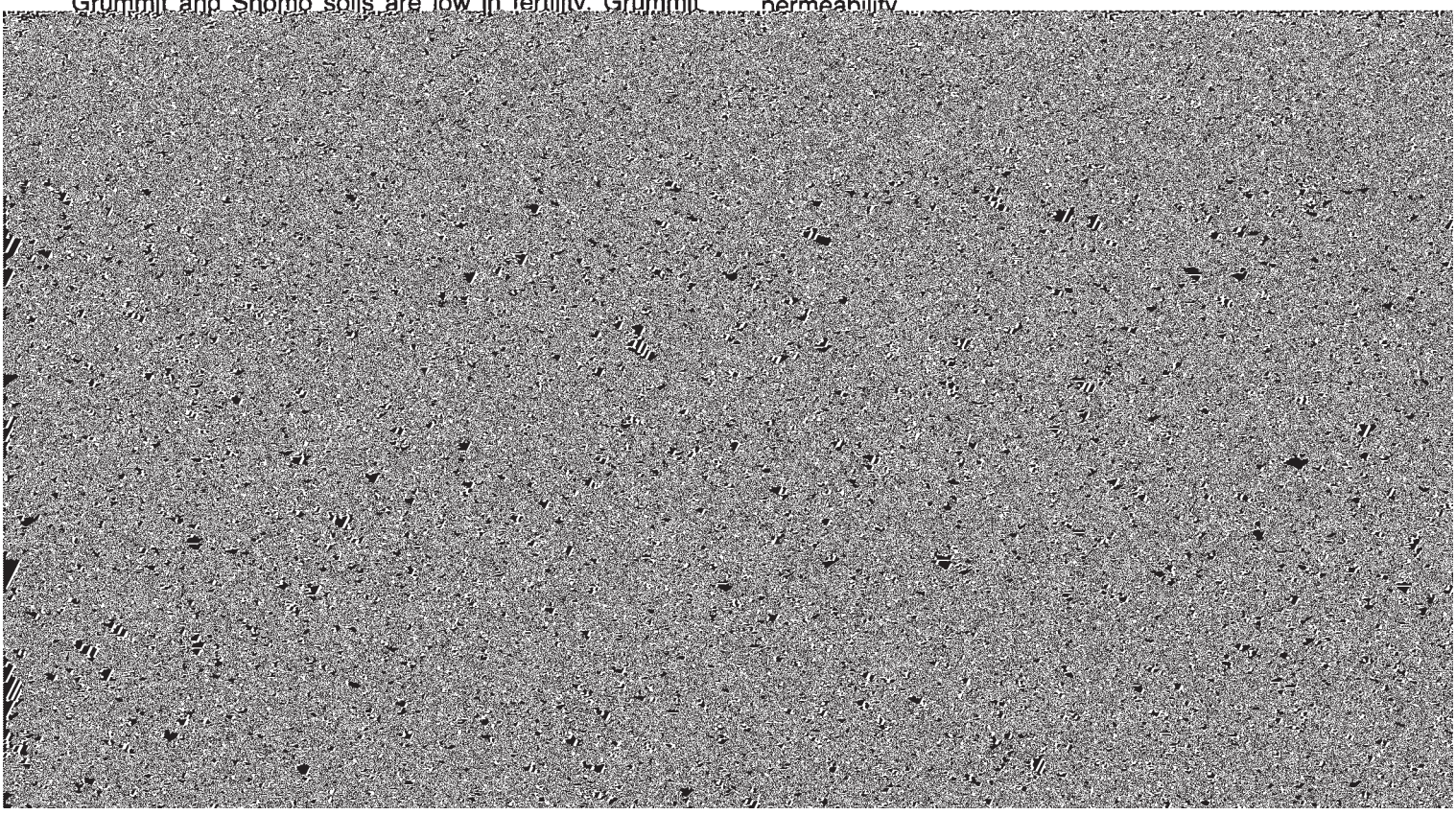
This map unit consists of side slopes on the outer edge of the Black Hills. Slopes generally are long and smooth, and main drainages from the Black Hills are entrenched into the limestone bedrock.

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.



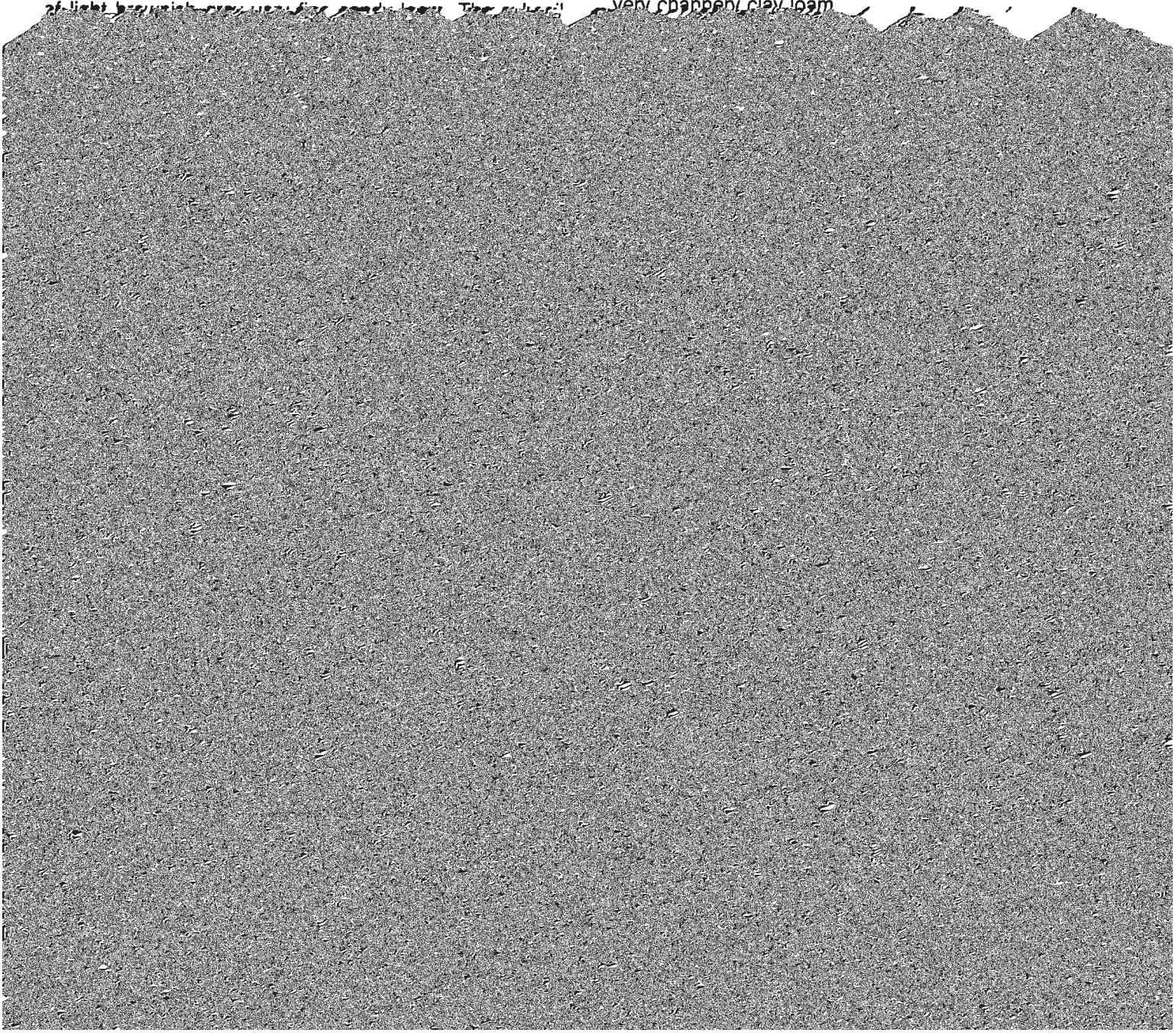
This map unit makes up about 2 percent of the county. It is about 50 percent Lakoa soils, 40 percent Maitland soils, and 10 percent minor soils.

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

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.



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."

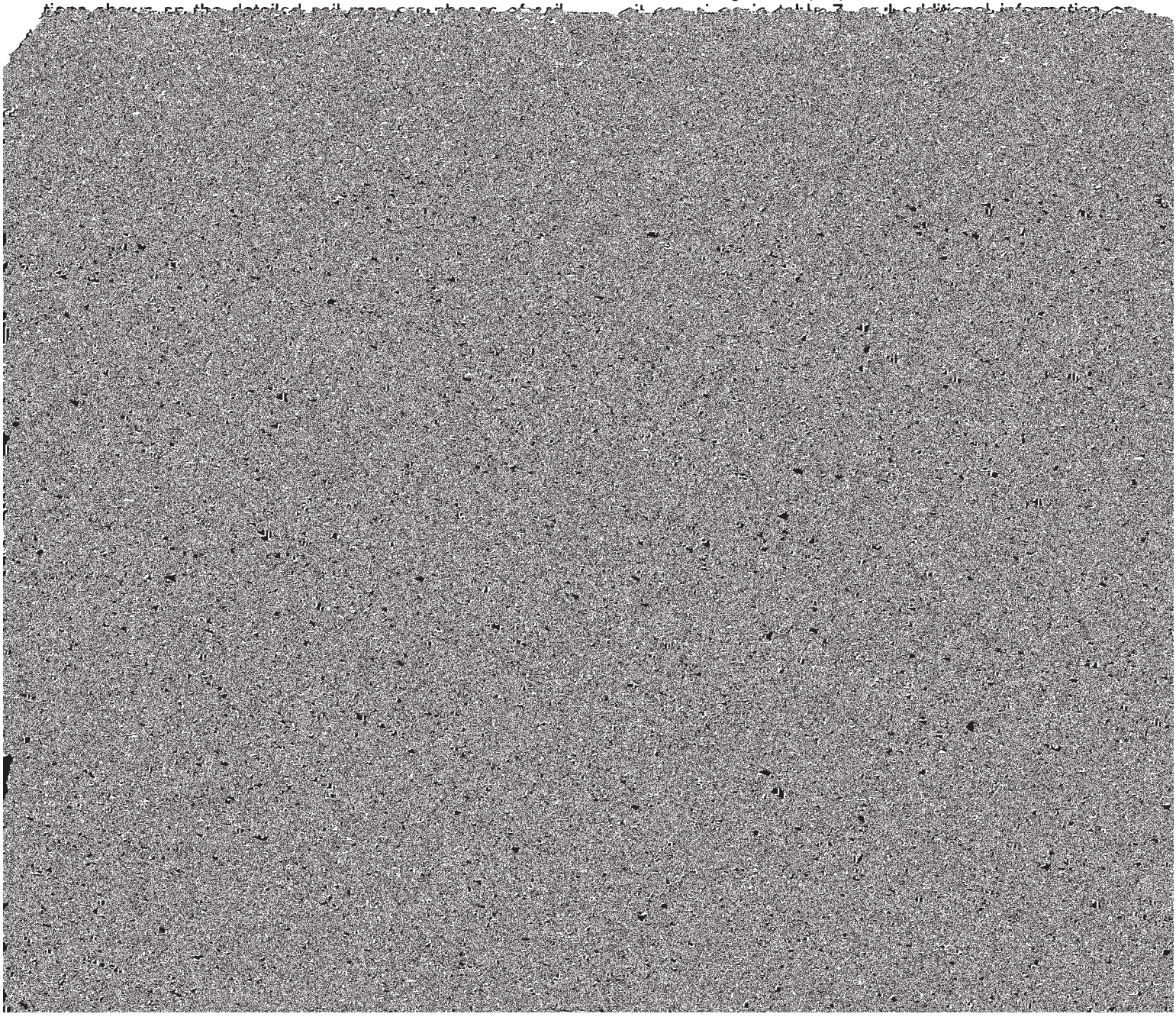
Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns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

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



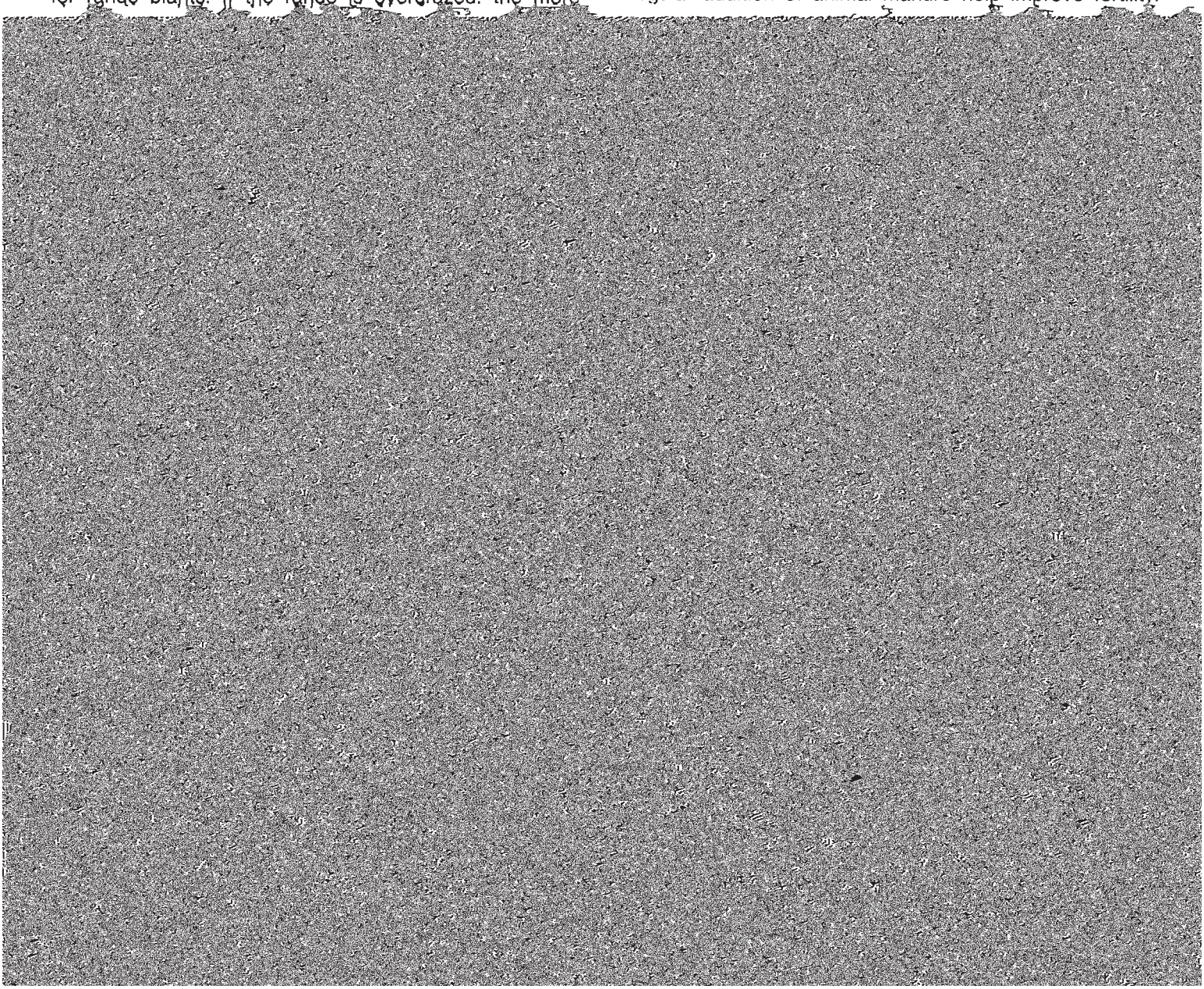
Stubble mulching, crop residue management, stripcropping, minimum tillage, and field windbreaks help control soil blowing and conserve moisture. Returning crop residue to the soil, green manure crops, and the regular addition of animal manure help improve fertility and reduce soil blowing. Seeding this 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

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.



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.

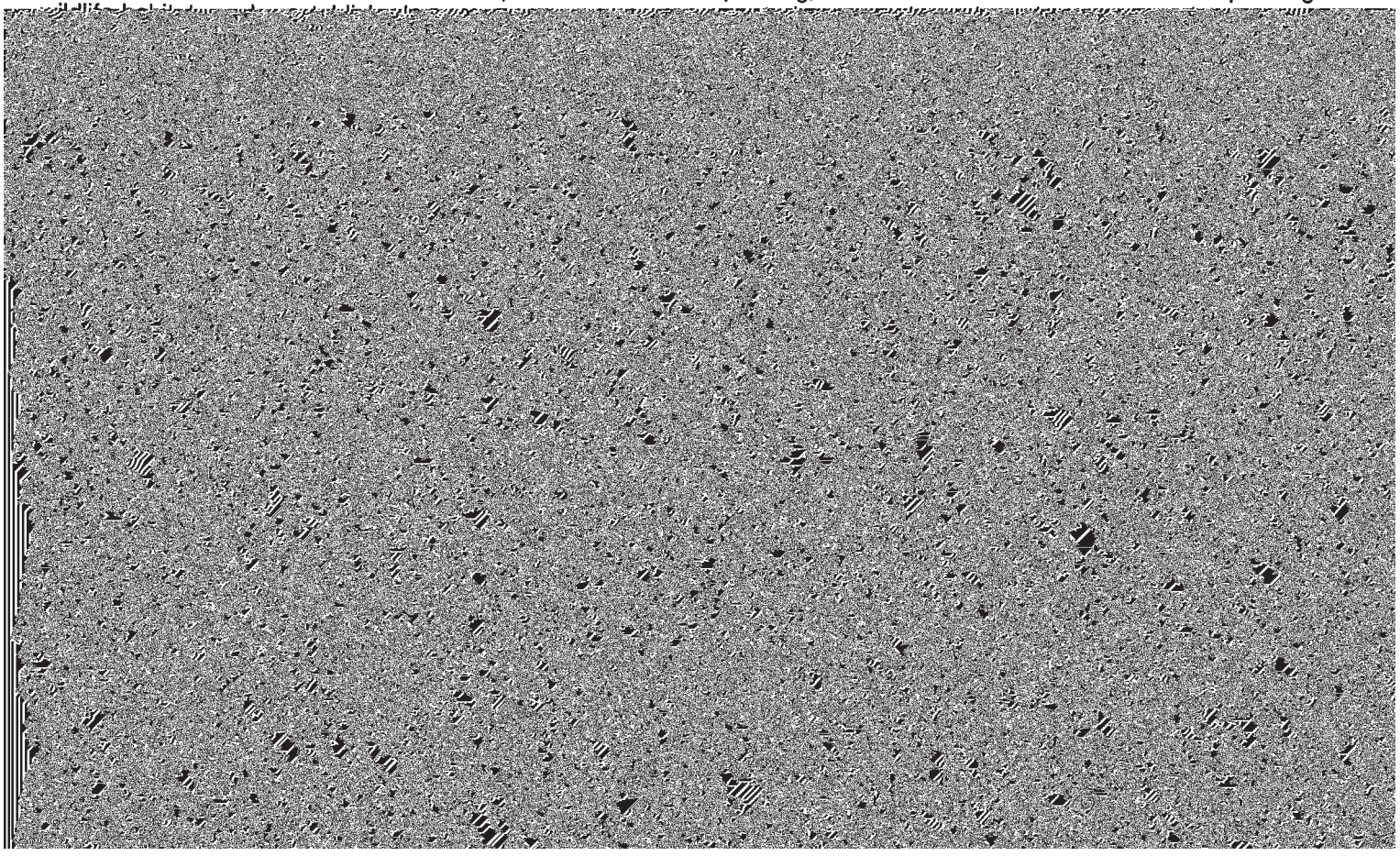
If special plantings are made and shrubs and trees that require extra moisture are selected, plant cover for

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



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

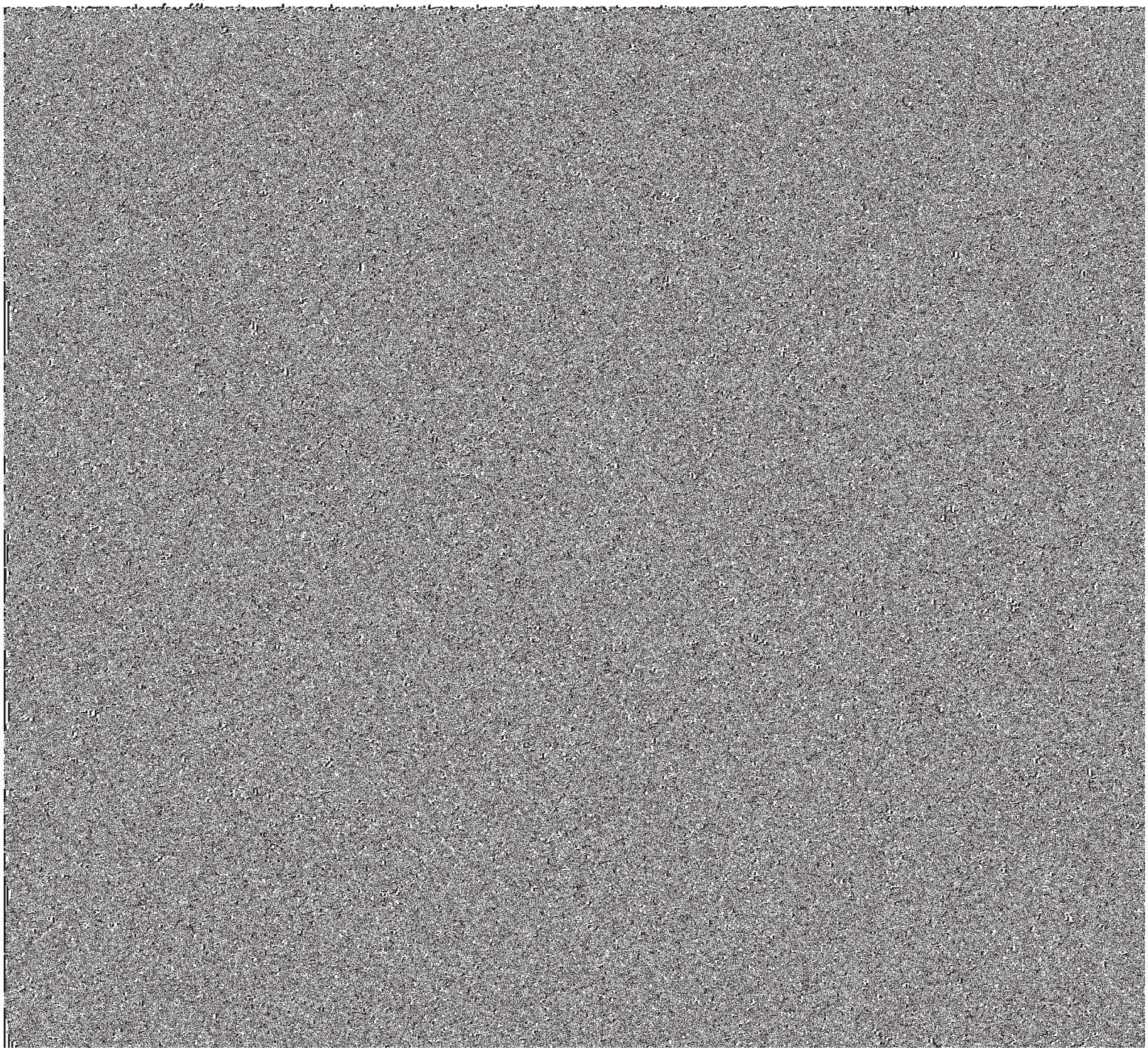
have a high moisture requirement. This soil needs to be summer fallowed before planting to improve first year survival, and cultivation continued after planting to control grass and weeds and conserve moisture.

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

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 moun-



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

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

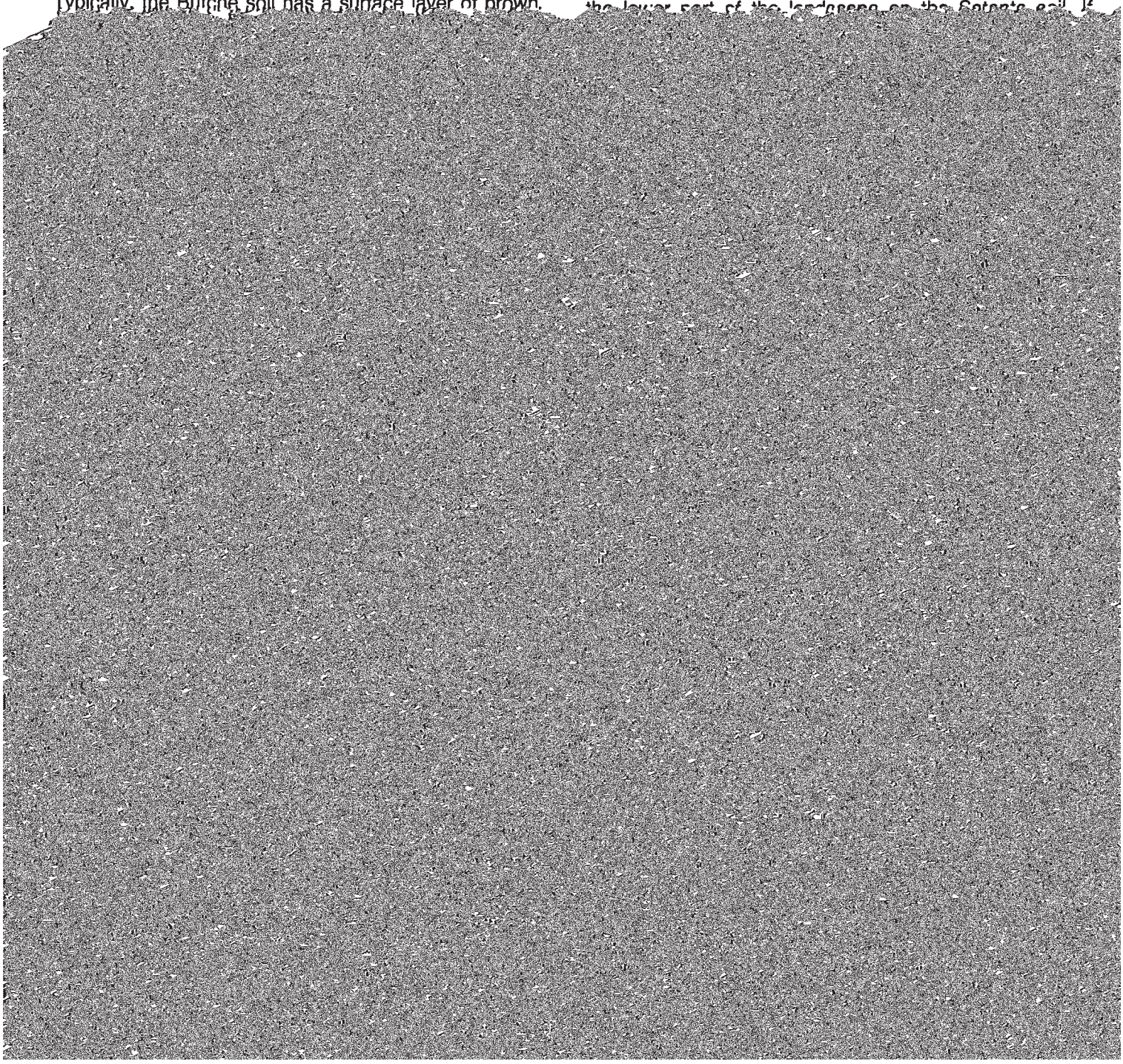
BkD—Butche-Satanta loams, 6 to 25 percent slopes. This map unit consists of shallow and deep, well drained, moderately sloping to moderately steep soils on uplands. The irregularly shaped areas range from 50 to 1,000 acres in size and are about 55 to 65 percent Butche soil and 30 to 40 percent Satanta 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

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.

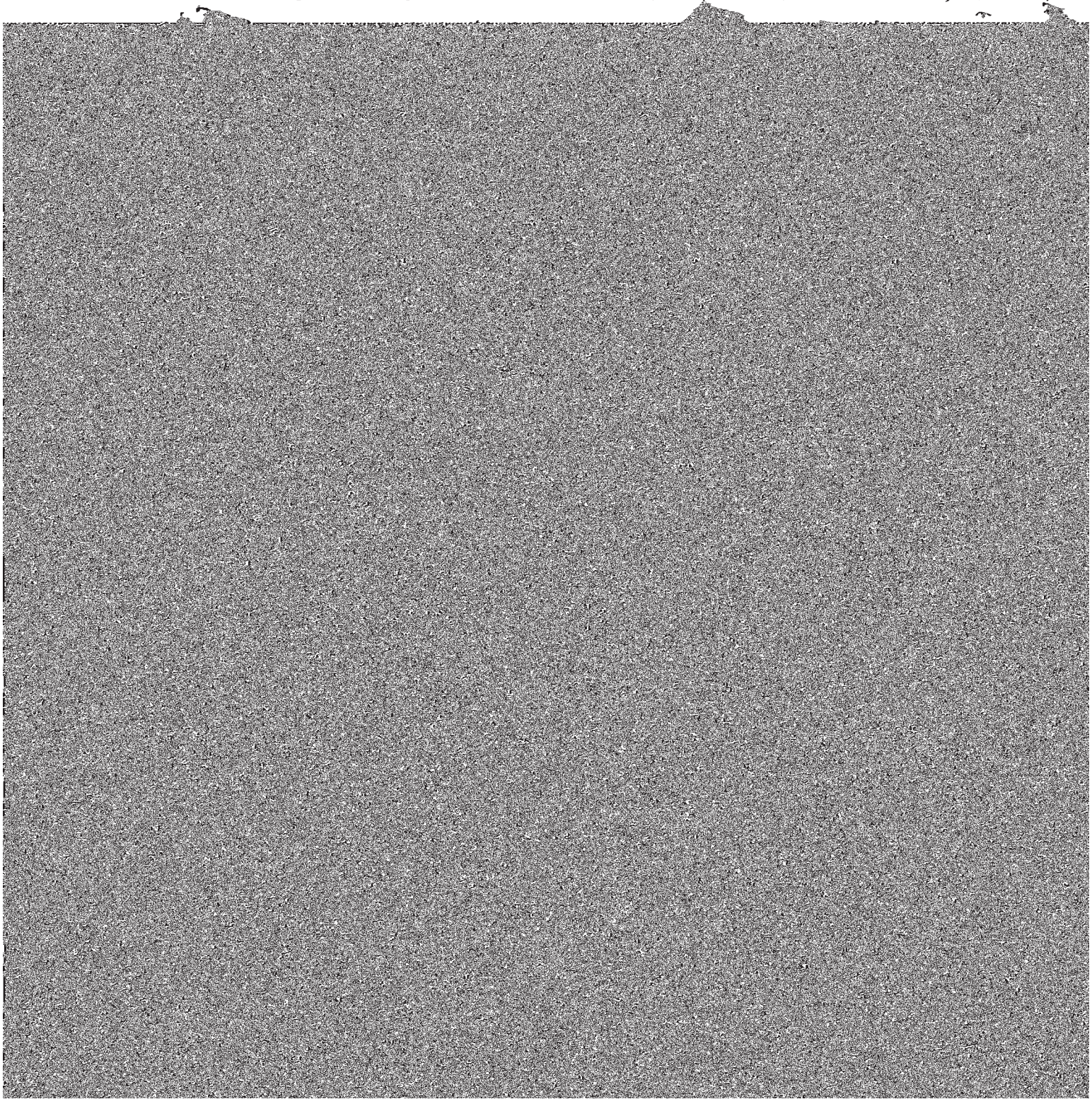
In most places, the areas of Satanta soils are too small for windbreaks, but suitable trees and shrubs for wildlife habitat and other special uses can be planted on selected sites.

Buildings and sanitary facilities need to be placed in



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



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

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.

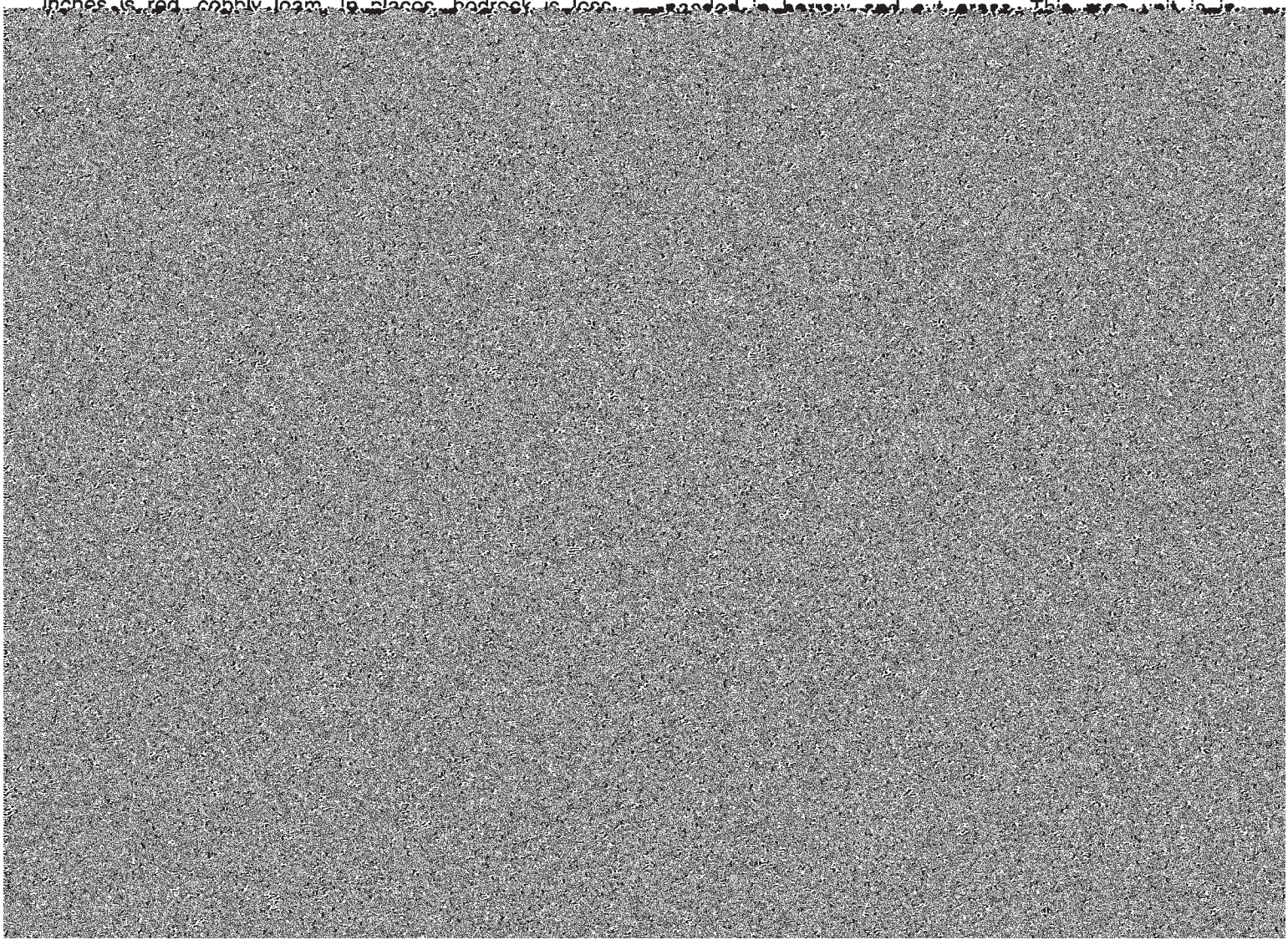
Individual areas of this map unit range from 80 to several thousand acres in size and are about 70 percent Citadel soil and about 30 percent minor soils. The minor soils are in areas that range to 40 acres in size. The uses of this unit, however, are such that separate mapping of the larger areas of 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 [illegible] motes 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.

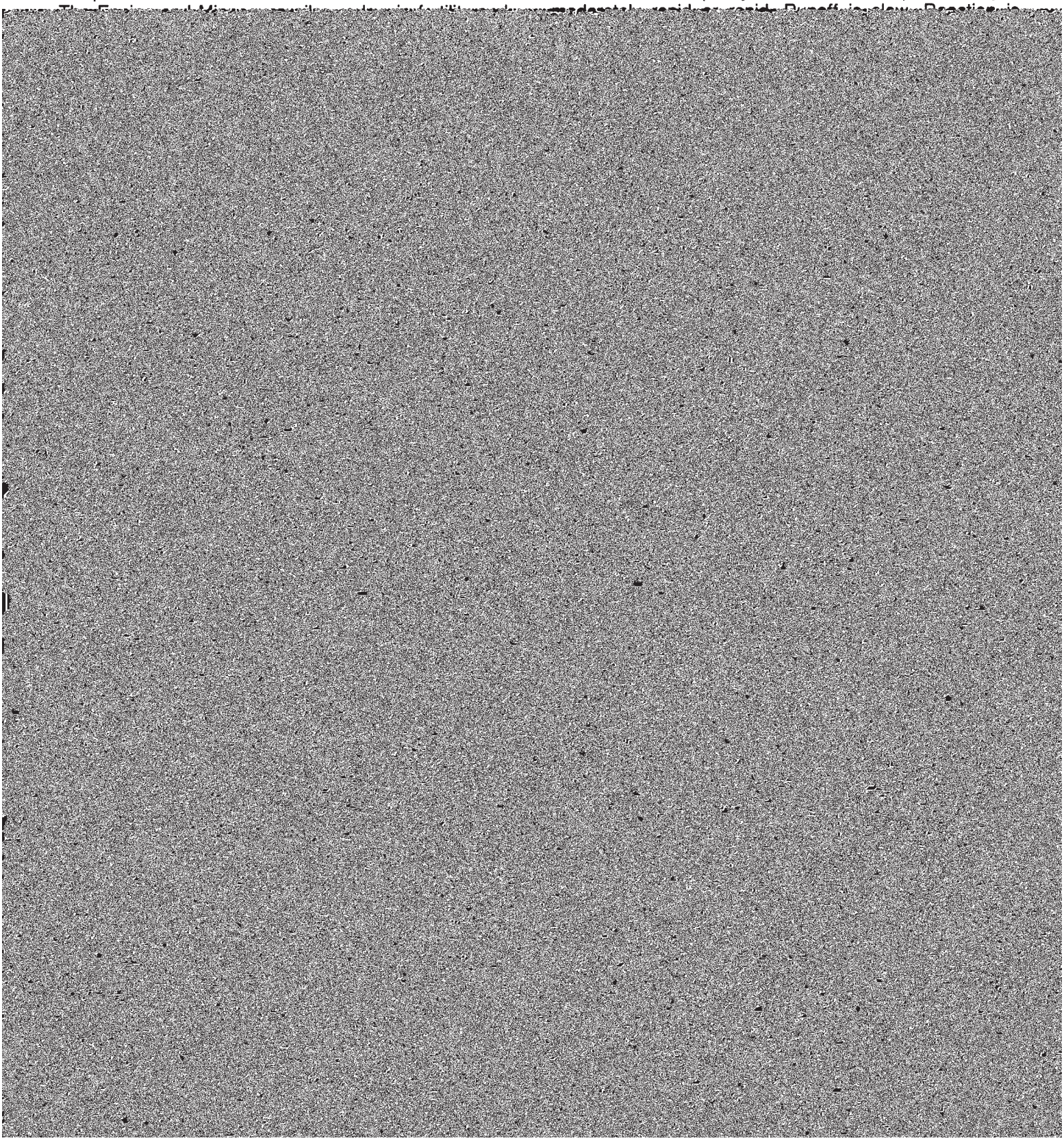
Buildings can be constructed if the shrinking and swelling of this soil is overcome. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitation of slow movement of effluvent. Buildings and septic tank absorption fields need to be placed in the 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 [illegible]



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

The soil is low in fertility and content of organic matter. Available water capacity is moderate, and permeability is

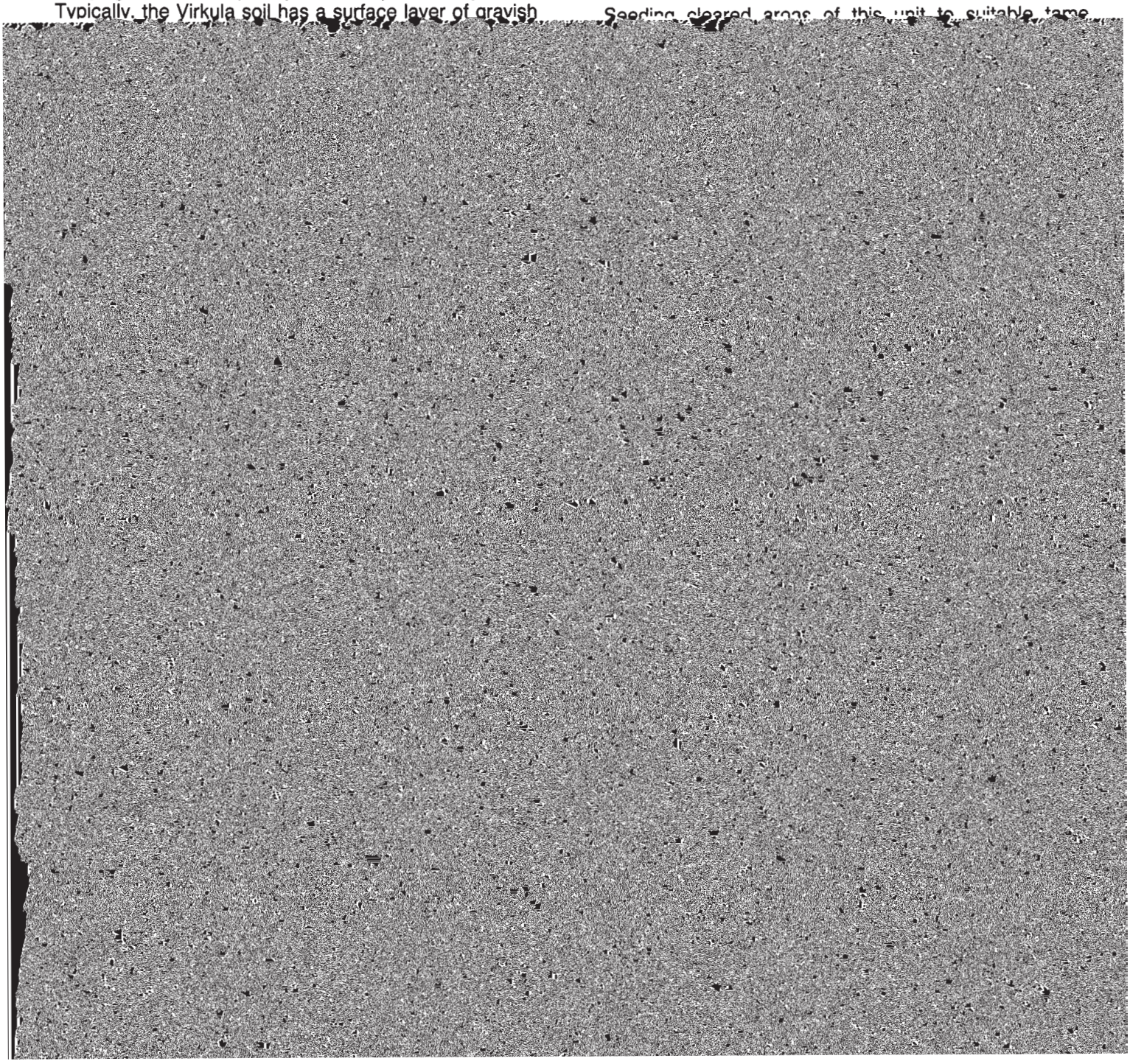


Typically, the Grizzly soil has a surface layer about 20 inches thick. The surface layer is dark gray, very gravelly silt loam in the upper part, light brownish gray, gravelly silt loam in the middle part, and light gray, very gravelly silt loam in the lower part. The subsoil to a depth of 51 inches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

vals. 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



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.

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.

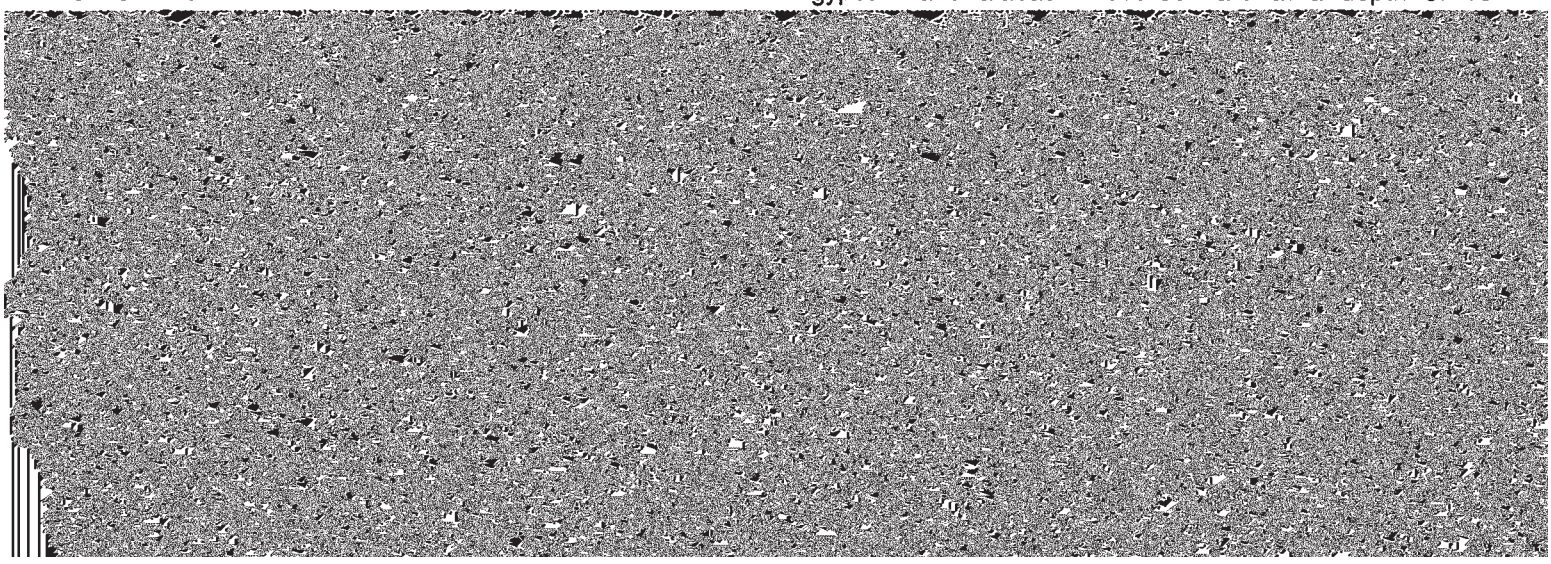
This map unit generally is not suited to cultivated crops, tame pasture, and windbreaks because of the very low available moisture capacity, severe hazard of erosion, and steep slopes. It is suited to wildlife habitat on selected sites; however, trees and shrubs need to be planted by hand and given special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



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 is very slow. Runoff is slow. Shrink-swell potential is high.

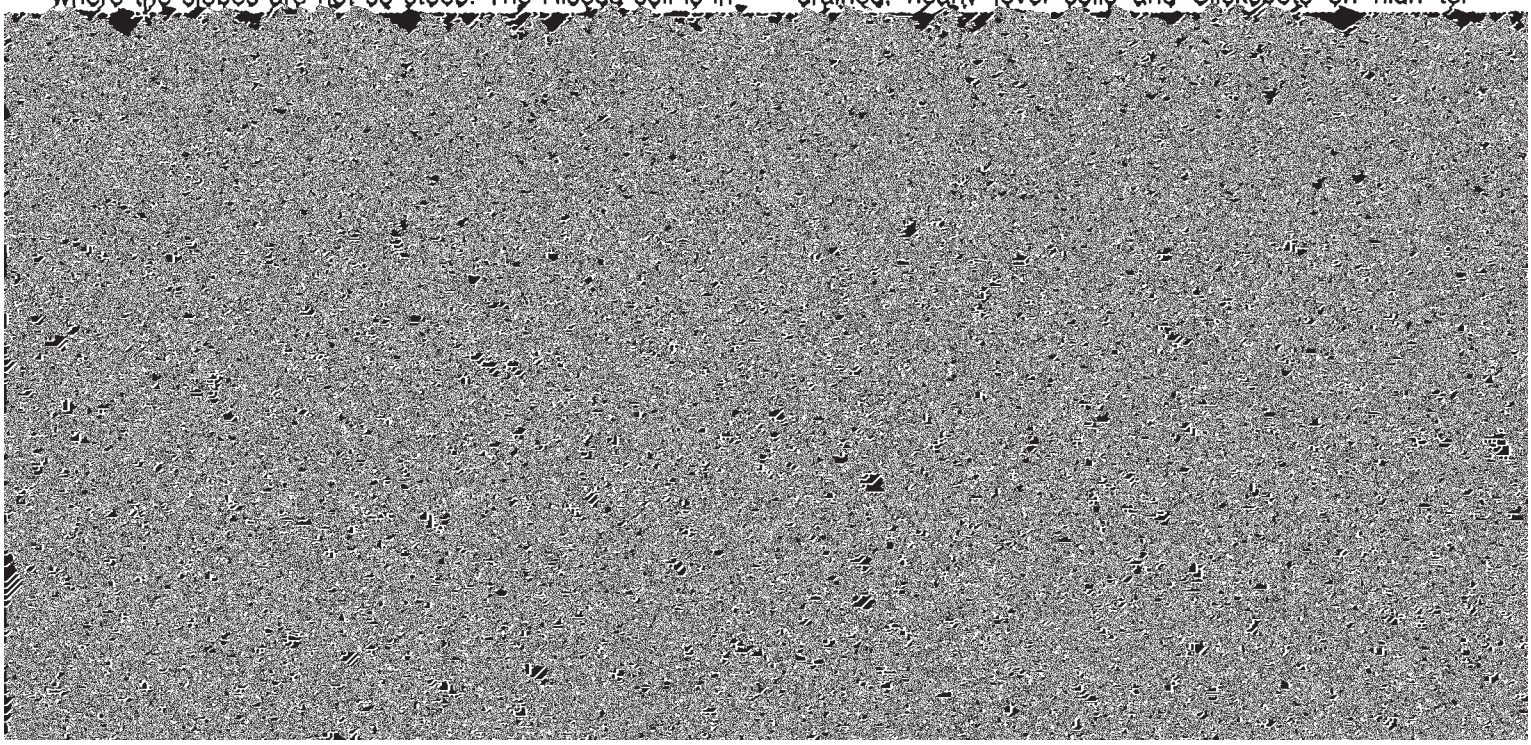
Most of this soil is in rangeland. This soil has poor potential for rangeland and rangeland wildlife habitat, cultivated crops, windbreaks and environmental plantings, most recreational uses, building sites, and most sanitary facilities.

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 ter-



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.

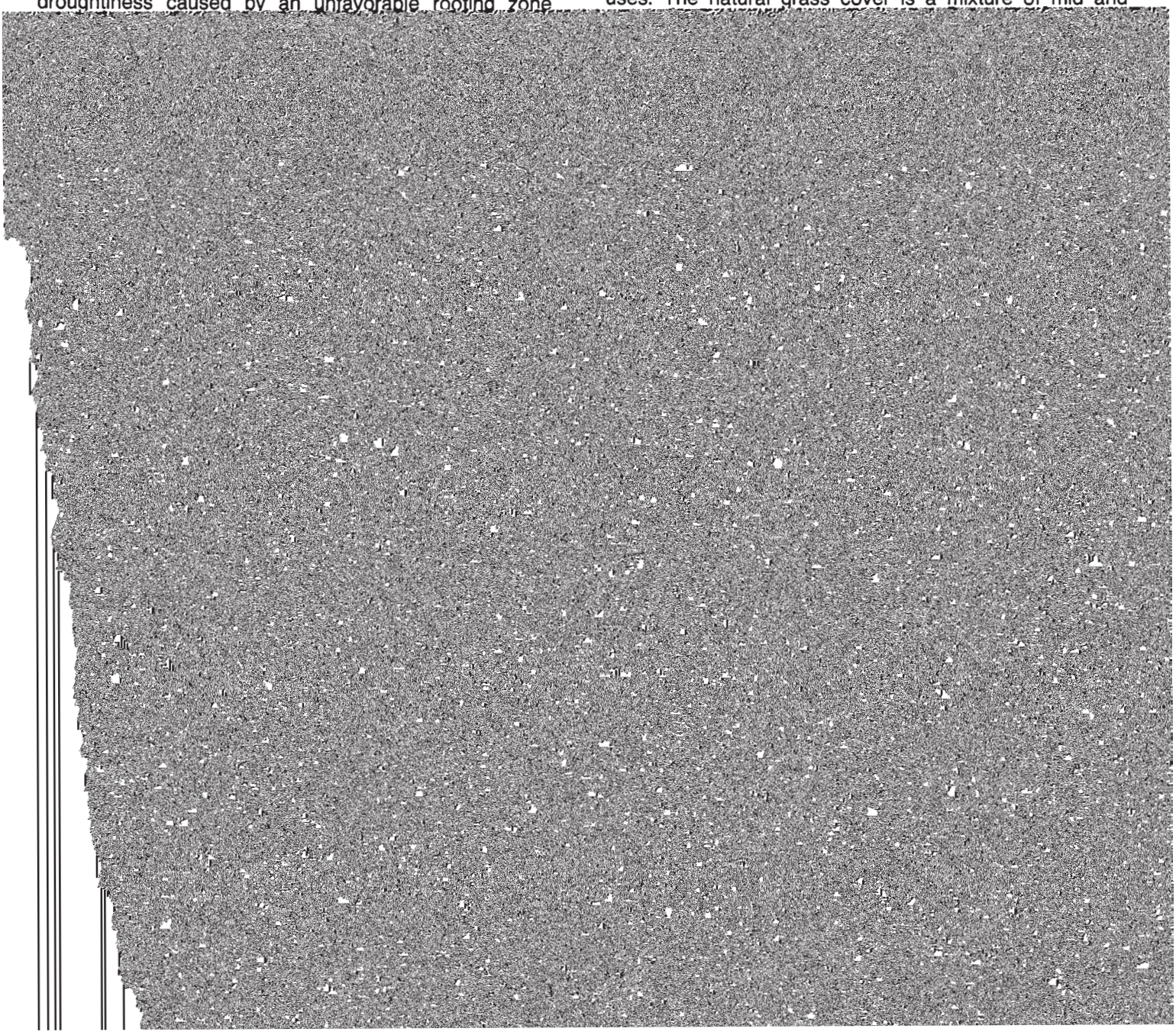
Most areas of this map unit are in rangeland. The soils in this unit have poor potential for rangeland and rangeland wildlife habitat, cultivated crops, windbreaks and environmental plantings, recreational uses, building sites, and most sanitary facilities.

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 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.

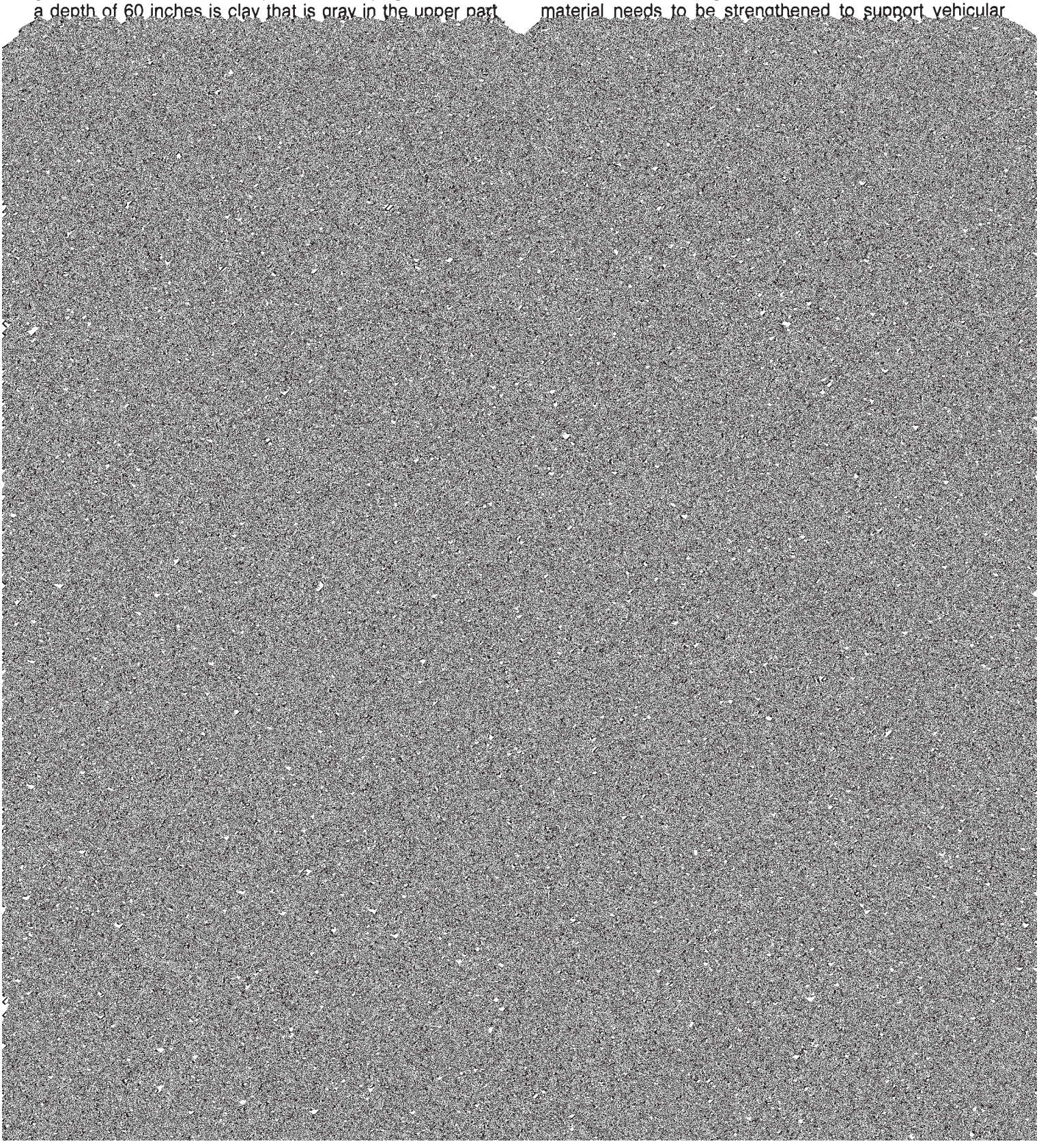
Most areas of this soil are in rangeland. The soil has good potential for rangeland and rangeland wildlife habitat and fair potential for cultivated crops, windbreaks, and environmental plantings. It has poor potential for openland wildlife habitat, most recreational uses, and most building sites and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

This soil is better suited to rangeland than to other uses. The natural grass cover is a mixture of mid and



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

Roads need to be graded to shed water, and the base material needs to be strengthened to support vehicular



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.

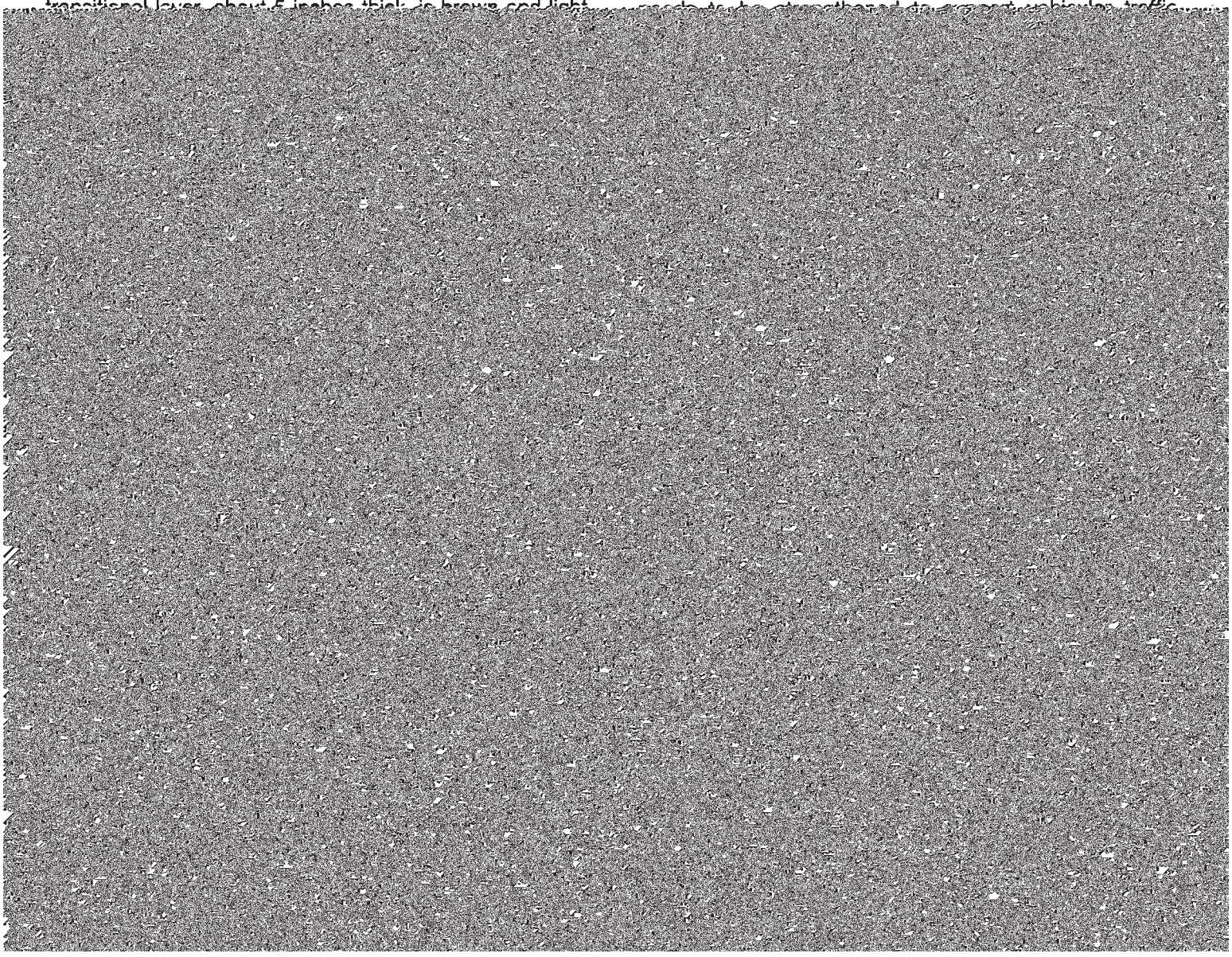
Typically, the surface layer is gray loam about 7 inches thick. The subsurface layer is light brownish gray, very friable very fine sandy loam about 4 inches thick. The transitional layer, about 5 inches thick, is brown and light

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



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.

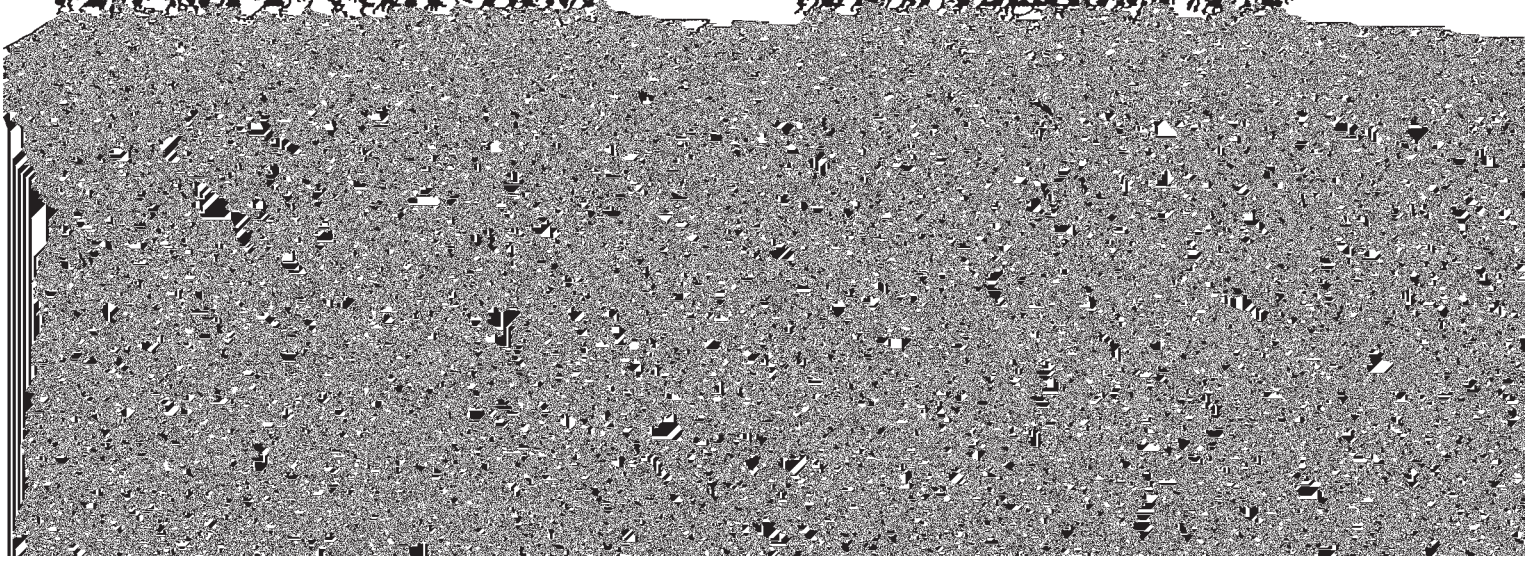
brownish gray very fine sandy loam about 4 inches thick. The transitional layer, about 5 inches thick, is brown and light brownish gray, friable loam. The subsoil extends to a depth of about 28 inches and is light brown, friable clay loam in the upper part; light yellowish brown, friable clay loam in 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.



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.

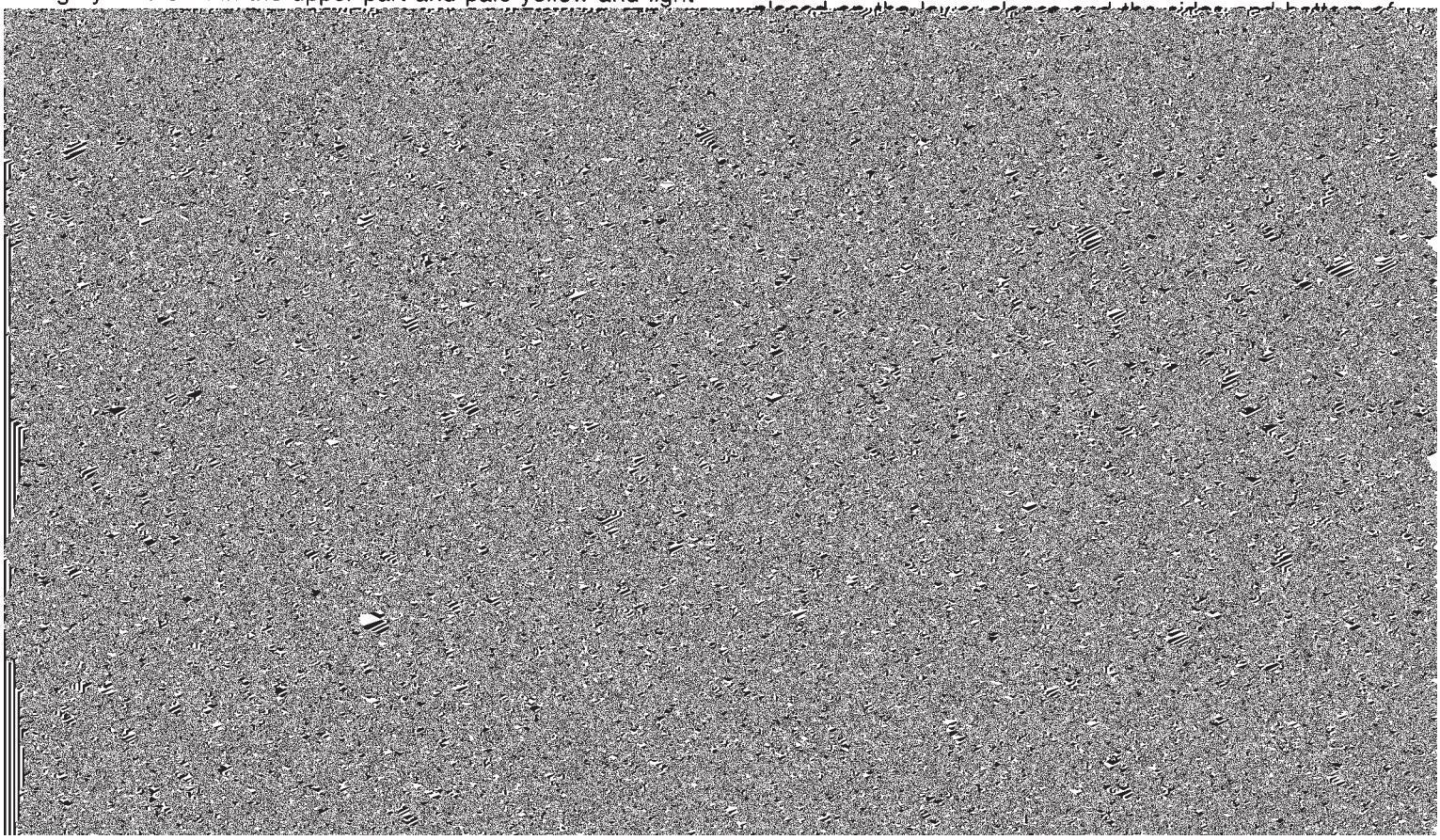
Typically, the Midway soil has a surface layer of very dark grayish brown silty clay loam about 2 inches thick. The transitional layer is grayish brown, very firm silty clay about 4 inches thick. The underlying material to a depth of about 16 inches is silty clay that is pale yellow and grayish brown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

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



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

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.

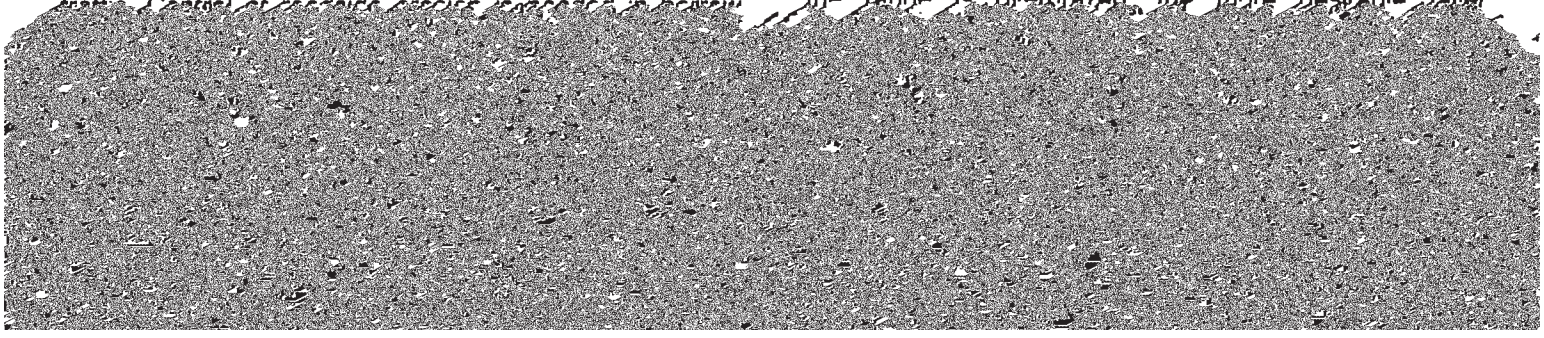
This soil is low in fertility and content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is medium.

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

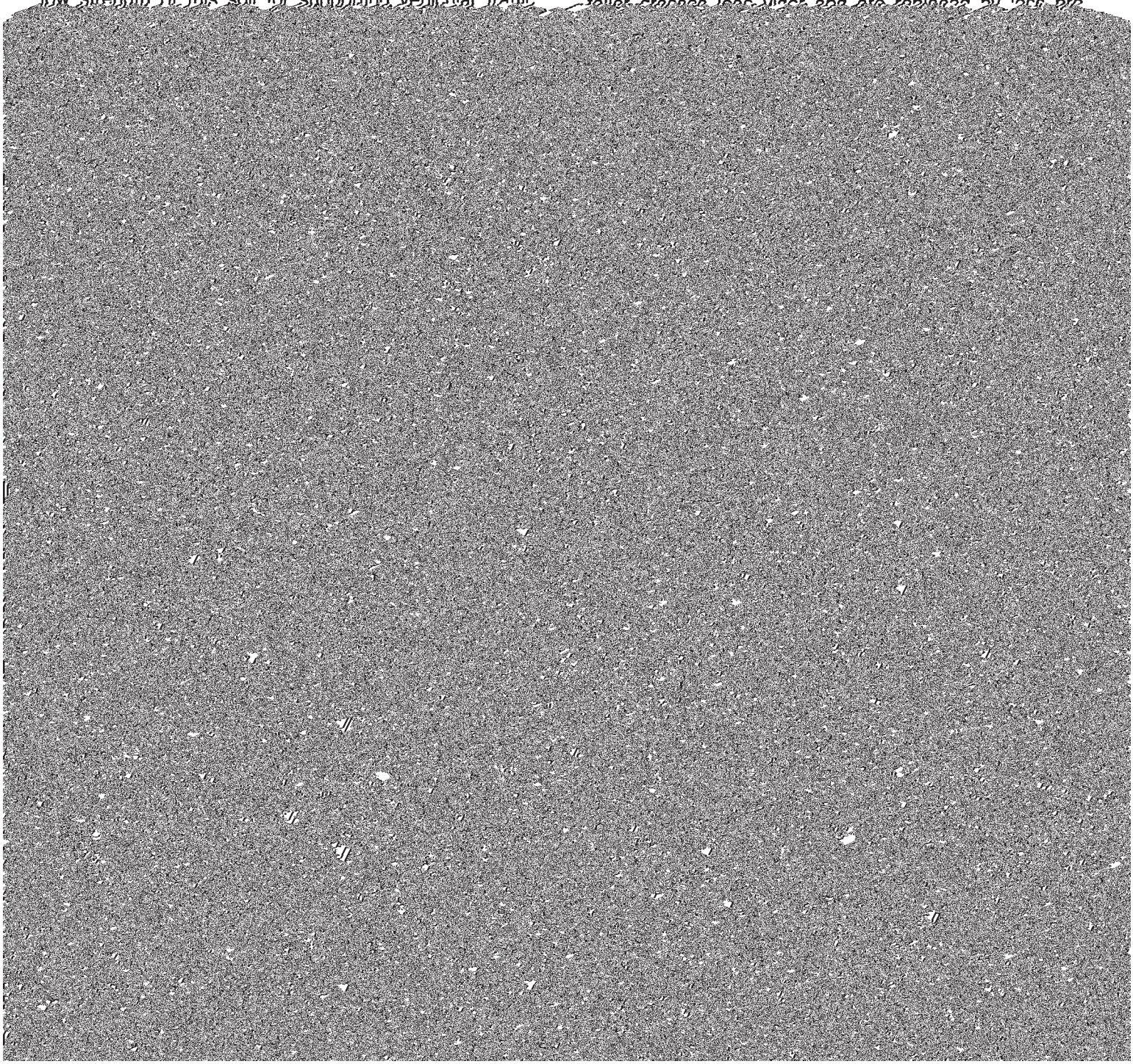


Proper design of building foundations and footings helps prevent structural damage caused by the low strength of this soil. If this soil is used for septic tank absorption fields, enlarging the absorption area helps to overcome the limitations of slow movement of effluent and moderate depth to bedrock.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

Spearfish soil has poor potential for recreational uses, sanitary facilities, building sites, and local roads and streets.

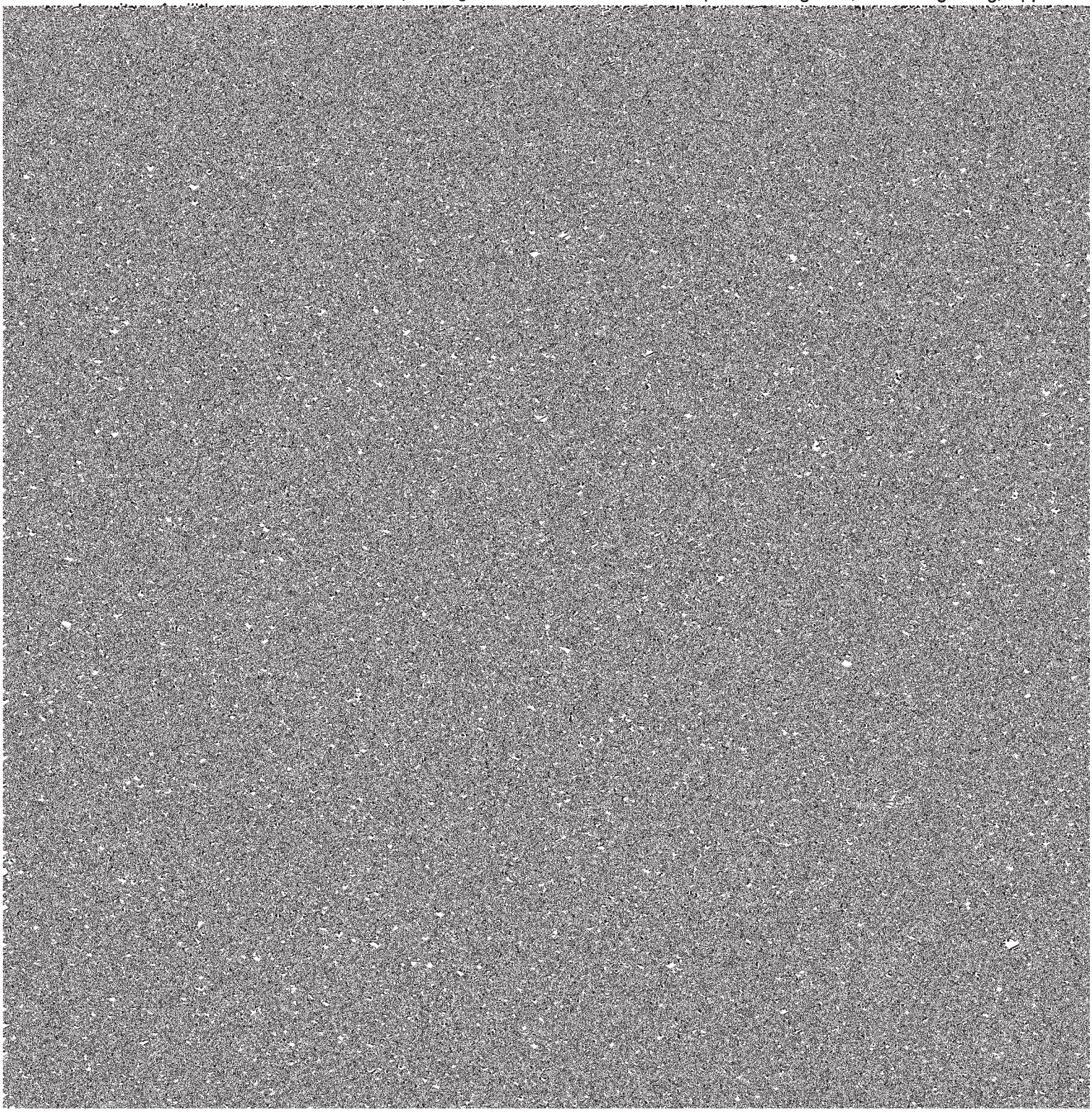
This map unit is better suited to rangeland than to other uses. The natural grass cover is a mixture of tall, mid, and short grasses. Management that maintains an adequate plant cover and ground mulch helps prevent excessive soil loss and improves soil moisture by reducing runoff. If the range is overgrazed,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



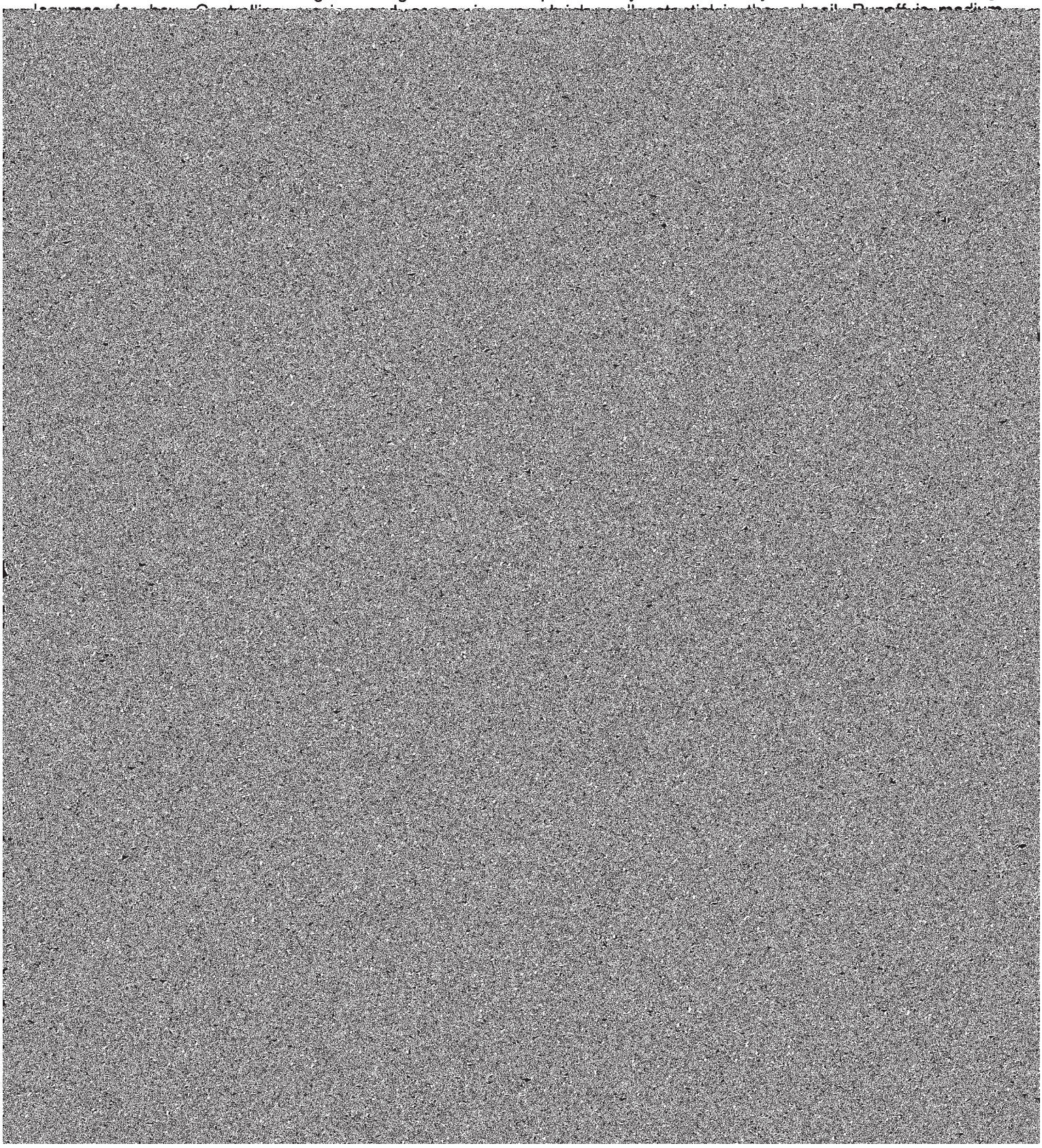
Most areas of this soil are in rangeland. This soil has fair potential for rangeland and rangeland wildlife habitat, most recreational uses, and local roads and streets. It has poor potential for cultivated crops, openland wildlife habitat, windbreaks and environmental plantings, and

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, appli-



This soil is well suited to small grain and grasses and permeability is moderately slow. This soil has high



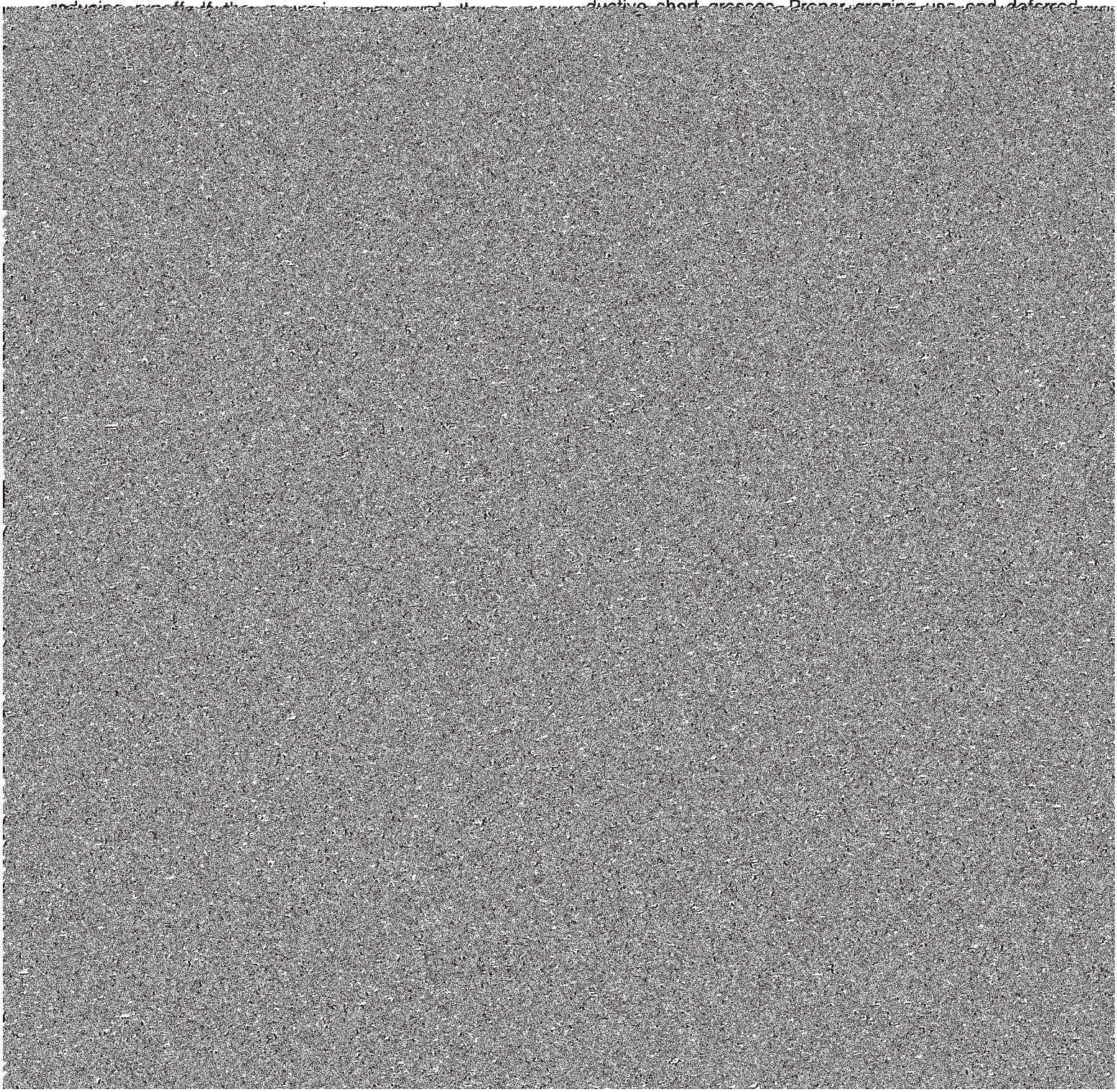
throughout the unit but is mainly on tops of ridges and

Seeding cleared areas of this map unit to suitable

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

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 pro-



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.

present, limestone rock, which is crushed and used as construction material, is mined from some quarries.

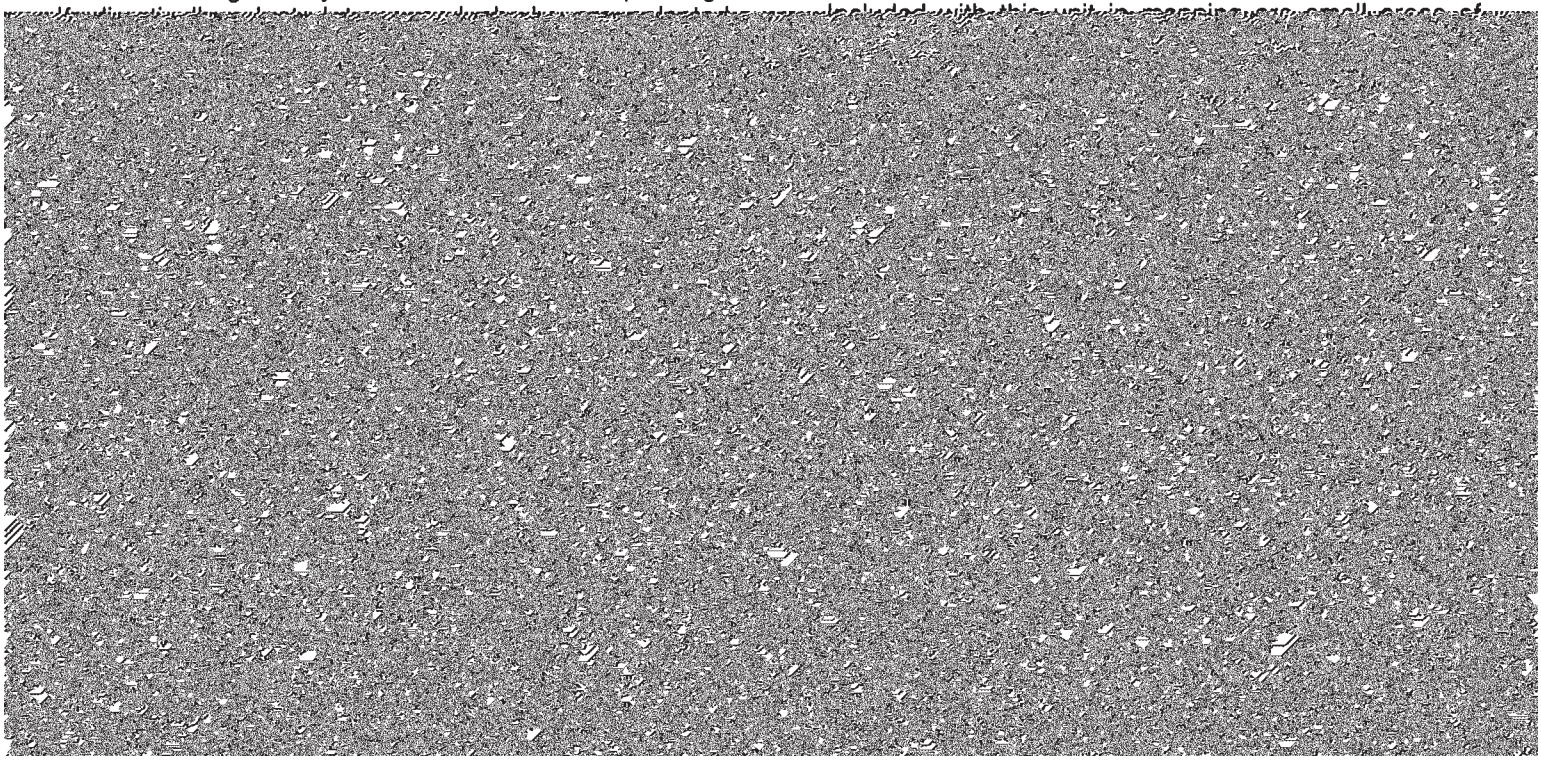
Most of these areas are void of vegetation and are suited only to wildlife habitat. This map unit is in Capability unit VIIIs-2. It is not placed in a range site.

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.

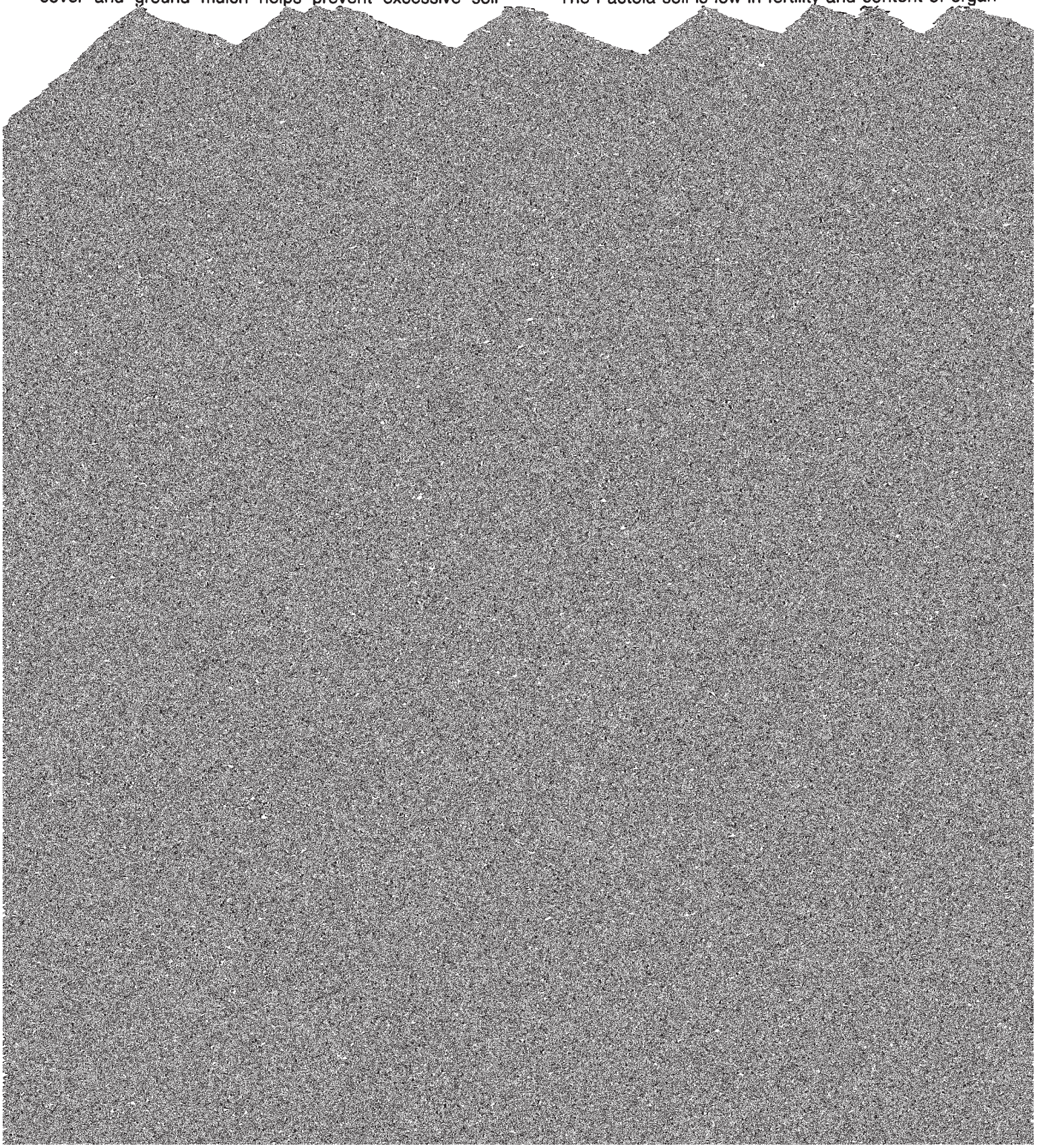
Typically, the Gypnevee soil has a surface layer of reddish brown loam about 7 inches thick. The transitional layer is yellowish red, friable silt loam about 6 inches thick. The underlying material to a depth of about 60 inches is friable silt loam that is reddish yellow in the upper part and light red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



cover and ground mulch helps prevent excessive soil

The Pactola soil is low in fertility and content of organ-



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.

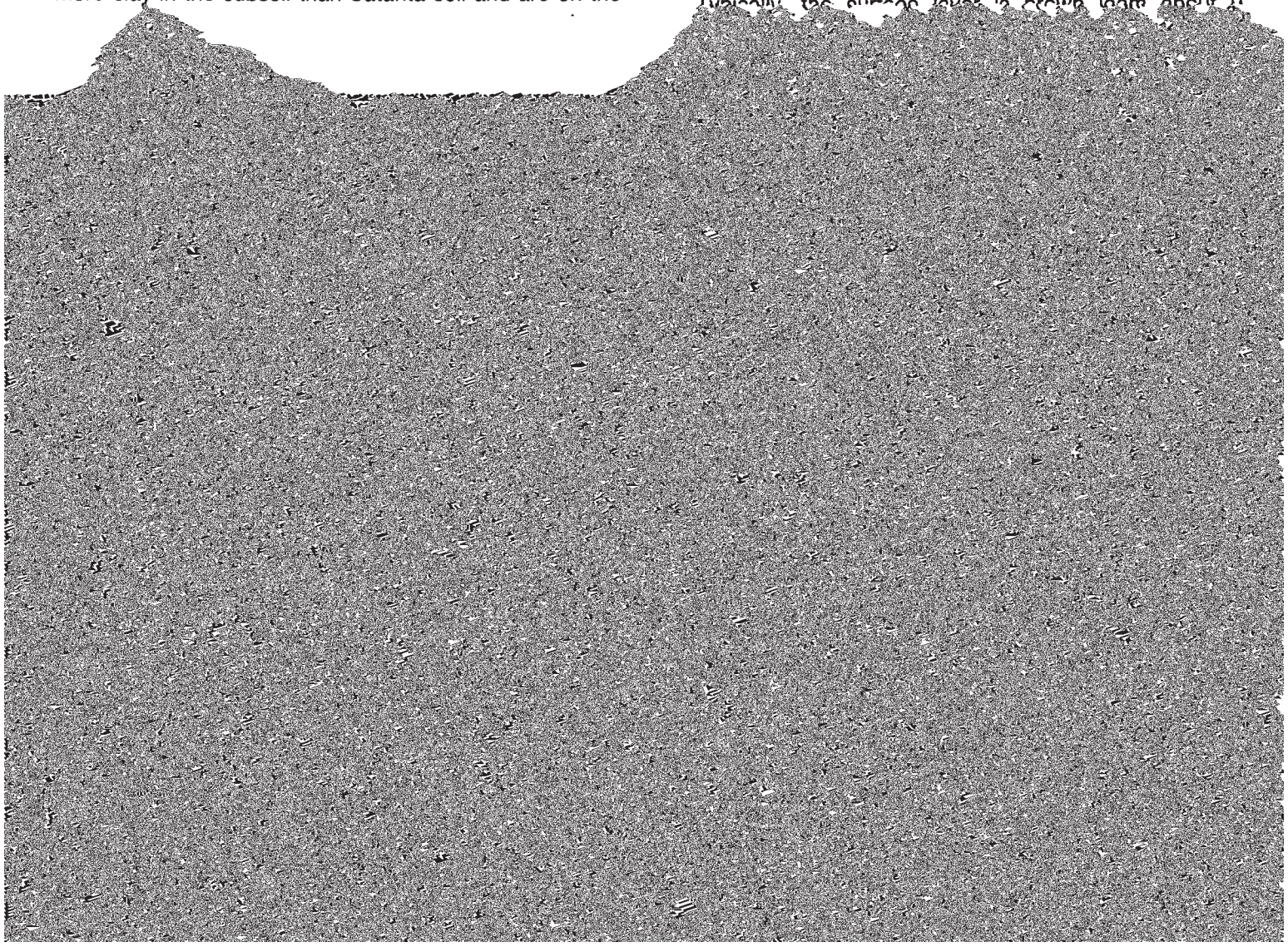
Included with this soil in mapping are small areas of Boneek and Nunn soils. Boneek and Nunn soils have more clay in the subsoil than Satanta soil and are on the tour helps reduce the hazard of erosion. Good survival can be expected if the soil is summer fallowed before planting and cultivation is continued 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 6



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

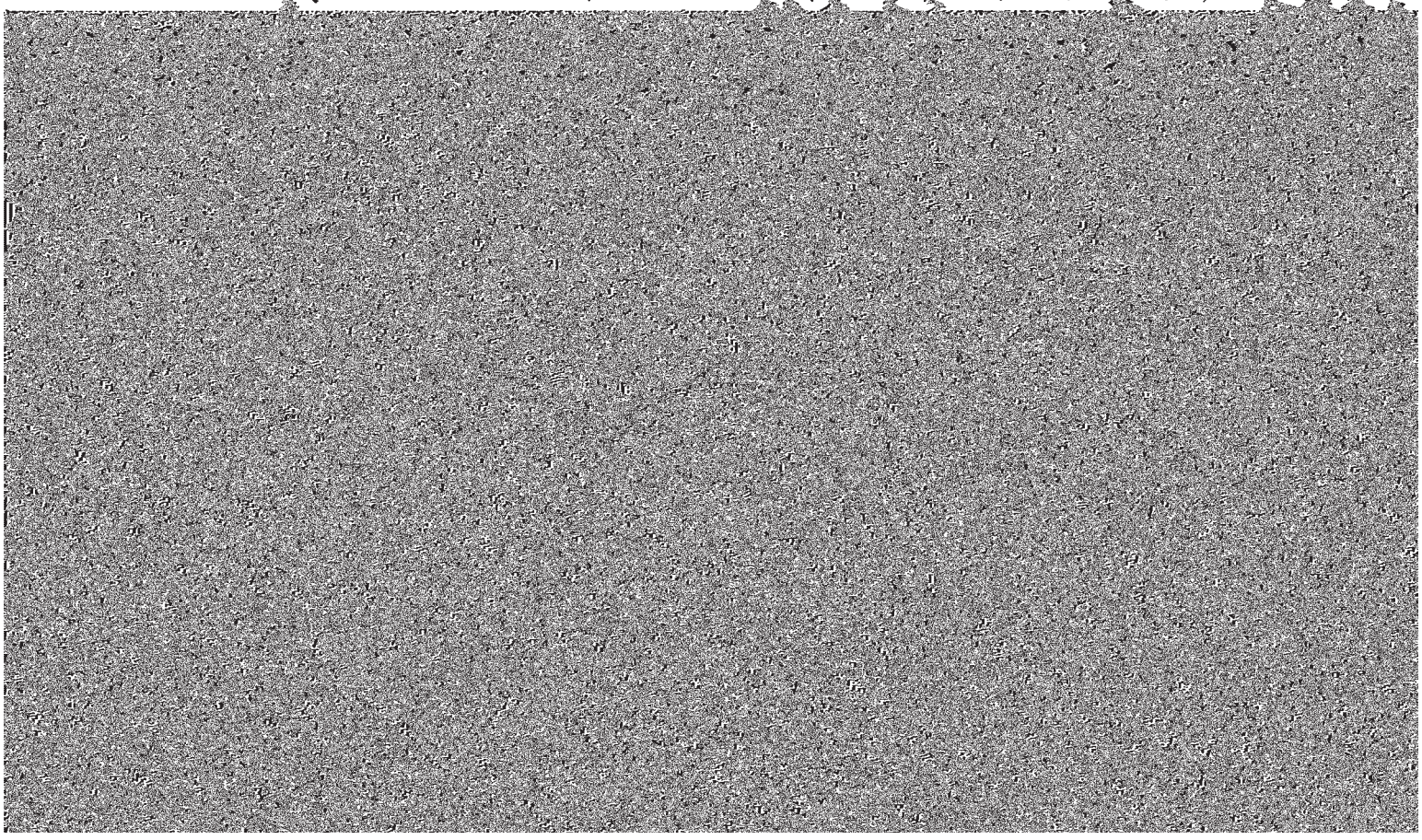
al uses; and poor potential for most building sites, most sanitary facilities, and local roads and streets.

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



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

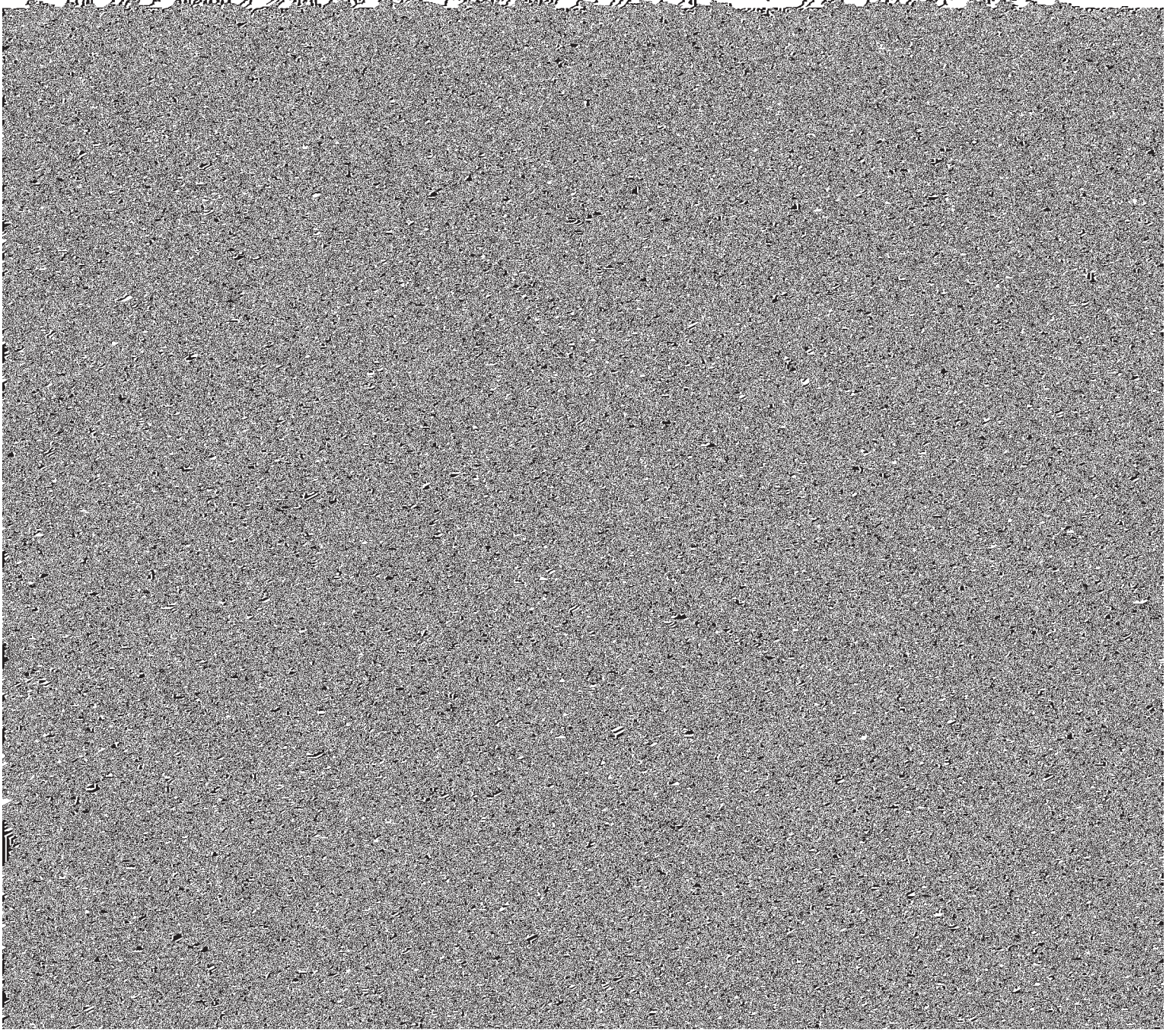
This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderately slow. Shrink-swell potential is high. Runoff is medium.

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 [illegible]

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



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.

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.

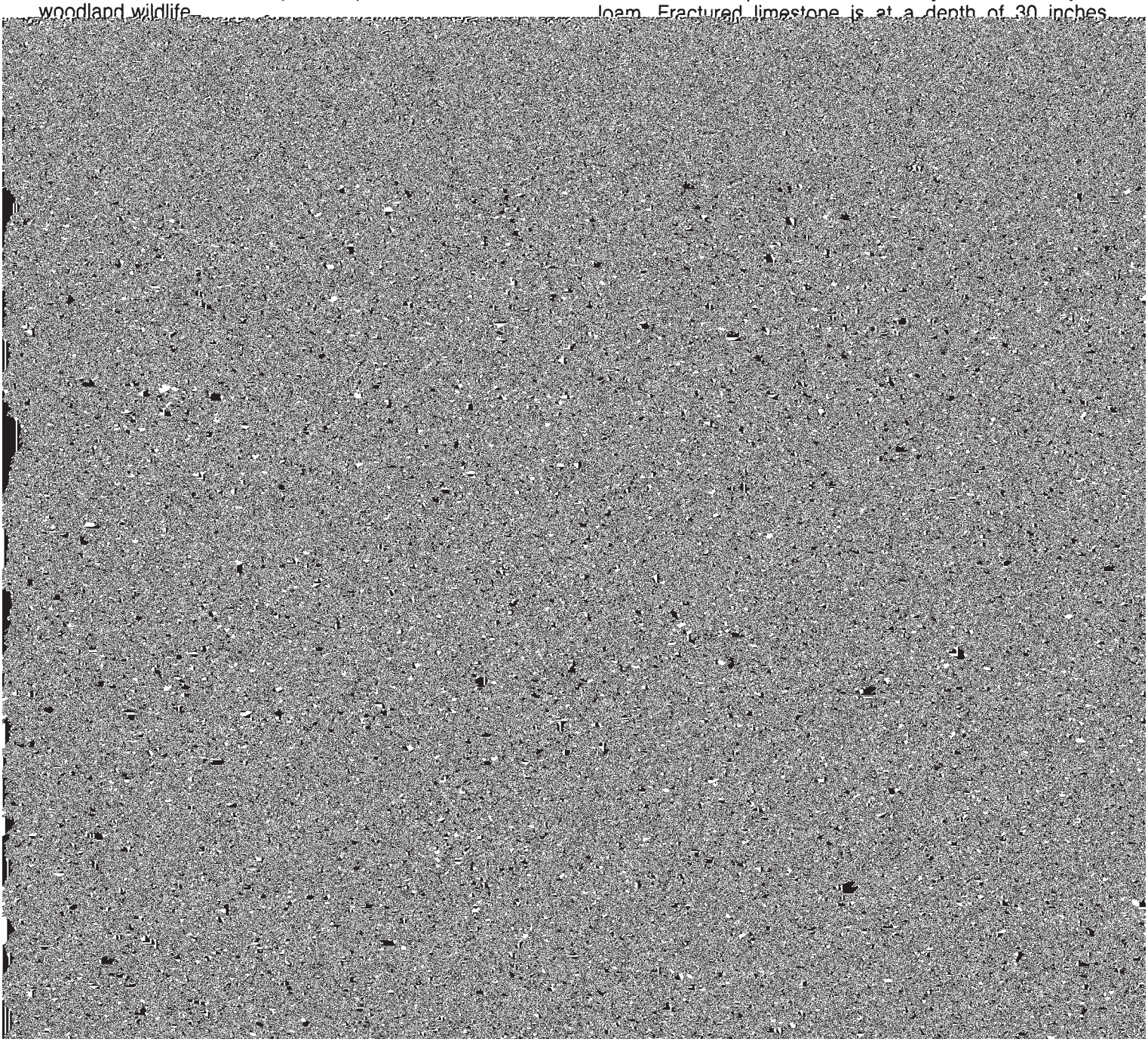
The Stovho soil is low in fertility and moderately low in content of organic matter. Available water capacity is high, and permeability is moderately slow. The shrink-swell potential is high in the subsoil. Runoff is medium or rapid. Reaction is medium acid to neutral.

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.

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.

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.



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 Capa-

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

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 silt loam. The upper part is brown, and the lower part is pale brown. The substratum to a depth of 60 inches or more is pale brown silt loam.

Included with this soil in mapping are small areas of Lakoma soils and soils that have a dark surface layer more than 10 inches thick. Also included are small areas of soils that are similar to this Tilford soil but have a surface layer of very fine sandy loam. Included areas make up about 10 percent of the map unit.

Permeability is moderate in the Tilford soil. Available water capacity is high. Runoff is slow. The hazard of water erosion is slight. The hazard of soil blowing is moderate. The hazard of flooding is slight.

This soil is well suited to cultivated crops. Stripcropping, crop residue management, and minimum tillage help control soil blowing and water erosion. Proper fertilization helps maintain the fertility of the soil.

This soil is well suited to grasses and legumes for hay and pasture. Proper grazing use, timely deferment of grazing, and adequate fertilizer help keep the pasture in good condition.

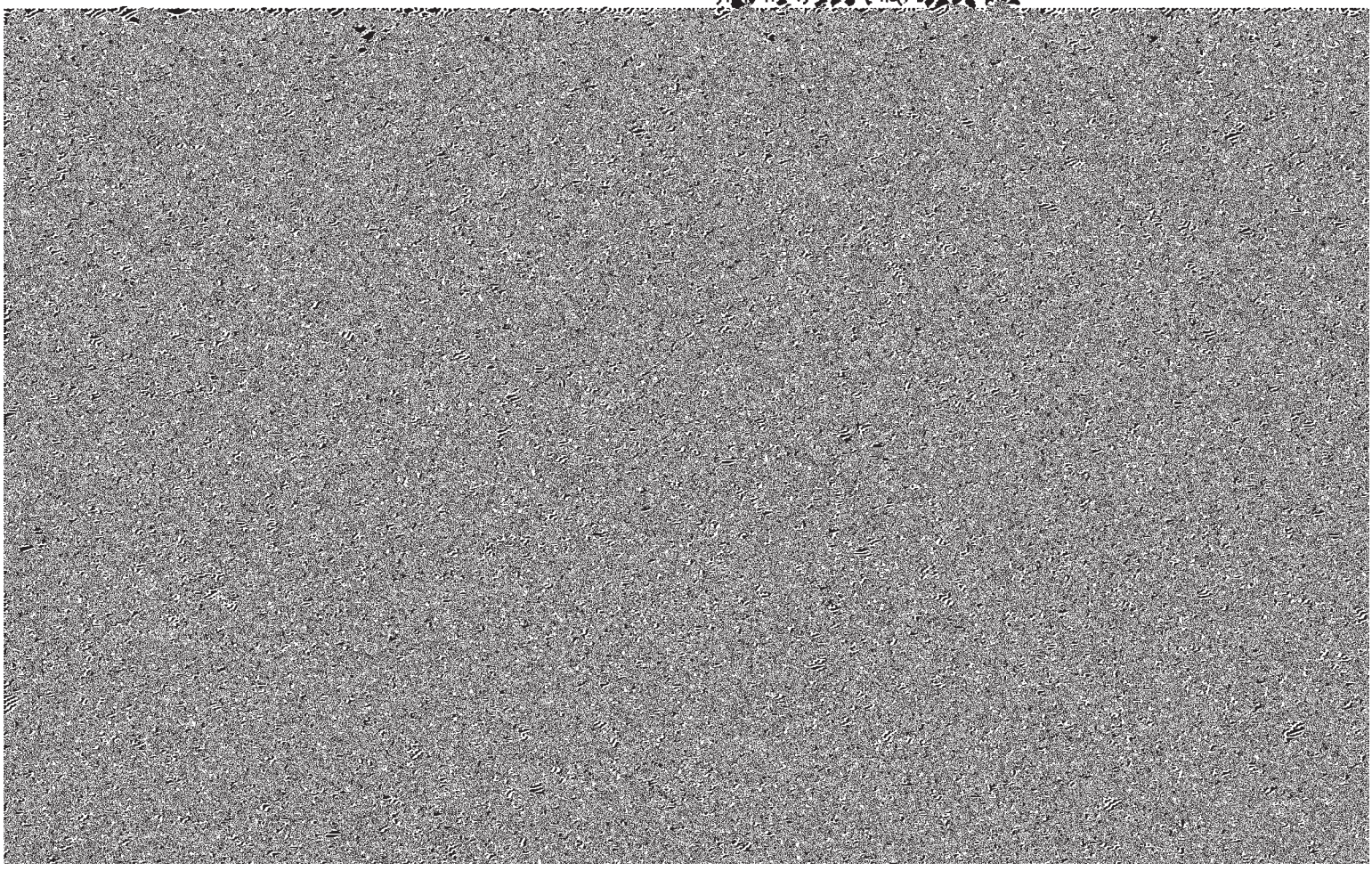
This soil is well suited to rangeland. The natural plant community is a mixture of tall, mid, and short grasses. Maintaining a good grass cover and ground cover mulch helps improve the moisture supply for rangeland plants. If the soil is overgrazed, the more desirable taller grasses lose vigor and are 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 [illegible]



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

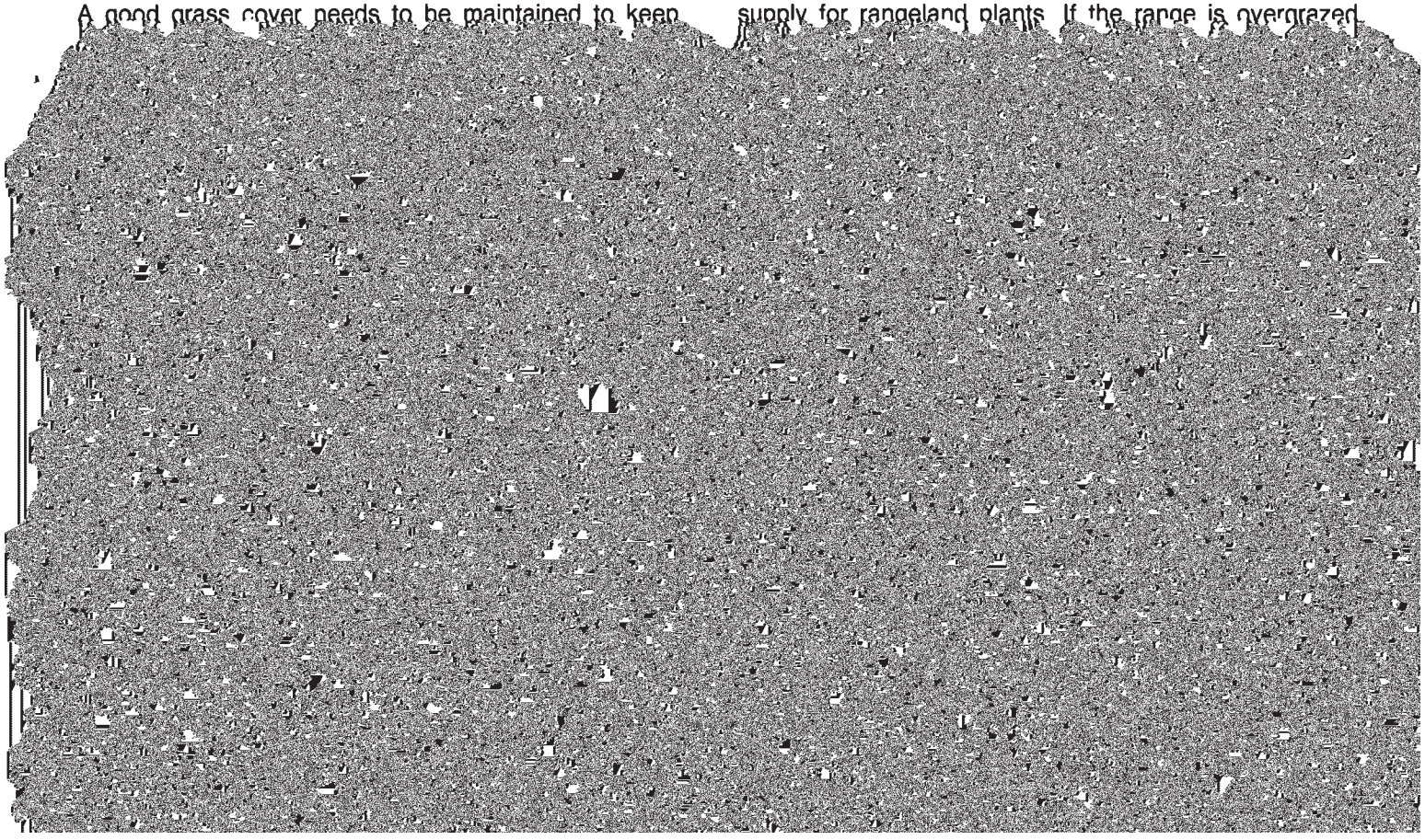
This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high, and permeability is moderate. Runoff is medium.

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,



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.

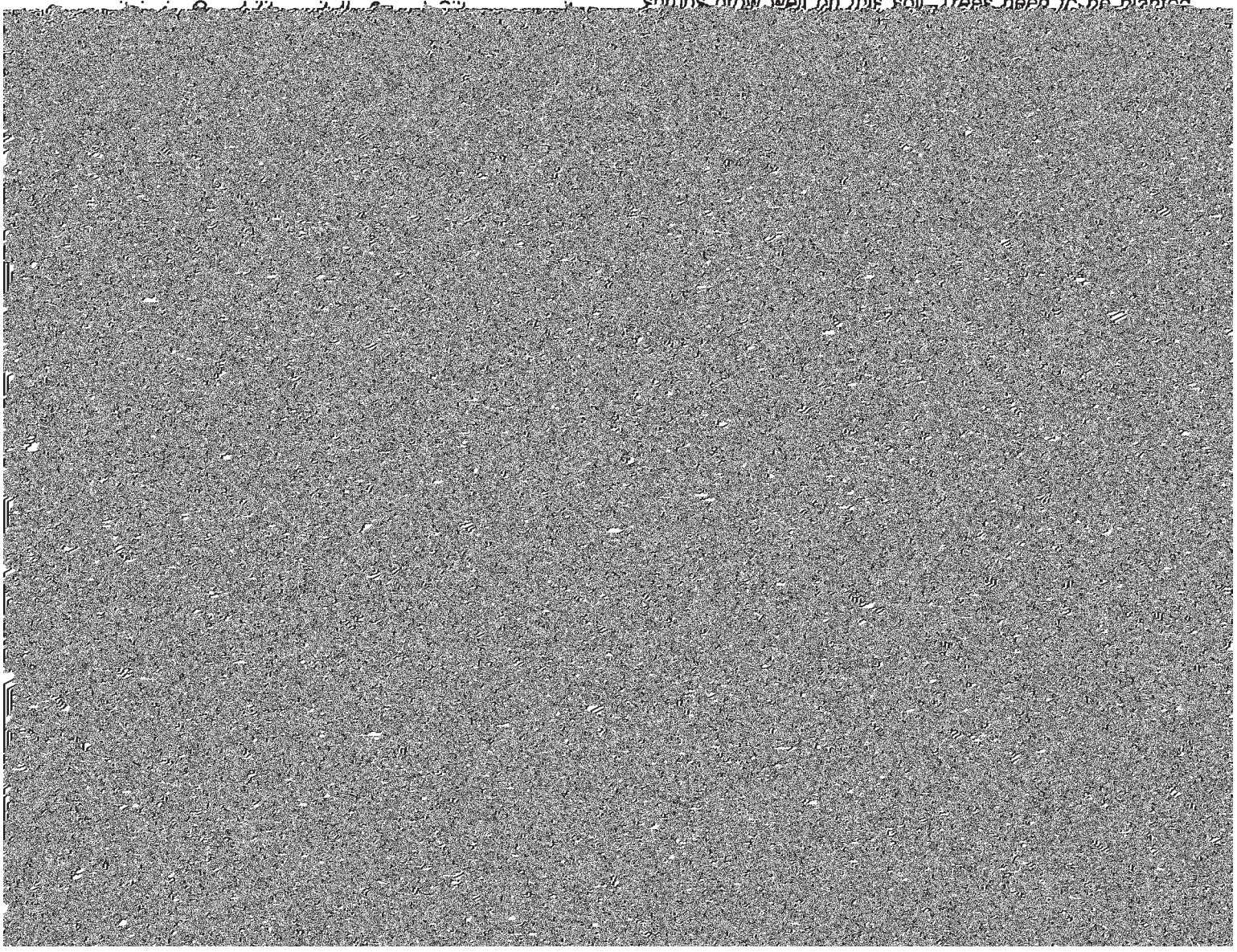
Strengthening the base material helps overcome the low strength of this soil for local roads and streets. This

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



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.

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.

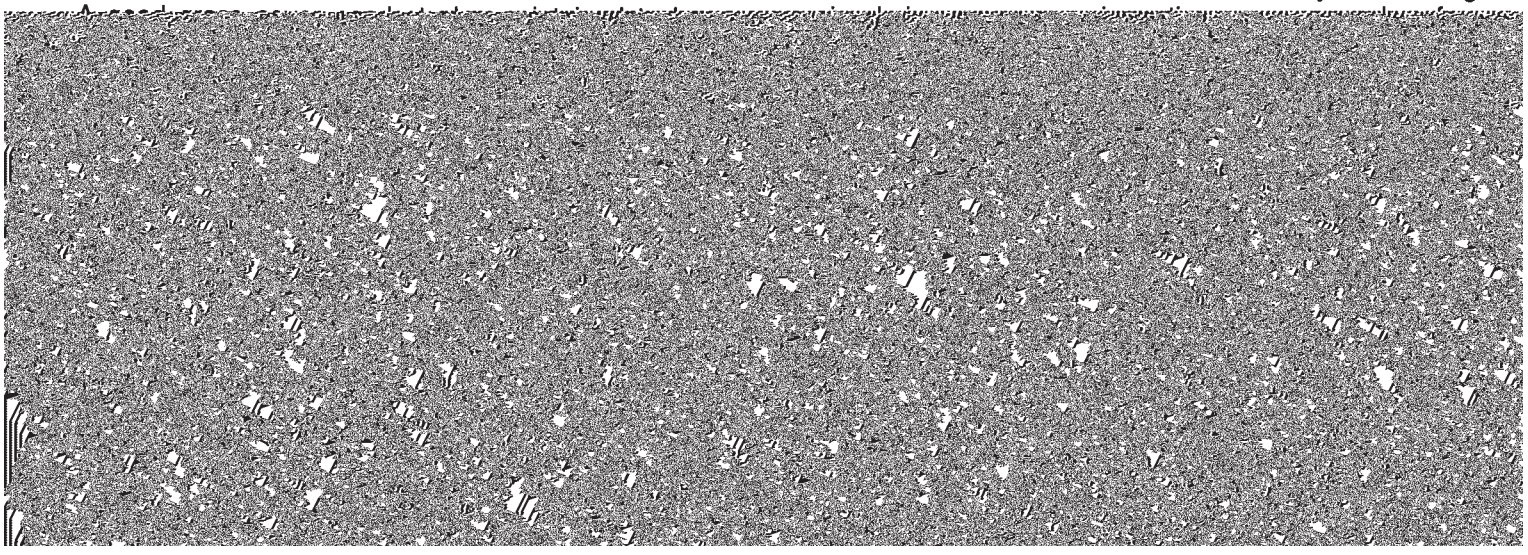
Typically, the Vanocker soil has a surface layer of dark grayish brown loam about 4 inches thick that is covered by about 1 inch of forest litter. The subsoil, about 11 inches thick, is channery clay loam. The underlying material to a depth of 60 inches is very pale brown, very channery clay loam.

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



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.

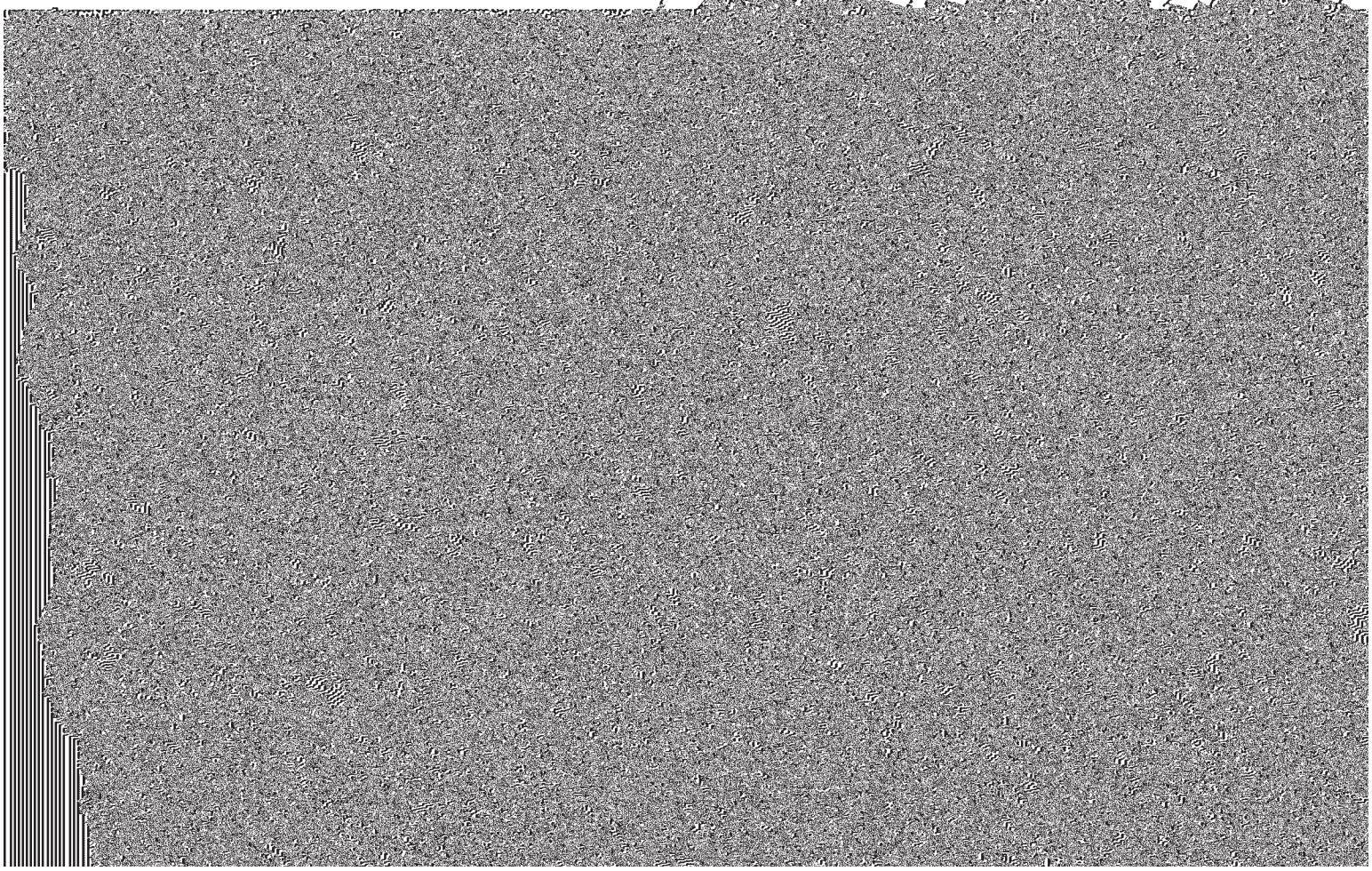
This map unit is unsuited to crops and windbreaks because of steep slopes and the severe hazard of erosion.

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 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



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

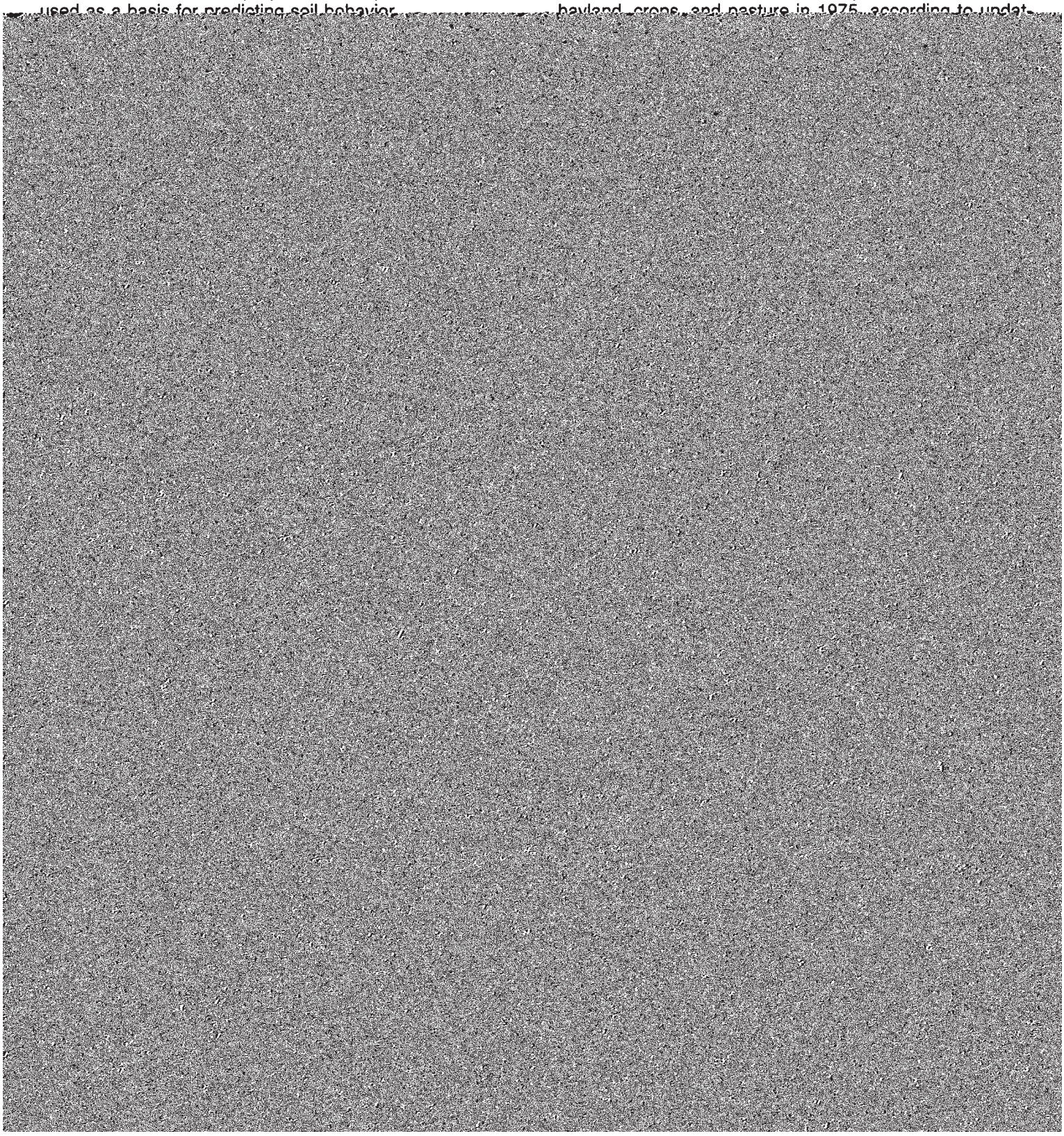
The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses 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.

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 updat-



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.

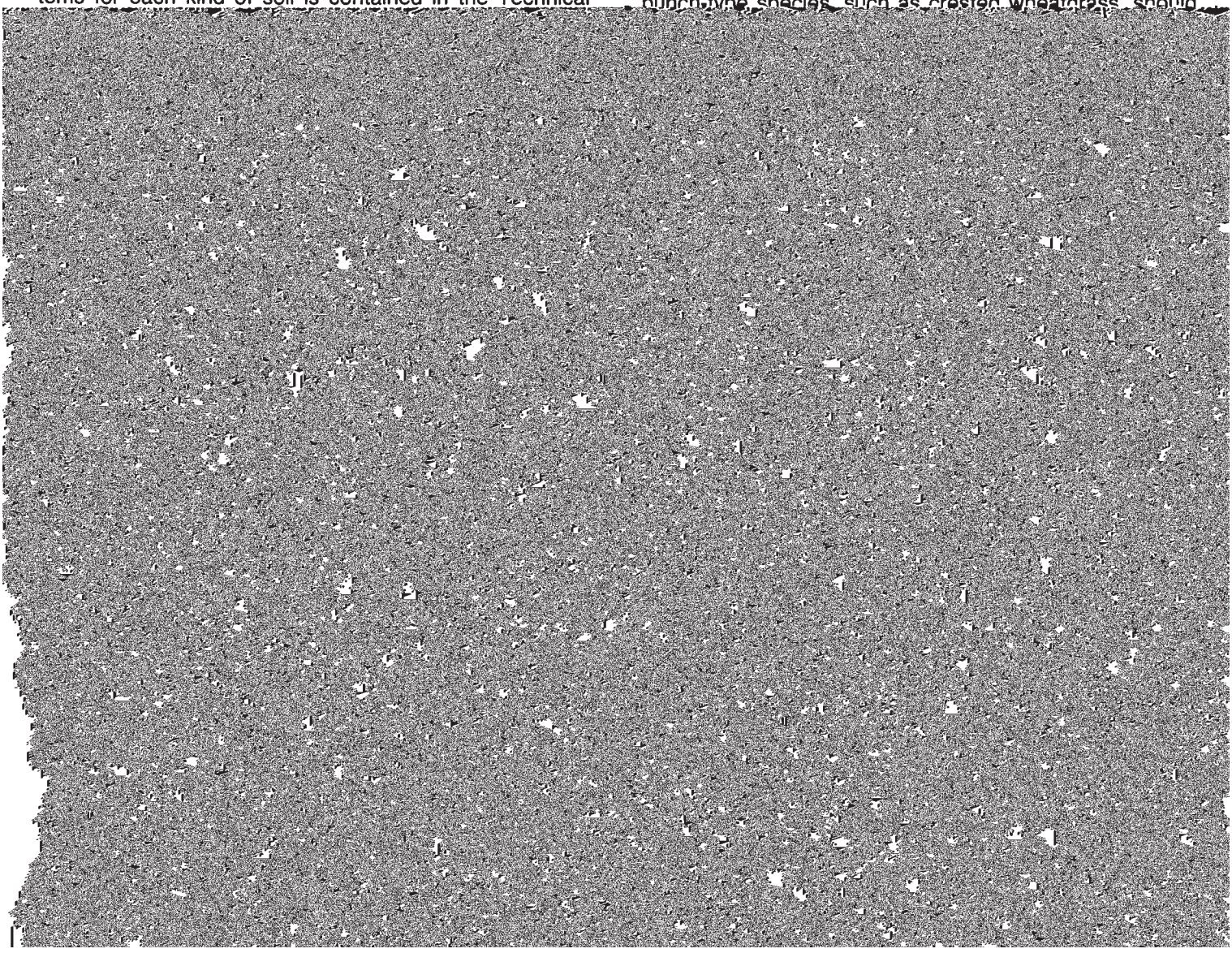
Information about the design of erosion control systems for each kind of soil is contained in the Technical

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

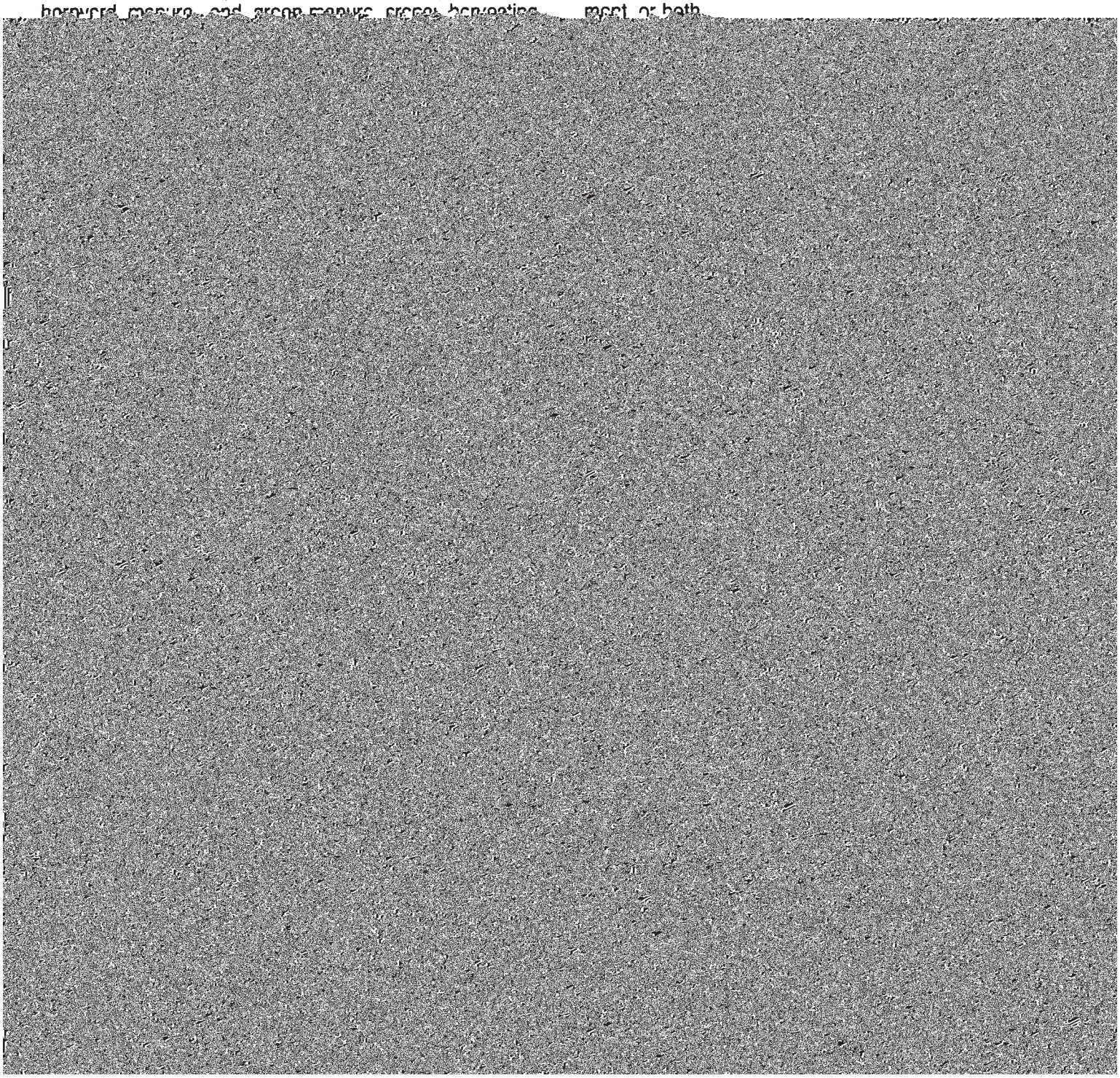


sion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, [illegible]

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

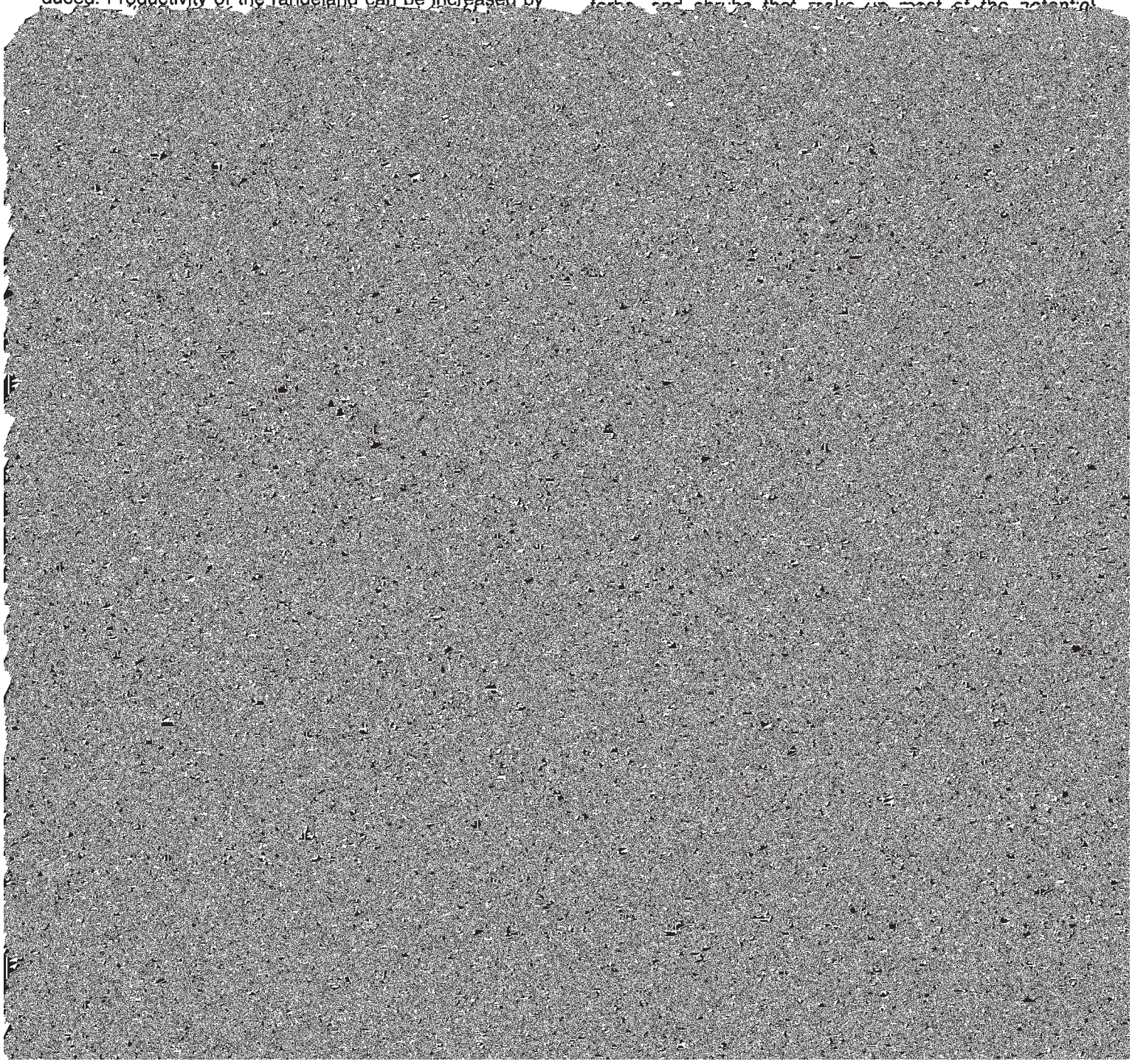
Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

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



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



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.

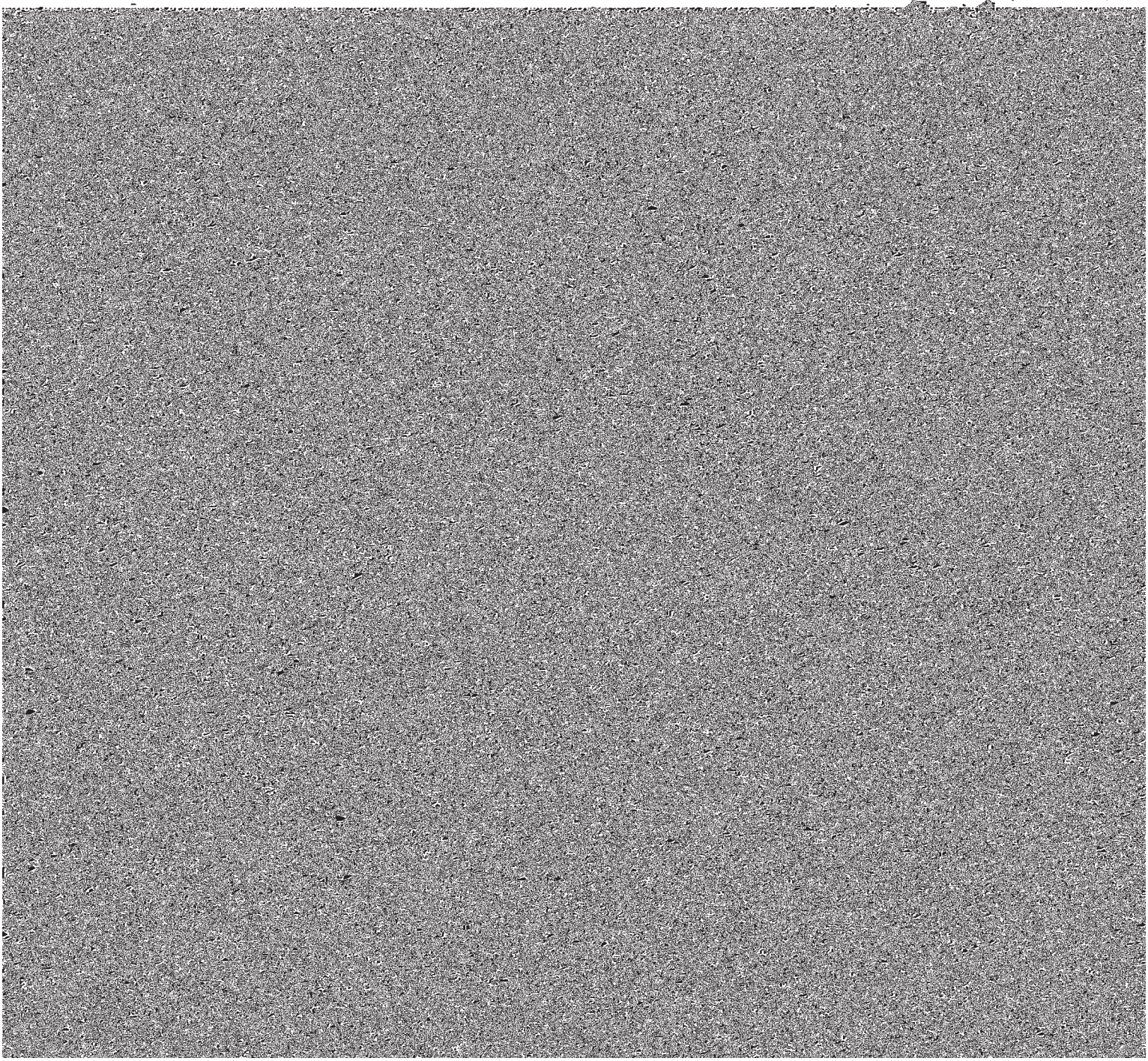
Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential

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

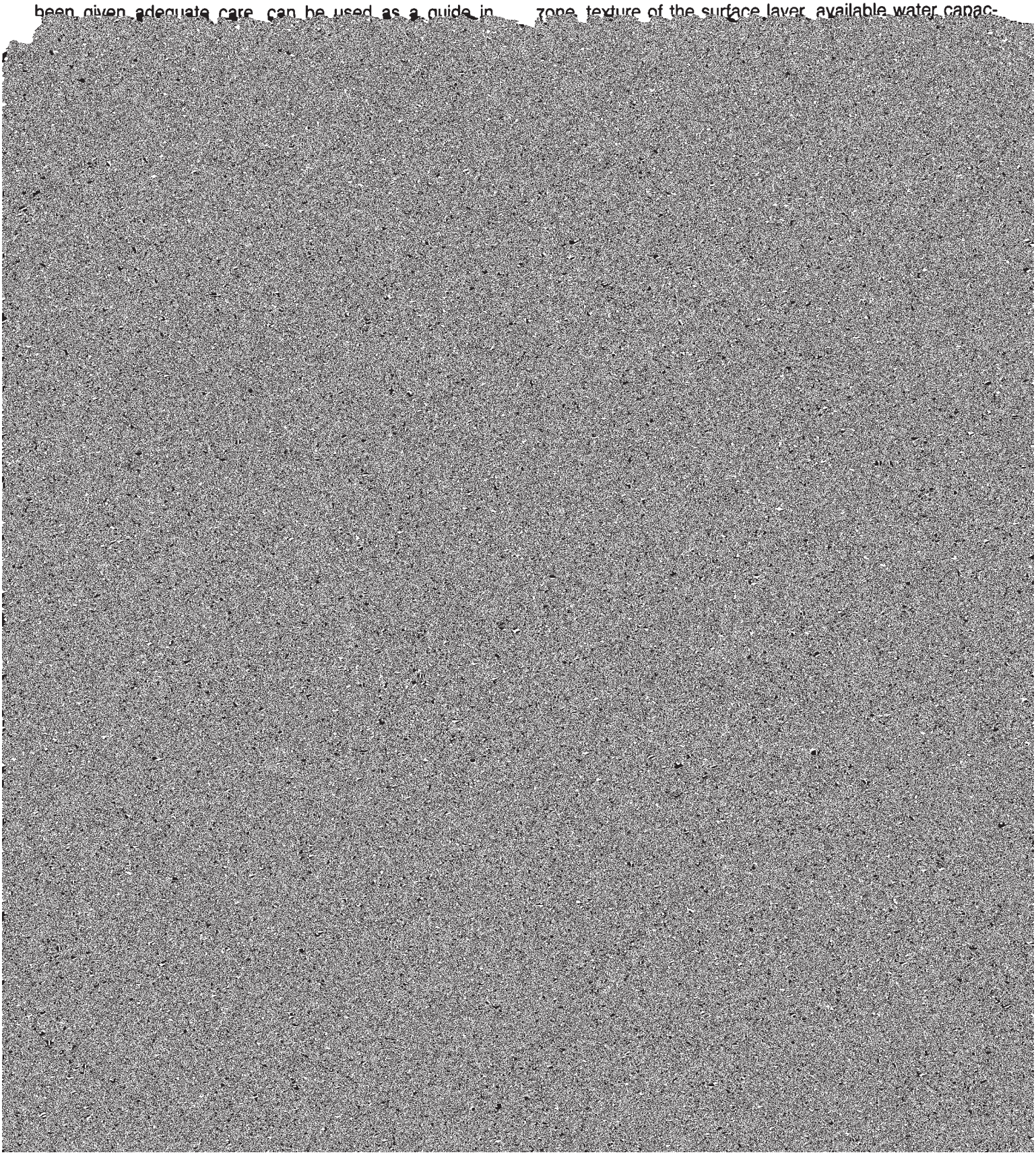
lings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

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



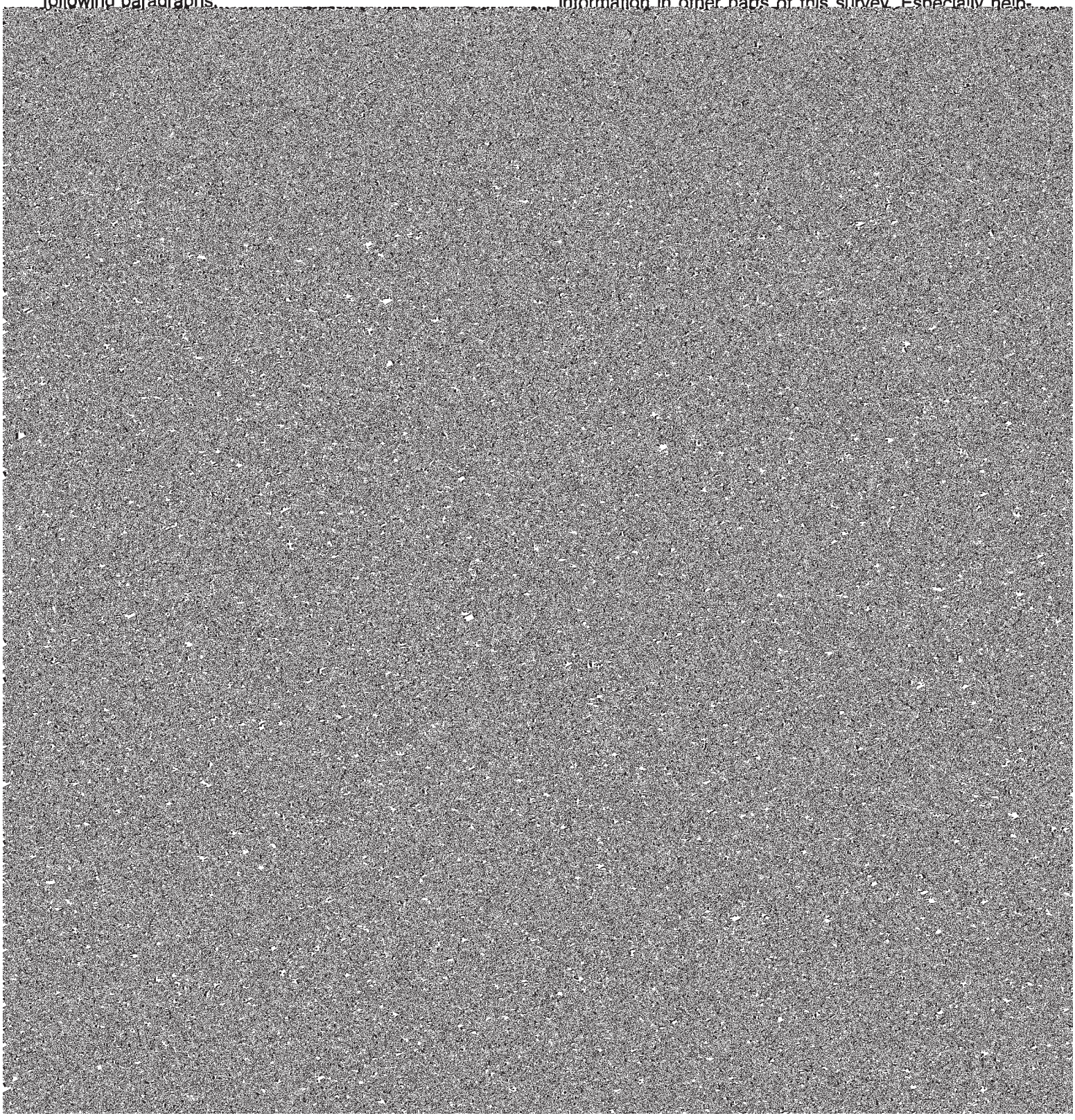
been given adequate care, can be used as a guide in

zone, texture of the surface layer, available water capac-



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.



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 help-

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.

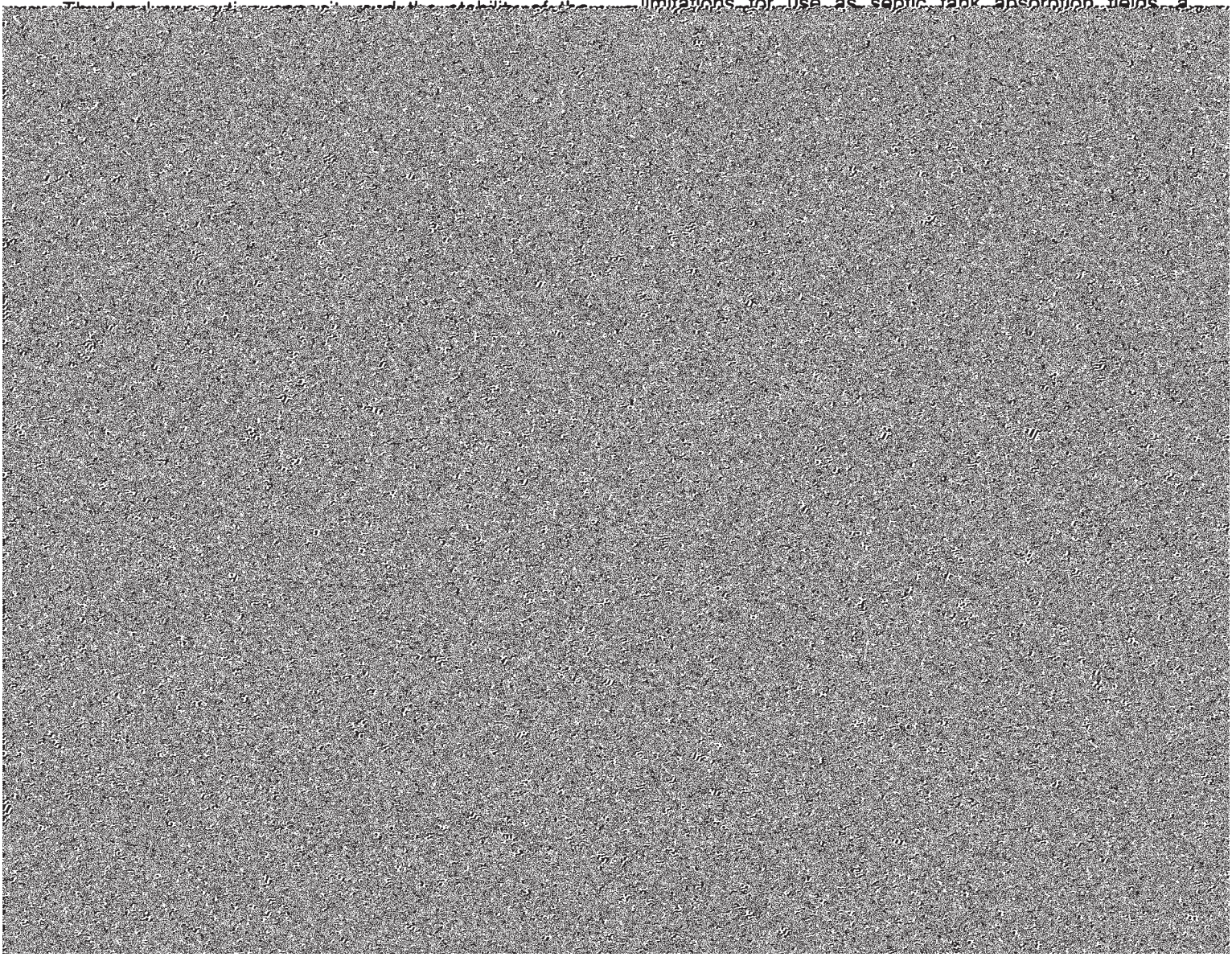
Local roads and streets referred to in table 14 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

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



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

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

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

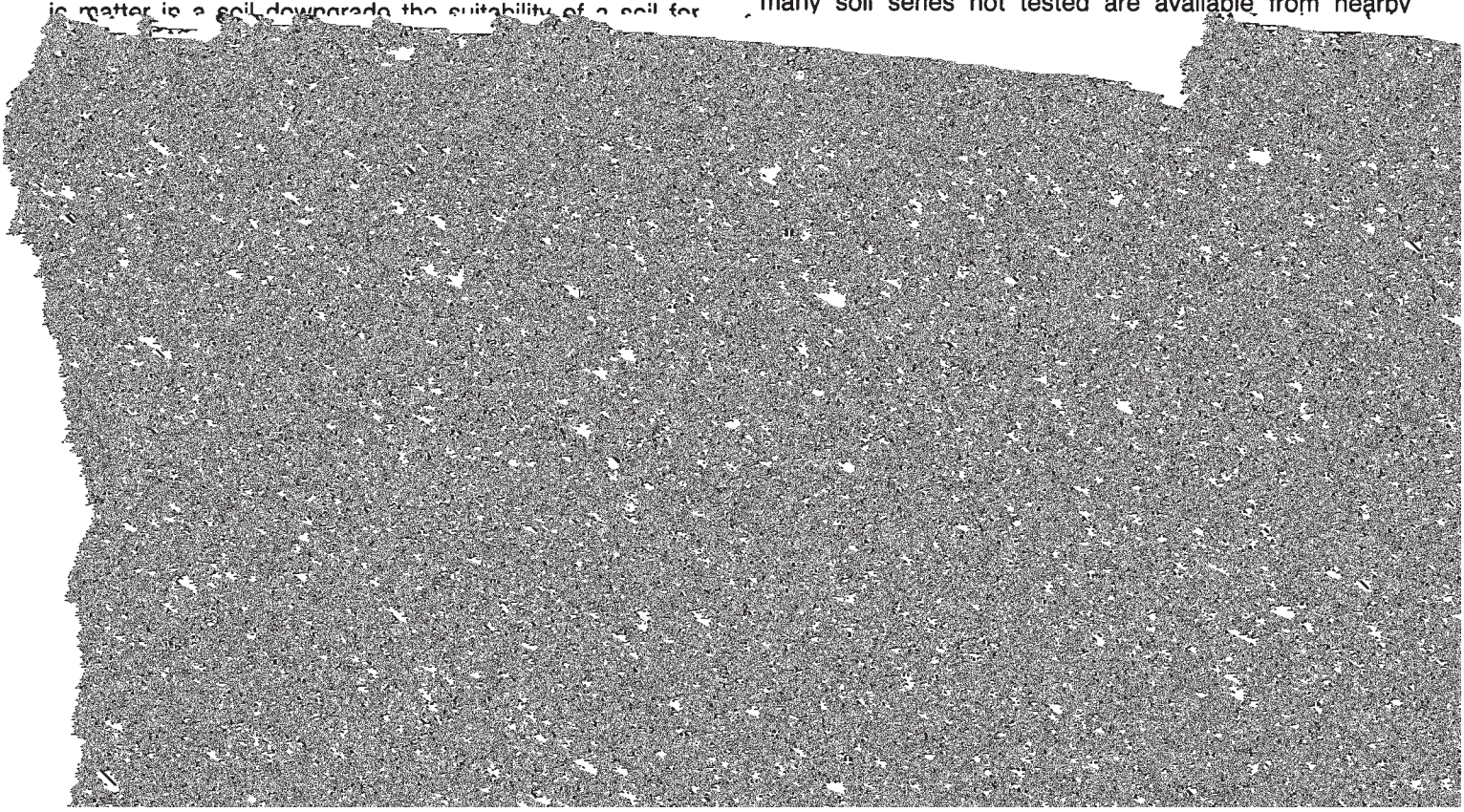
erodibility, wetness, and suitability for permanent vegetation.

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



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.

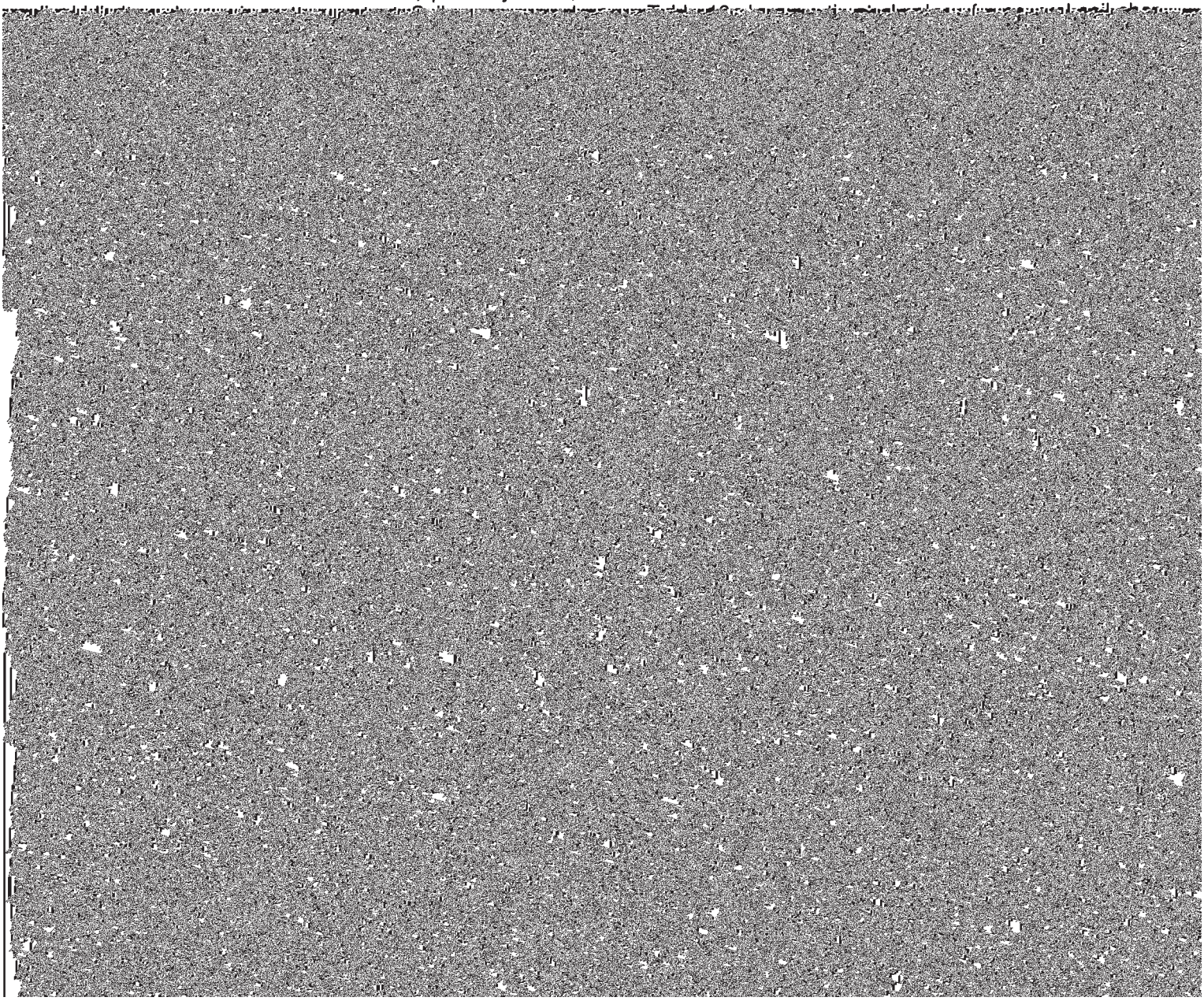
The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

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, [illegible]

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



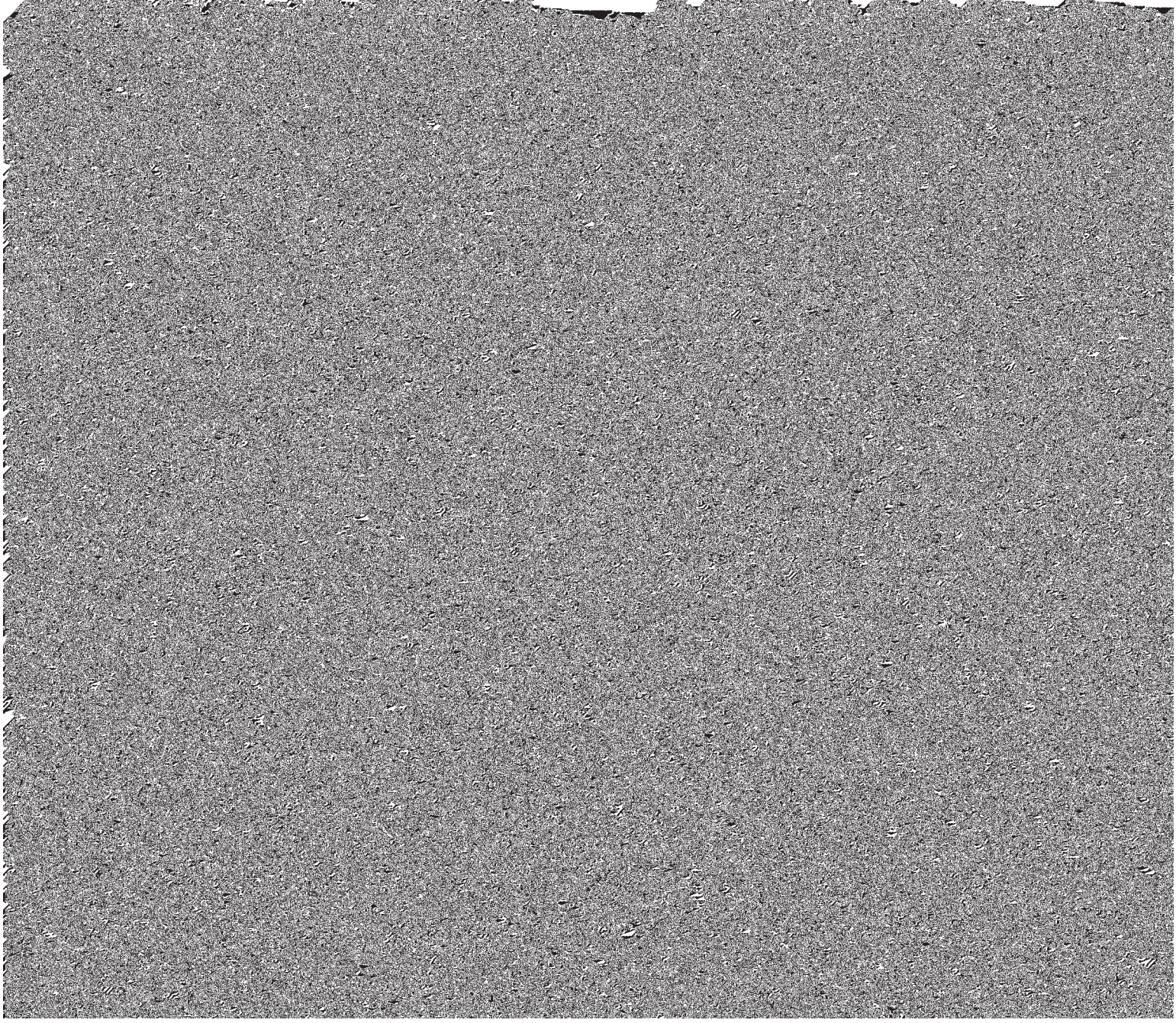
fields can differ greatly from the value given in table 19. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

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 [illegible]

moderately erodible, but crops can be grown if measures to control soil blowing are used.

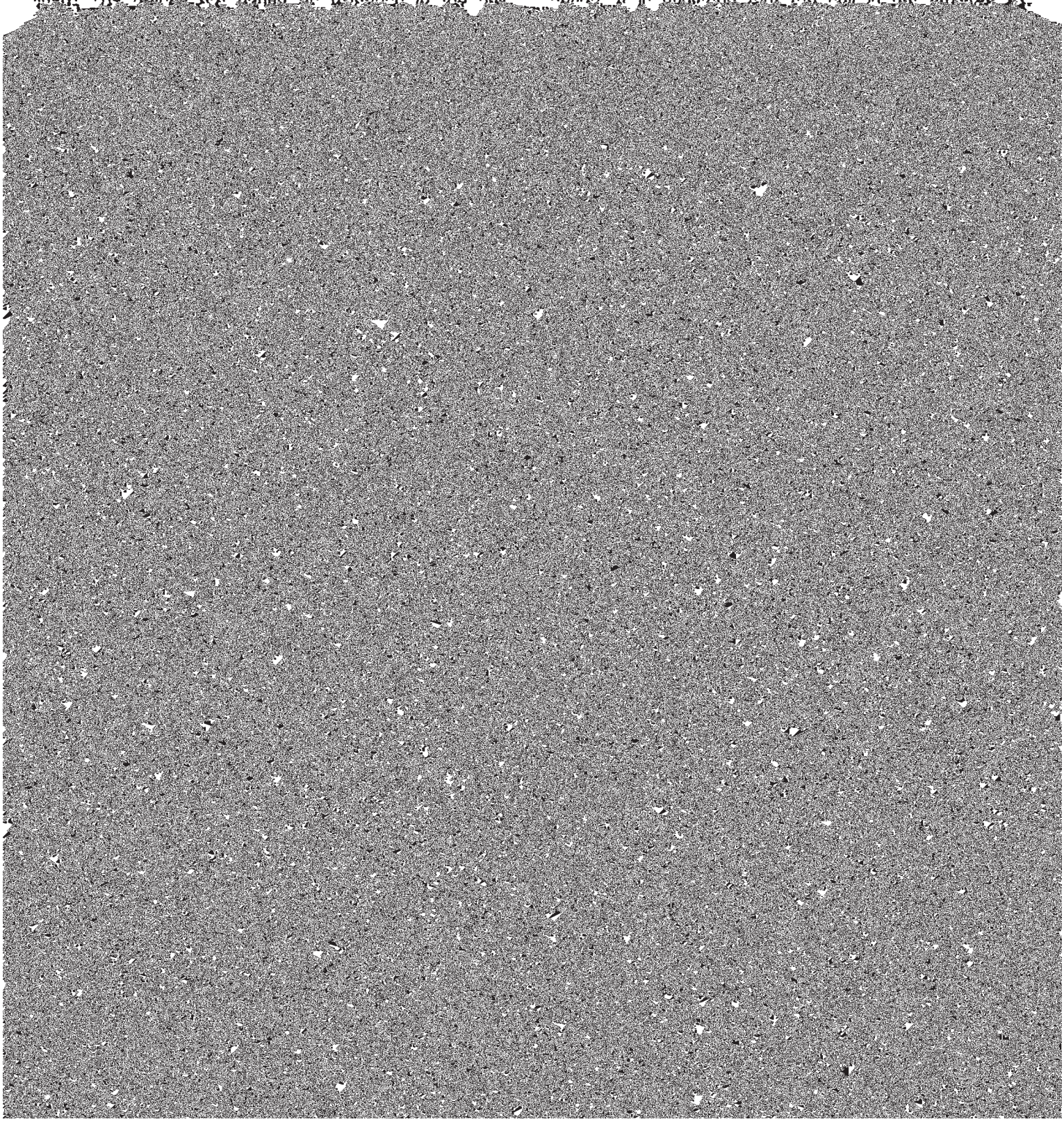
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing 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.



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

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



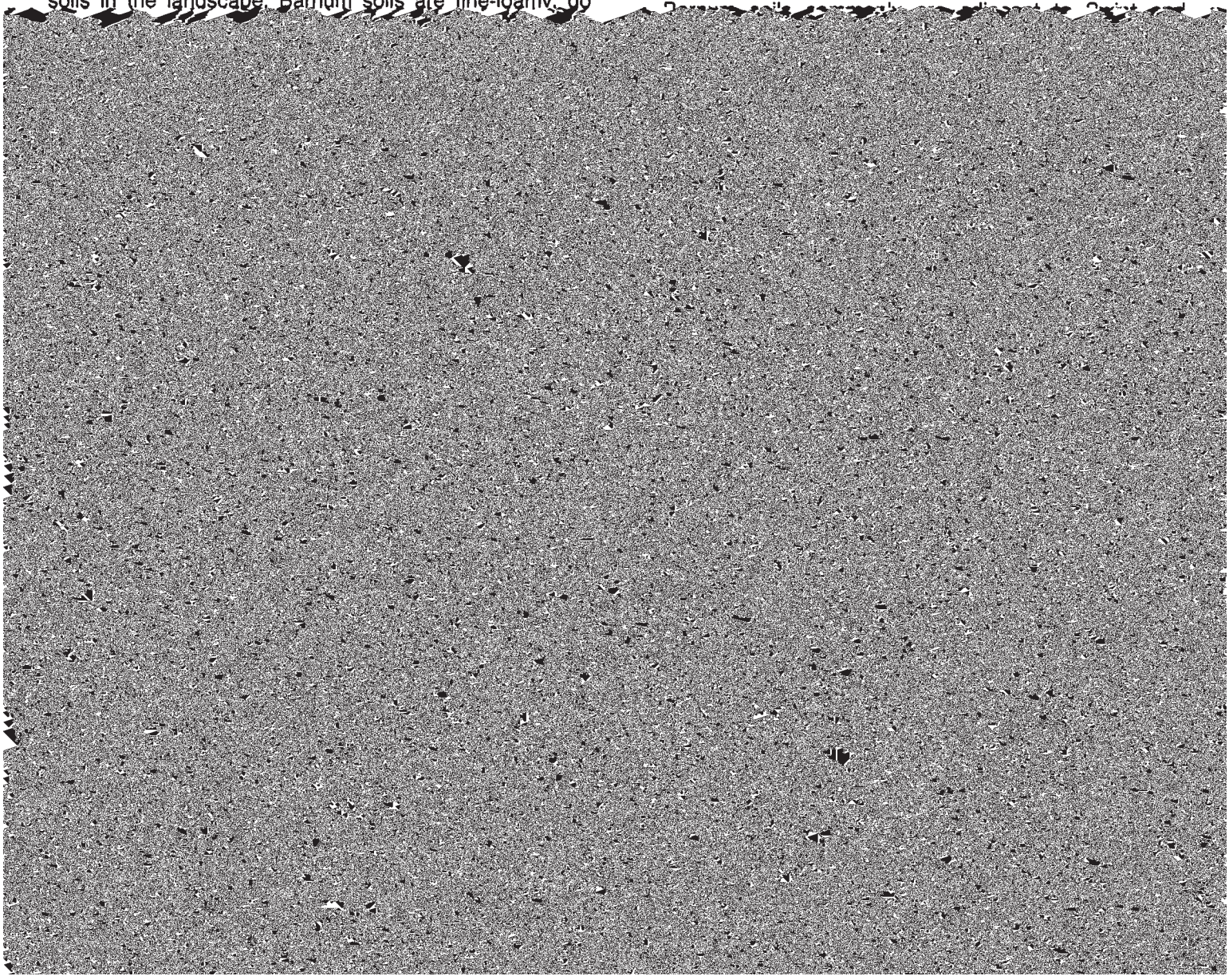
described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*8*). Unless otherwise noted, matrix colors described are for dry soil.

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



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.

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 1 to 3 in hue of 10YR or 2.5Y. It is silt loam or silty clay loam.

Bridget series

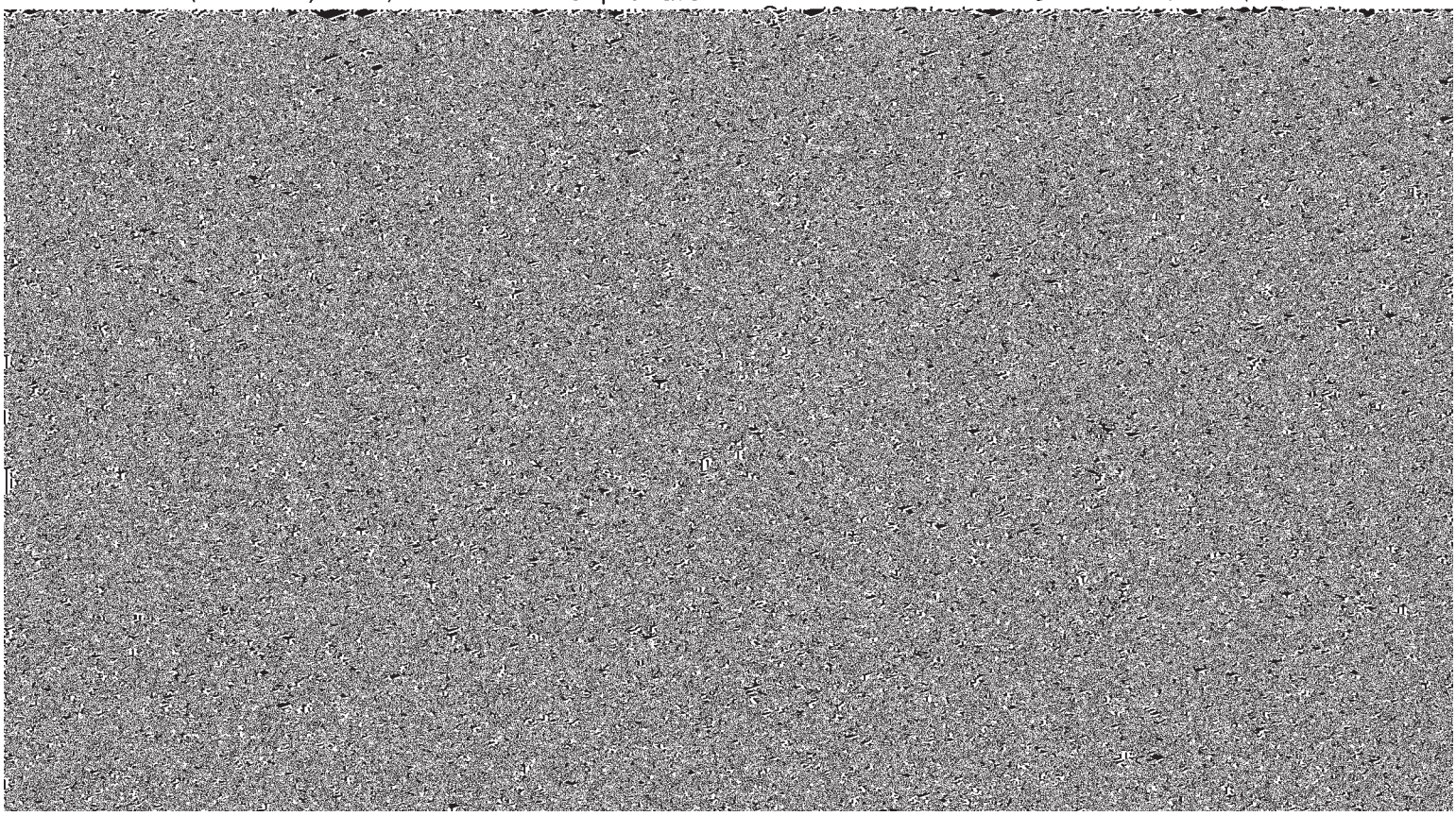
The Bridget series consists of deep, well drained soils that formed in calcareous sediment. These soils are on uplands. Permeability is moderate. Slopes range from 6 to 20 percent.

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.



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

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.

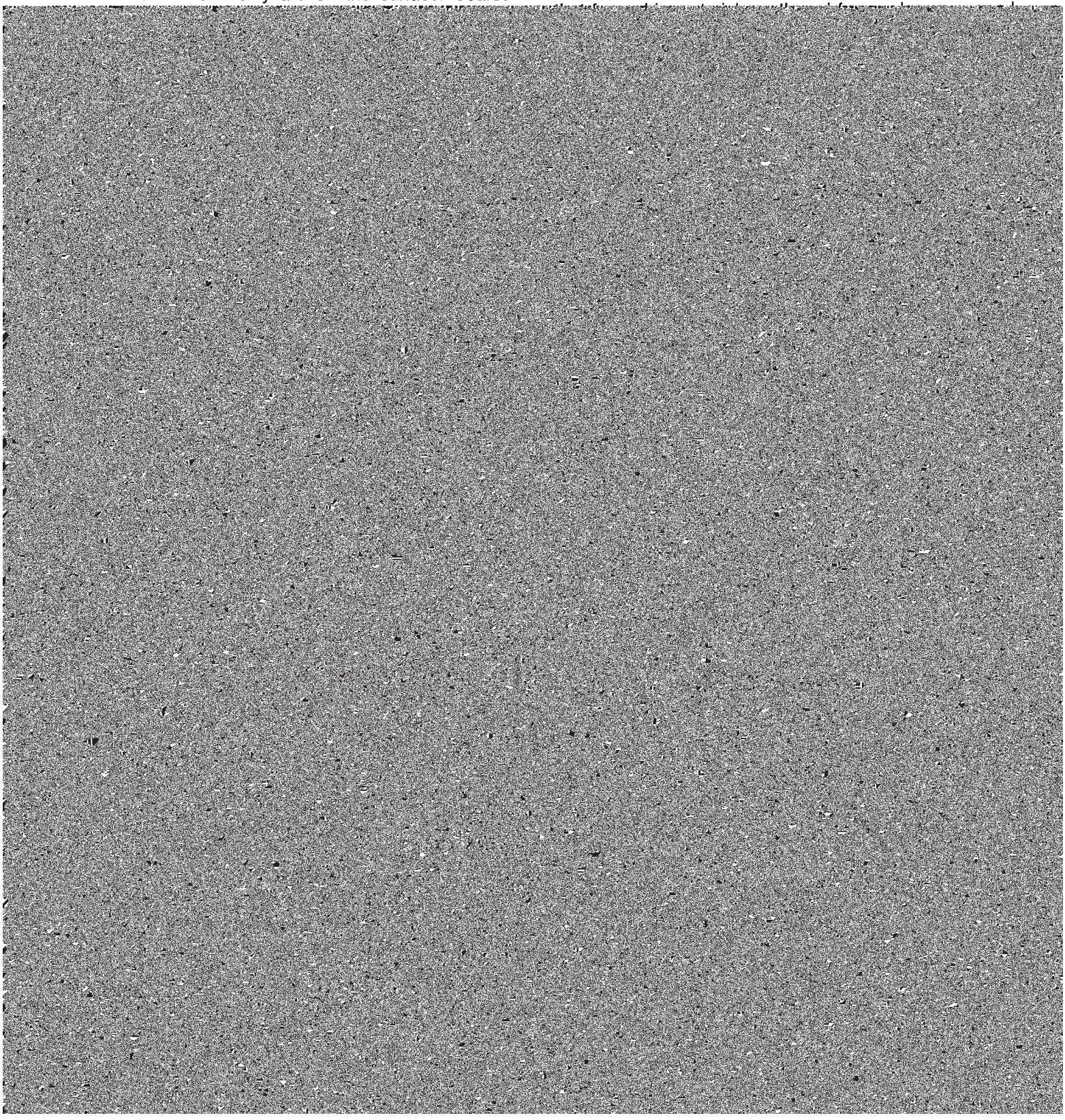
Butche soils are similar to Canyon soils and are adjacent to Lakoa and Satanta soils in the landscape. Canyon soils have free carbonates, have soft bedrock within a depth of 20 inches, and generally are below Butche soils. Lakoa soils have an argillic horizon and are more than 40 inches to bedrock. Satanta 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.:

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

Citadel series

The Citadel series consists of deep, well drained soils



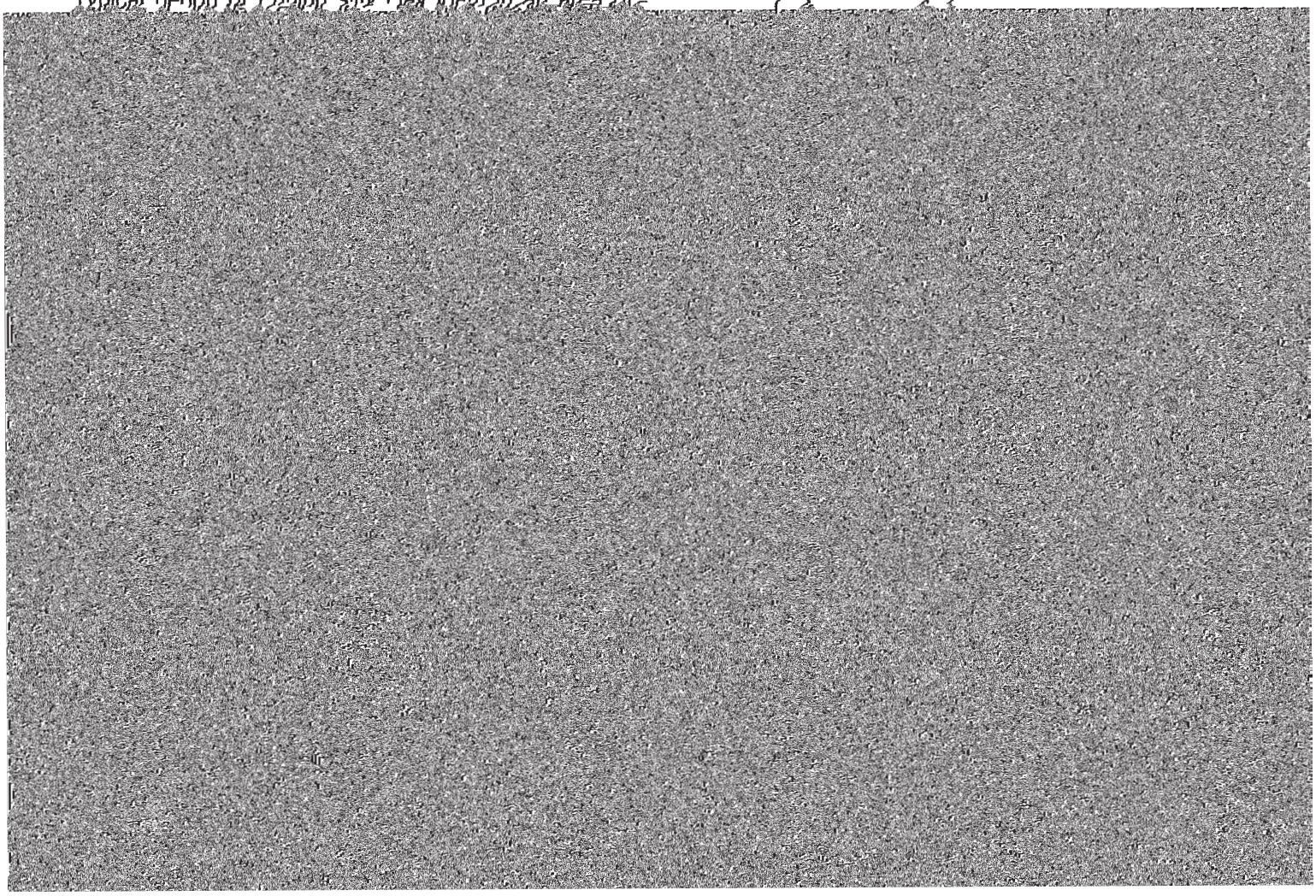
The A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2 in hue of 10YR to 5YR. It is very fine sandy loam, loam, or silt loam and is from 0 to 3 inches thick. The A2 horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3 in hue of 10YR to 5 YR. It is fine sandy loam, loam, or 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



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

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

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.

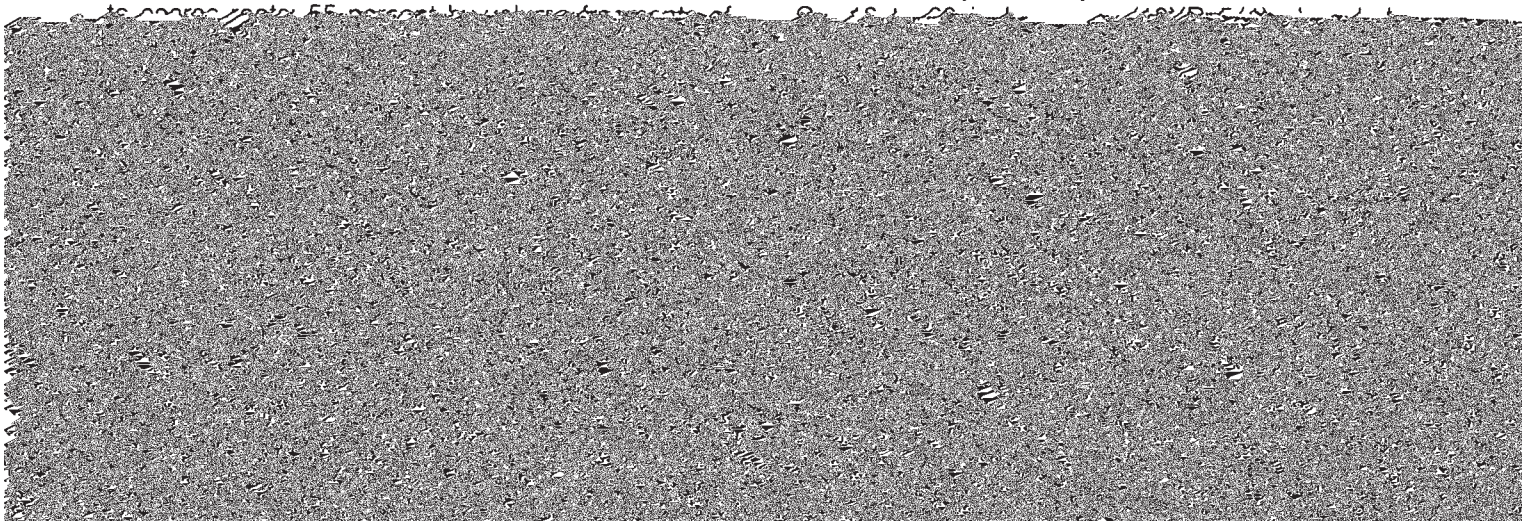
Grummit soils commonly are adjacent to Snomo soils. Snomo soils are deeper to shale than Grummit soils. They have a cambic horizon and are generally above Grummit soils.

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.



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

Higgins series

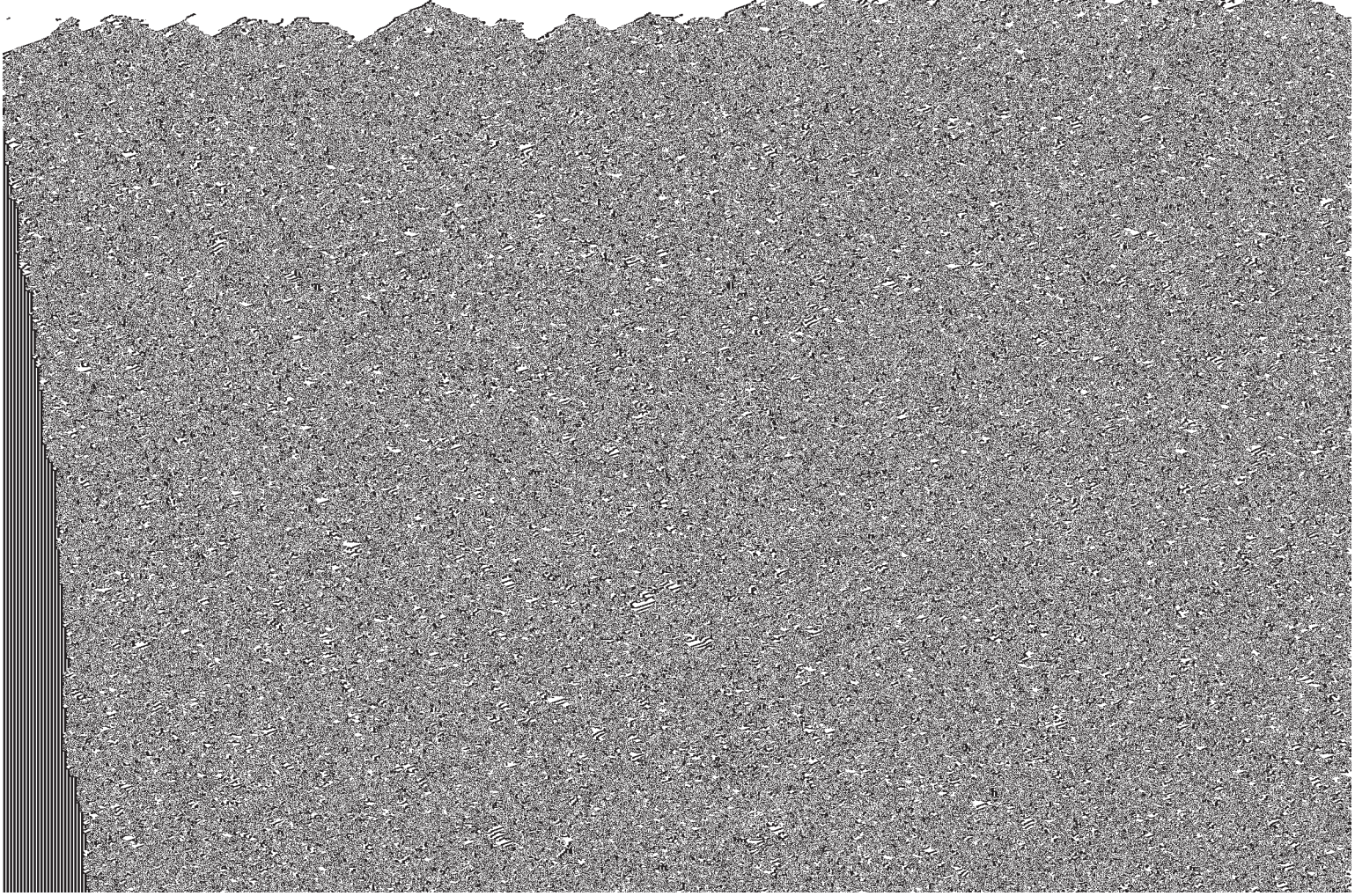
The Higgins series consists of deep, very poorly drained soils that formed in silty alluvium very high in gypsum. These soils are on alluvial fans and bottom lands. Permeability is moderate. Slopes are 0 to 2 percent.

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 per-



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 15 to 65 percent.

nery silt loam, very flaggy loam, or very flaggy silt loam. It is slightly acid to mildly alkaline.

Hisle series

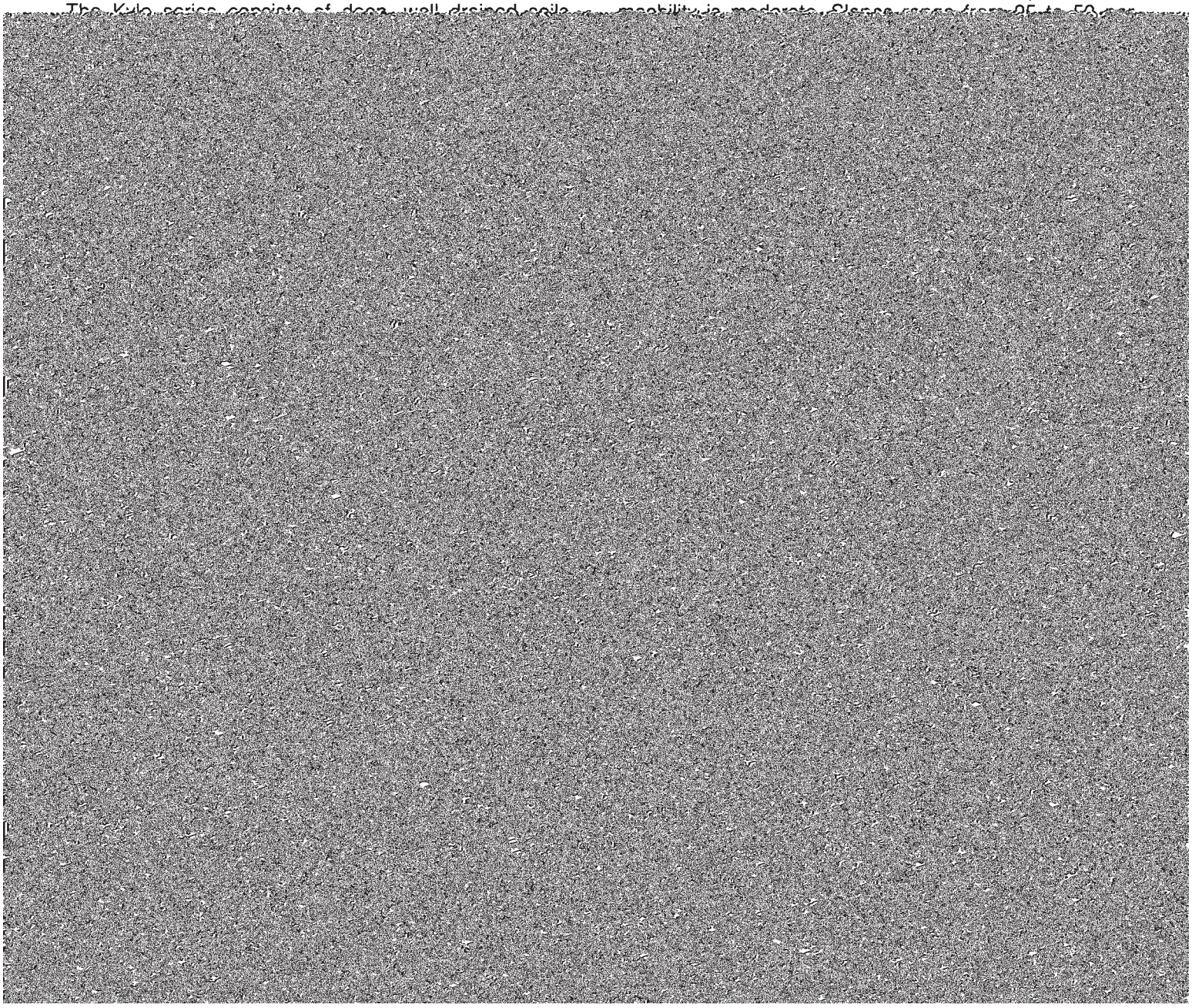
The Hisle series consists of moderately deep, well

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



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. Per-

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)

terial. These soils are on mountains. Permeability is moderate. Slopes range from 6 to 60 percent.

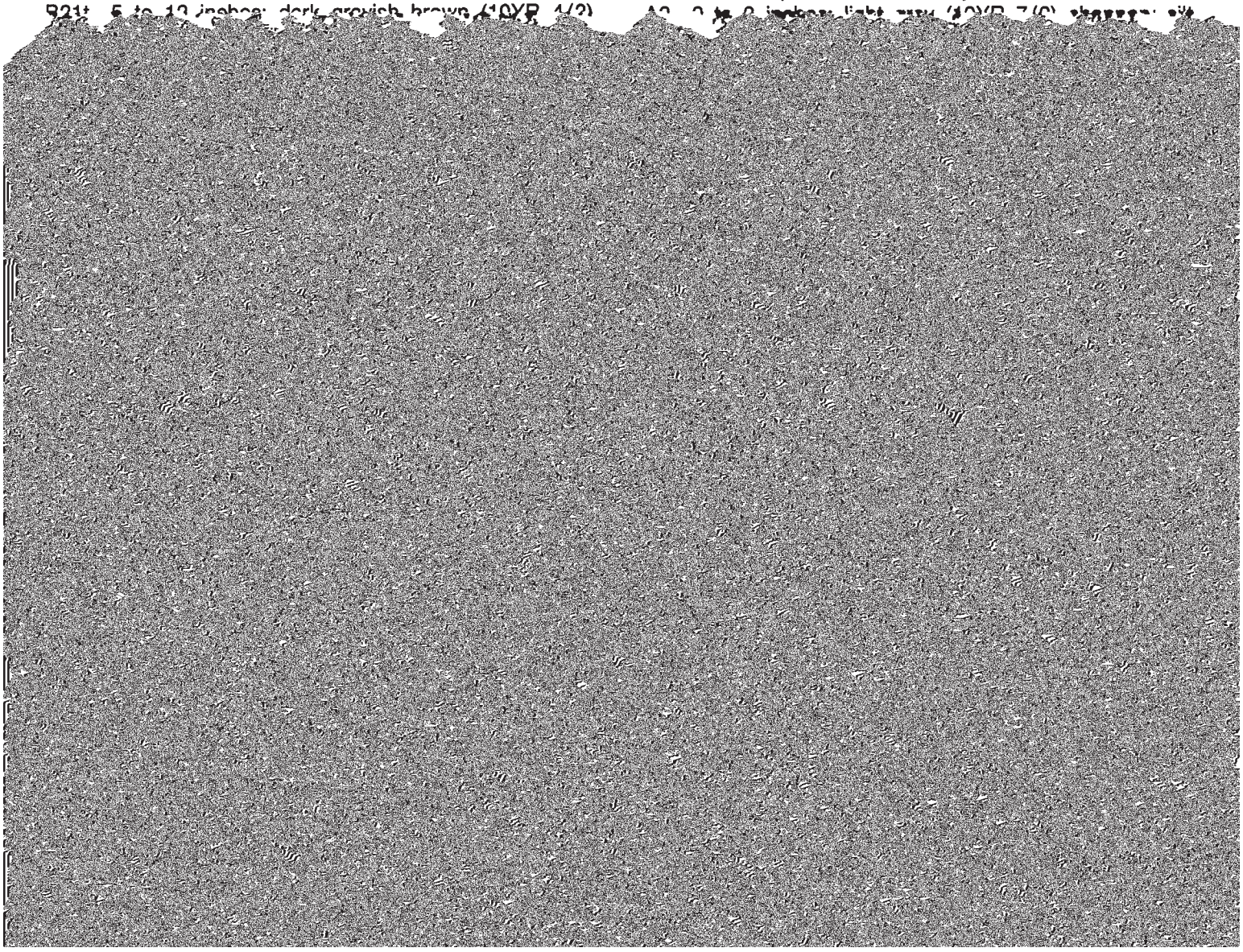
Pactola soils commonly are adjacent to Buska and Hisega soils in the landscape. Buska and Hisega soils have more mica than Pactola soils. Hisega soils do not have an argillic horizon and generally are on steeper slopes than Pactola soils.

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 8 inches; light gray (10YR 7/2) [illegible]



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;

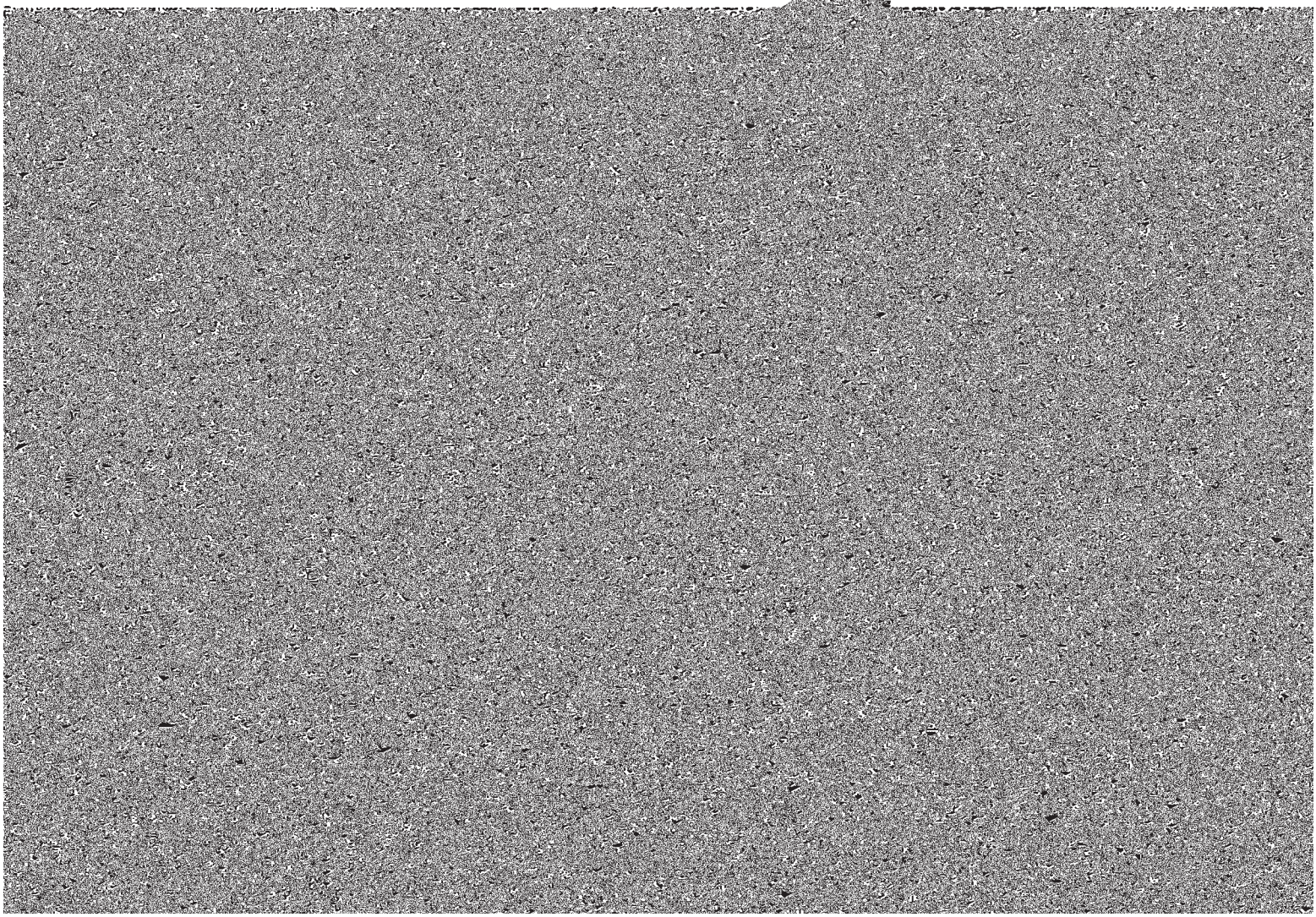
Pierre soils commonly are adjacent to Hisle and Kyle soils. Hisle soils have a natric horizon. Kyle soils are deeper to shale than Pierre soils.

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 sur-



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.

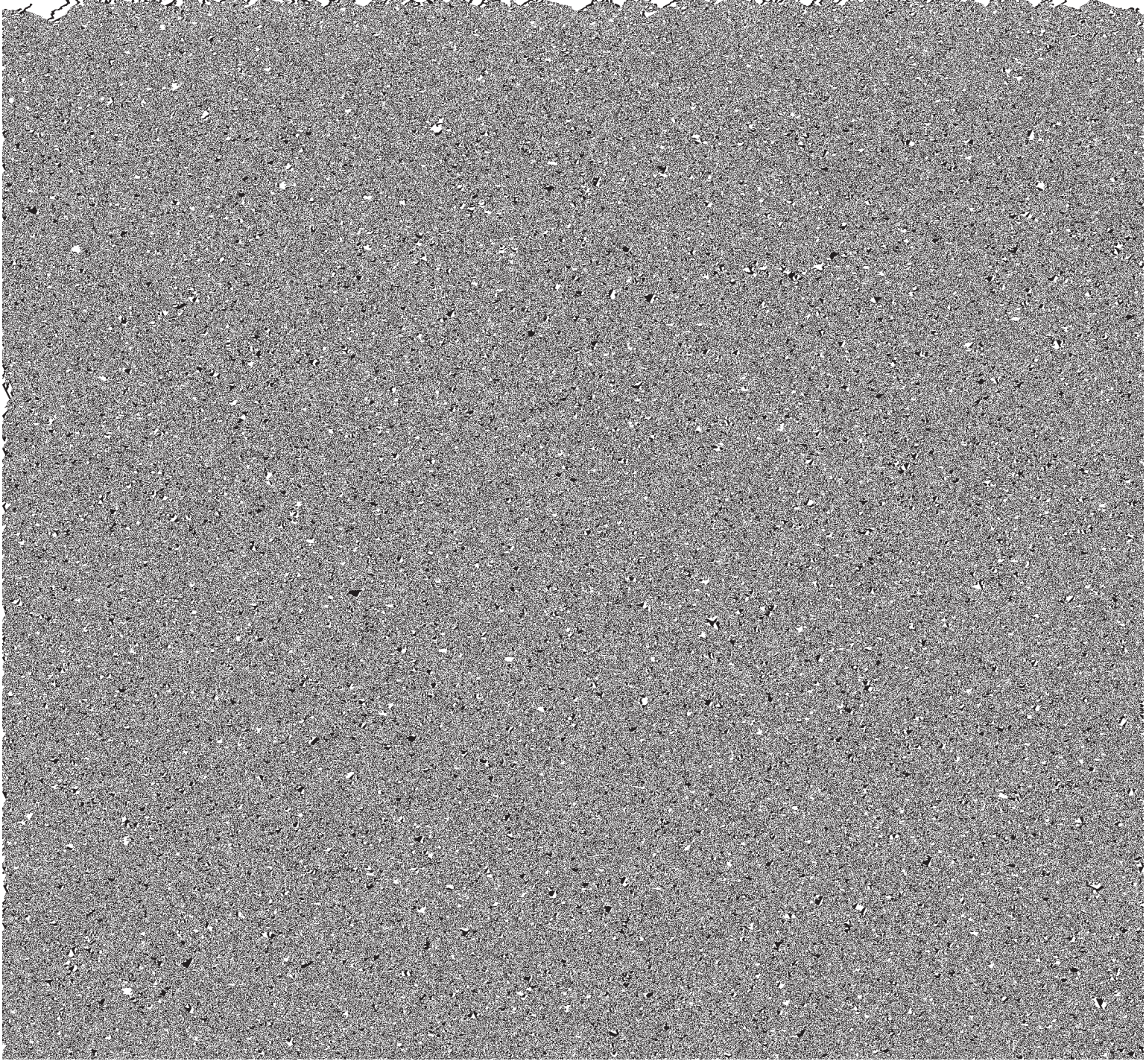
Razor soils commonly are adjacent to Midway soils. Midway soils are underlain by shale at a depth of 6 to 20 inches.

Typical pedon of Razor silty clay loam, in an area of

stone, 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



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.

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.:

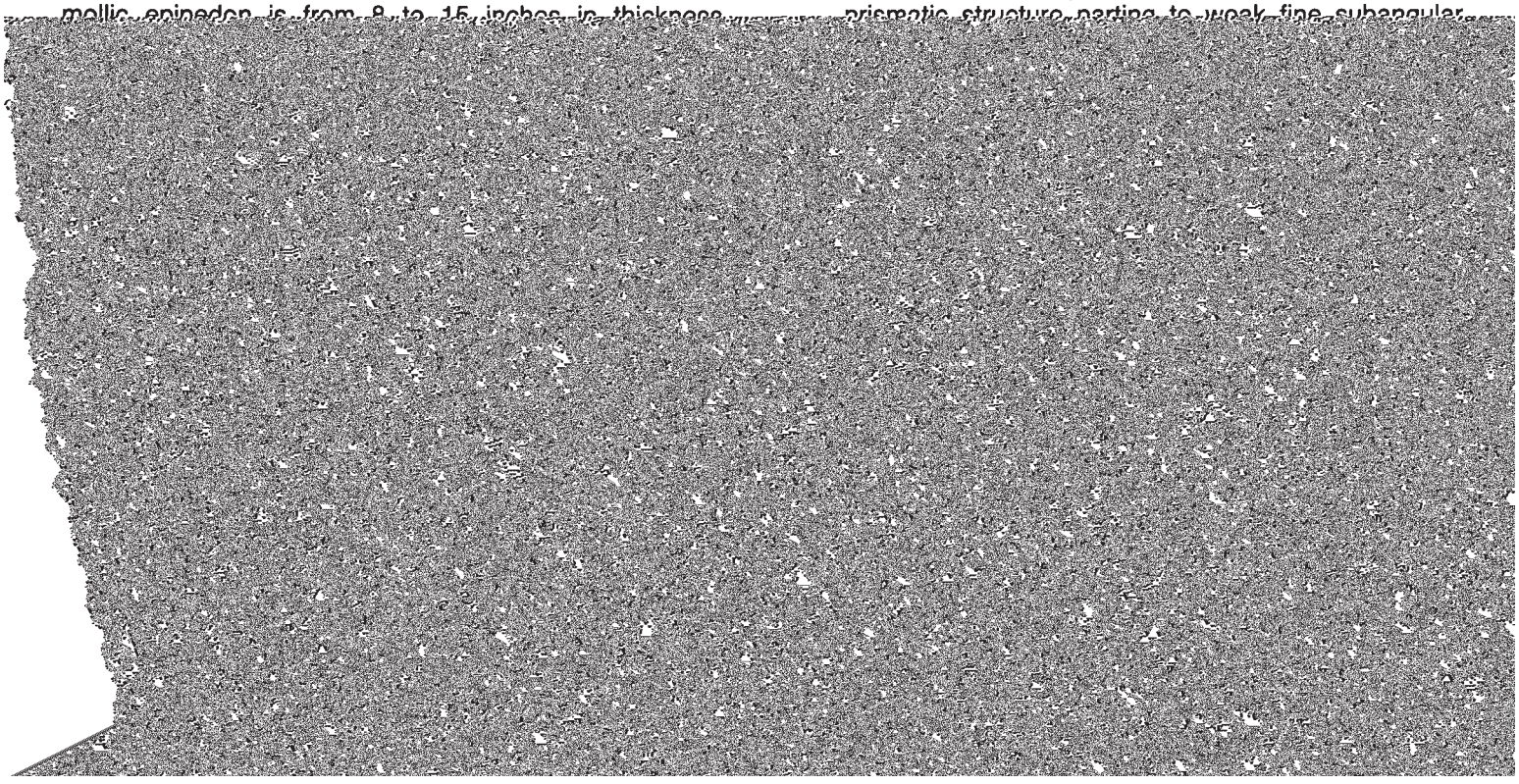
Ap—0 to 7 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; moderate thin and medium platy structure parting to weak medium subangular blocky; hard, friable; many roots; slightly acid; abrupt smooth boundary.

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



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; 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

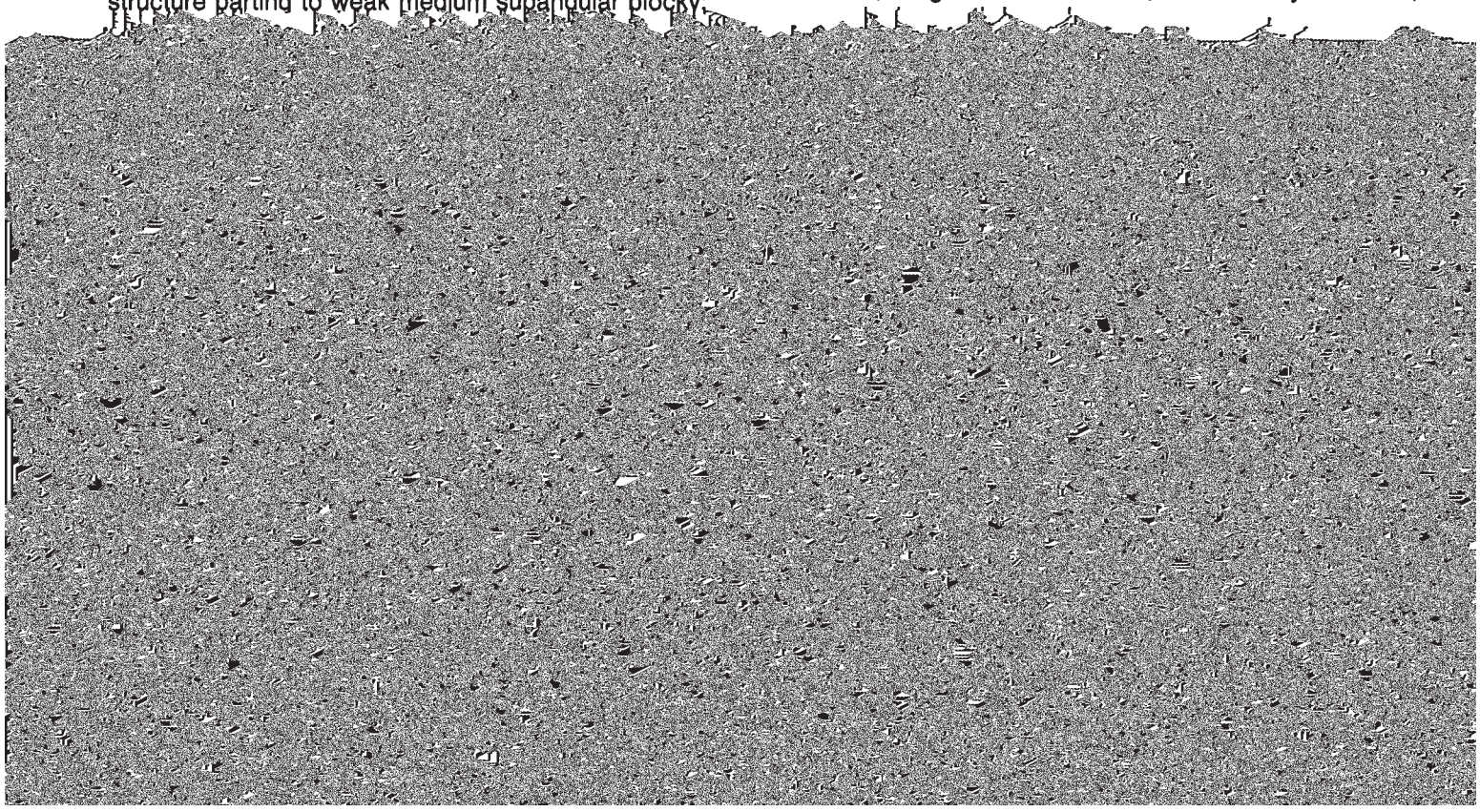
The Spearfish series consists of shallow, well drained and excessively drained soils that formed in material weathered from red gypsiferous siltstone, sandstone, and shale. These soils are on uplands. Permeability is moderate. Slopes range from 9 to 40 percent.

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.:

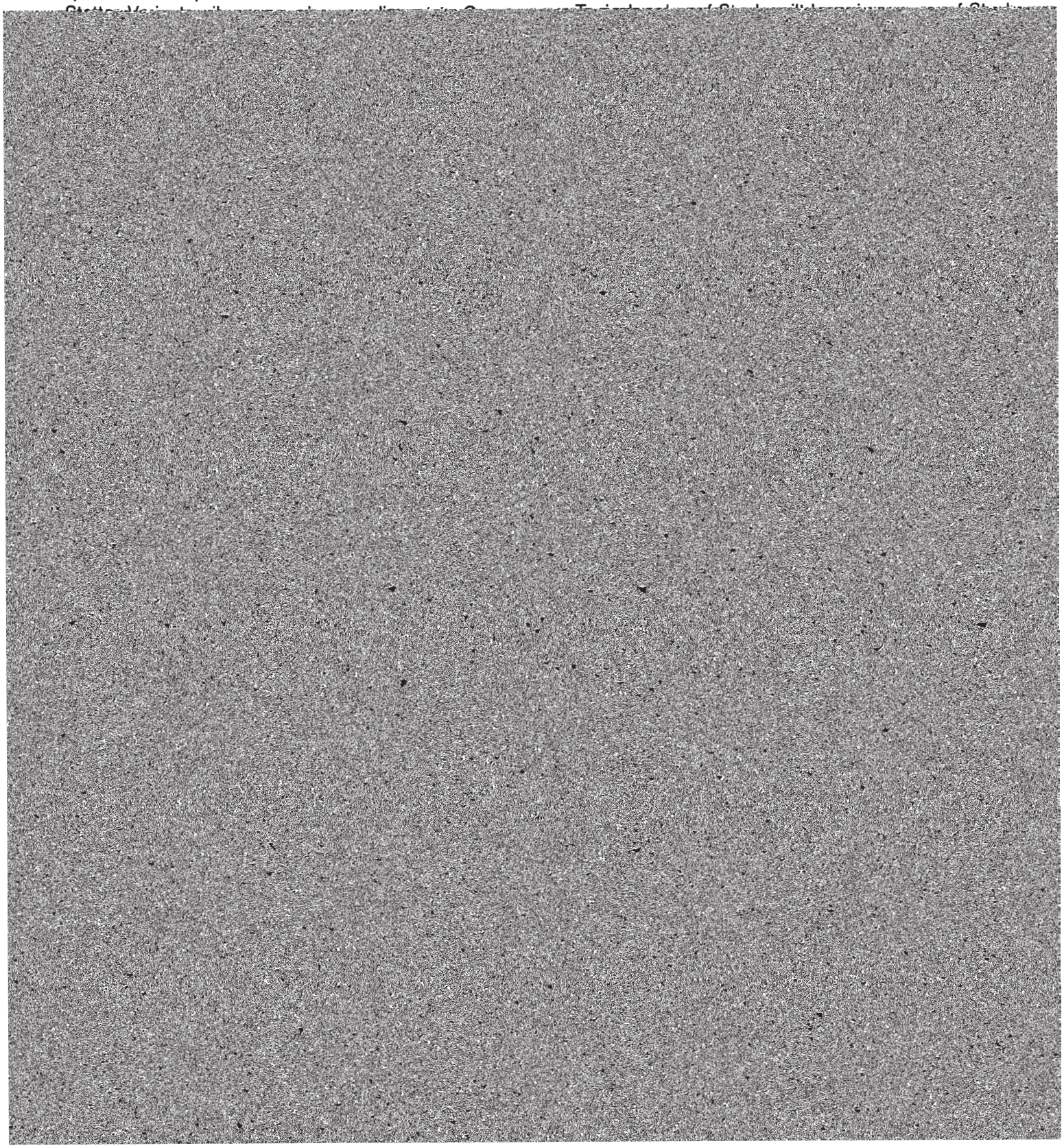
A1—0 to 2 inches; reddish brown (5YR 5/4) silt loam, dark reddish brown (5YR 3/3) moist; weak very thin platy structure parting to weak very fine granular; slightly hard, very friable; many roots; slight effervescence; mildly alkaline; clear smooth boundary.

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;



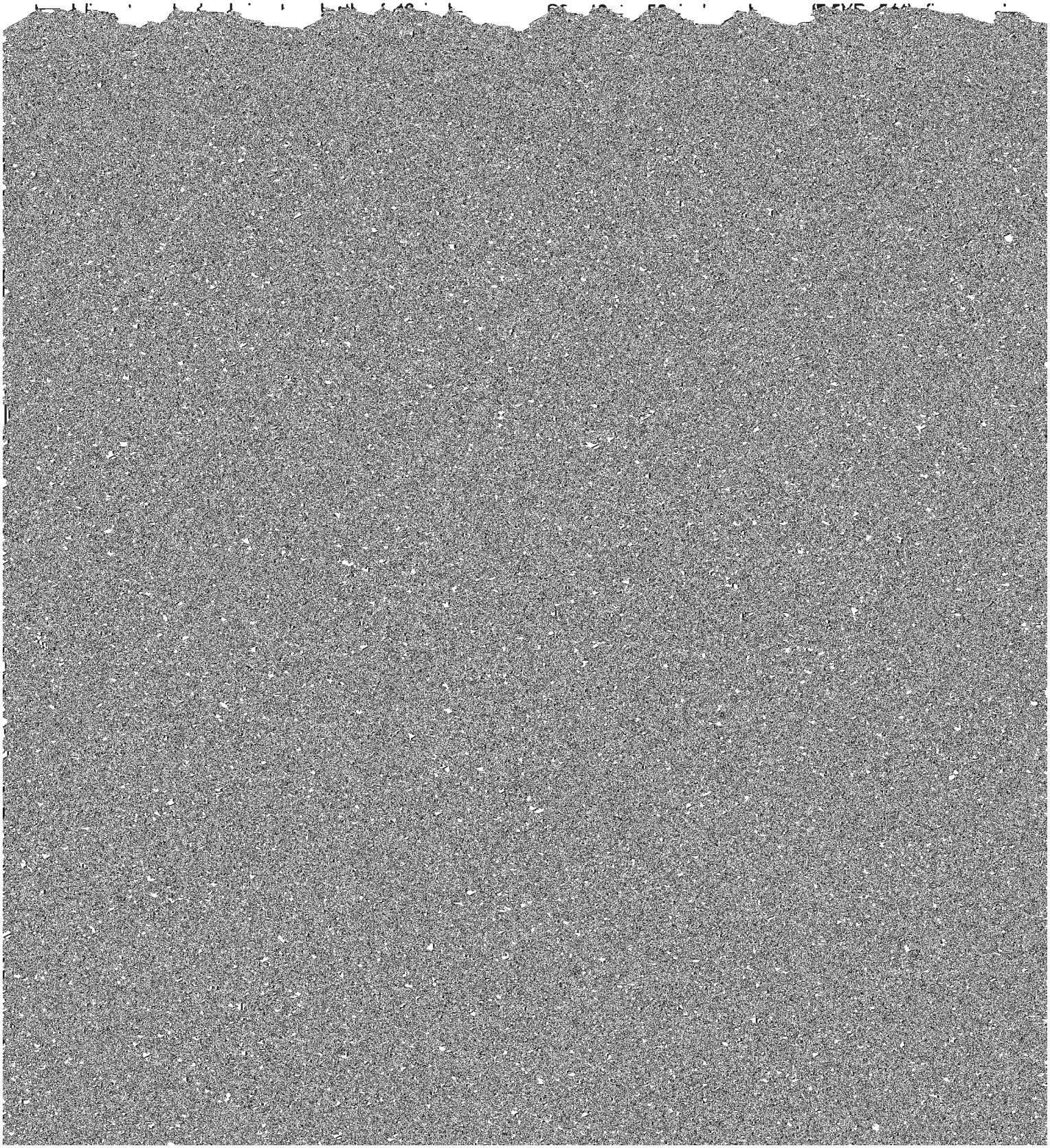
These soils are on bottom lands. Permeability is slow. Slopes are 0 to 3 percent.

lower to limestone bedrock and generally are above Stovho soils.



The solum ranges from 28 to 60 inches in thickness. Depth to free carbonates is from 25 to 60 inches. Frac-

many fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual 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.

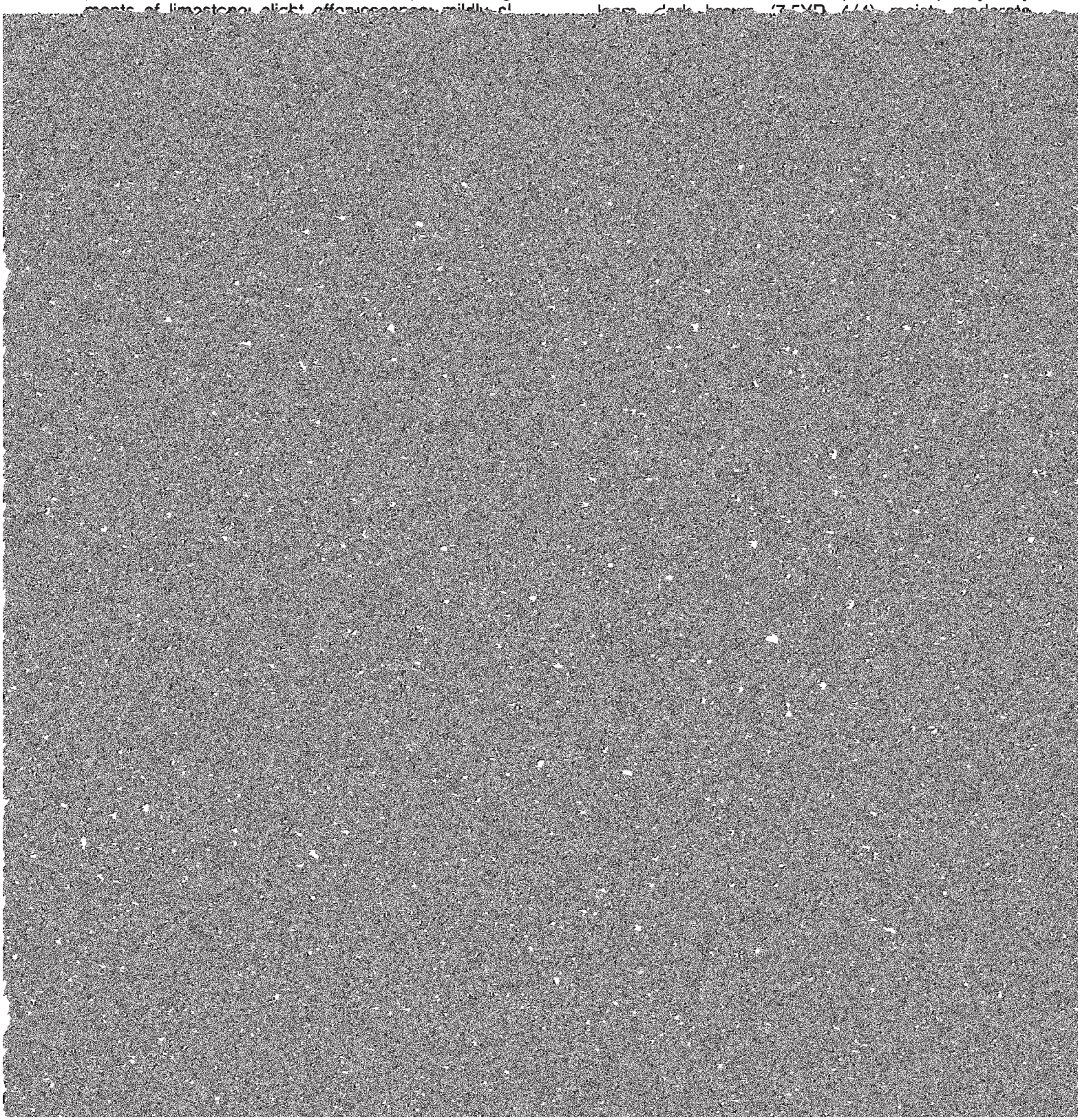
Typical pedon of Trebor silt loam in an area of Trebor-Rock outcrop association, hilly, 2,475 feet east and 660 feet north of the southwest corner of sec. 31, T. 3 N., R. 2 E.:

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)

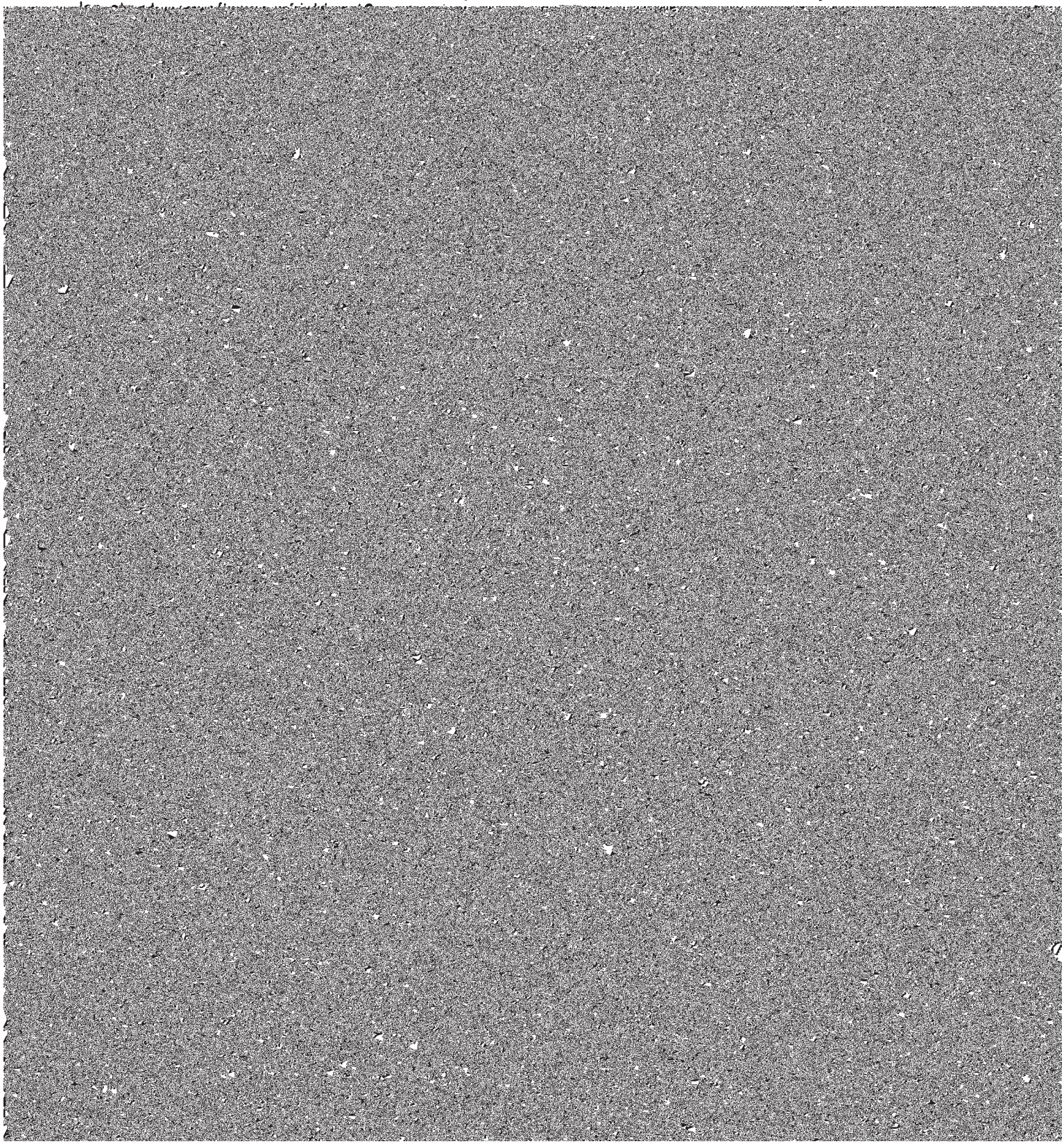
moist; moderate fine and medium subangular blocky structure; hard, friable; slightly sticky and slightly plastic; few fine and coarse roots; 30 percent fragments of limestone; slight effervescence; mildly al-

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



A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granu- common fine and coarse roots; many pores; medium acid; clear smooth boundary.



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

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.

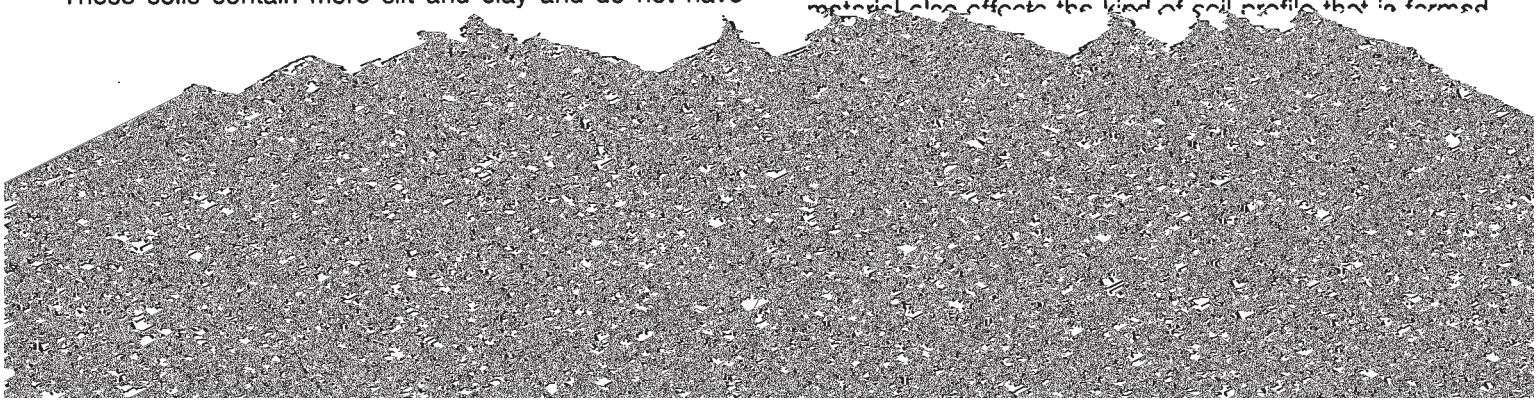
Formation of the soils

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



Climate

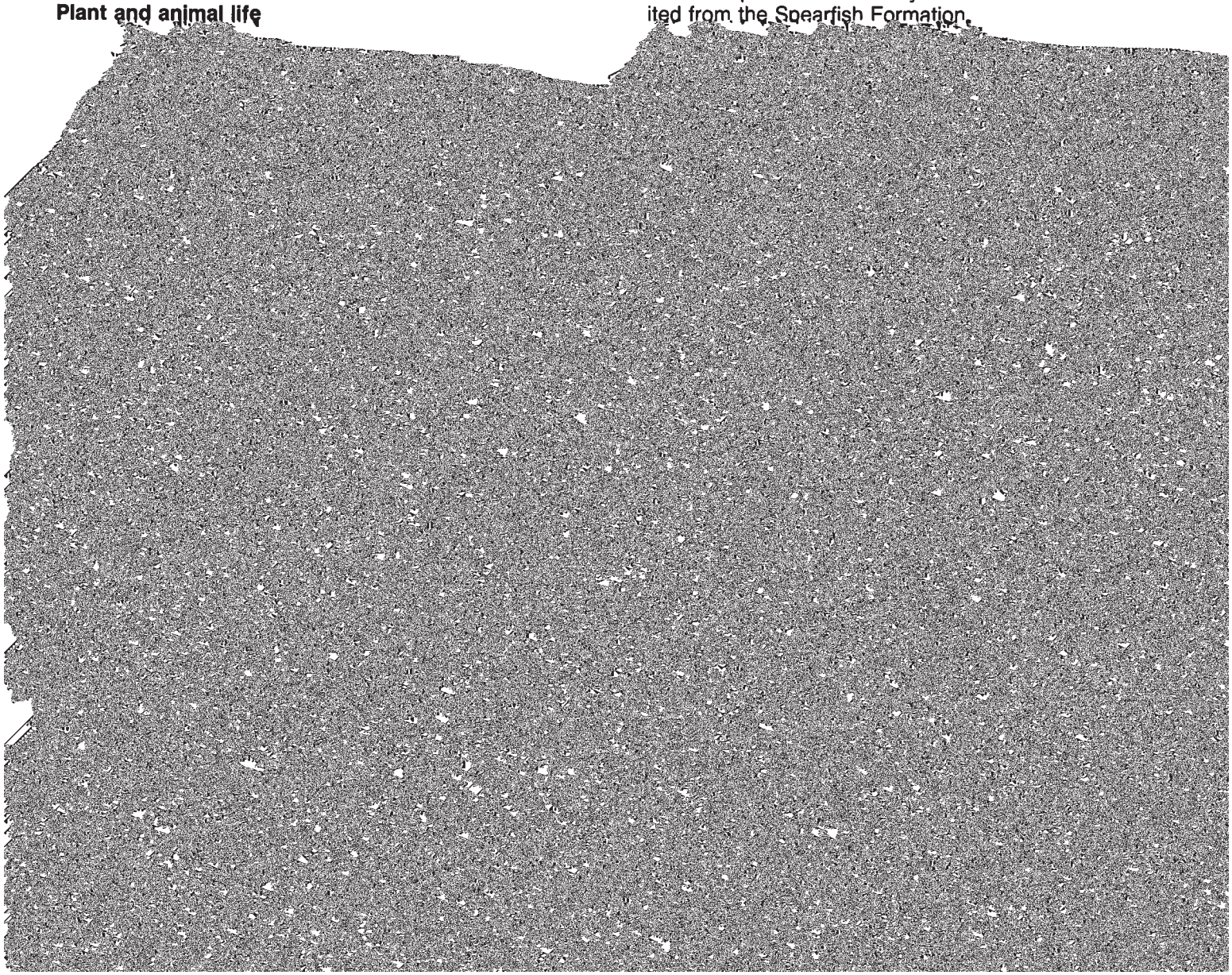
Climate is a factor in soil formation because of its direct influence on the rates at which the chemical and physical processes of weathering take place. Lawrence County has a continental climate characterized by hot summers and cold winters. The average annual air temperature is about 47 degrees F in 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

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.



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

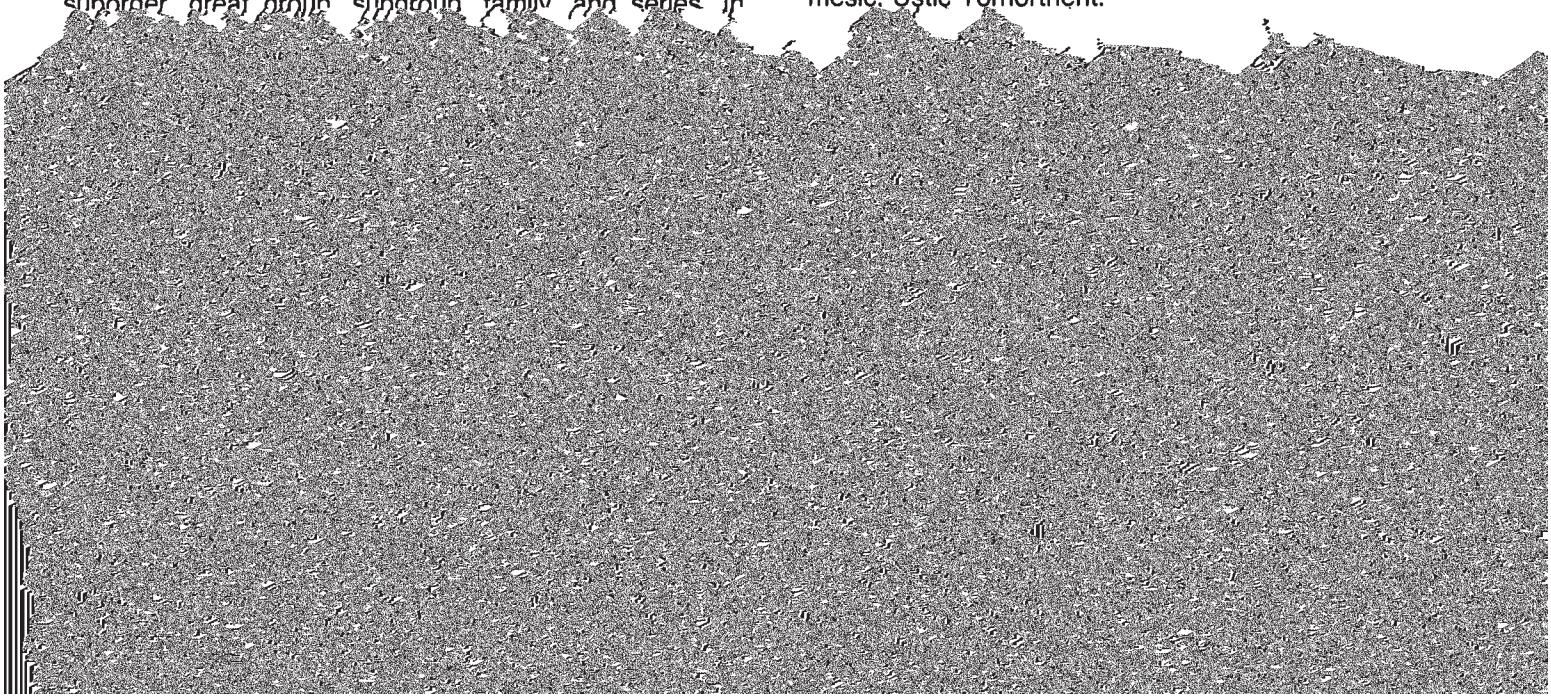
The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*10*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In 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.

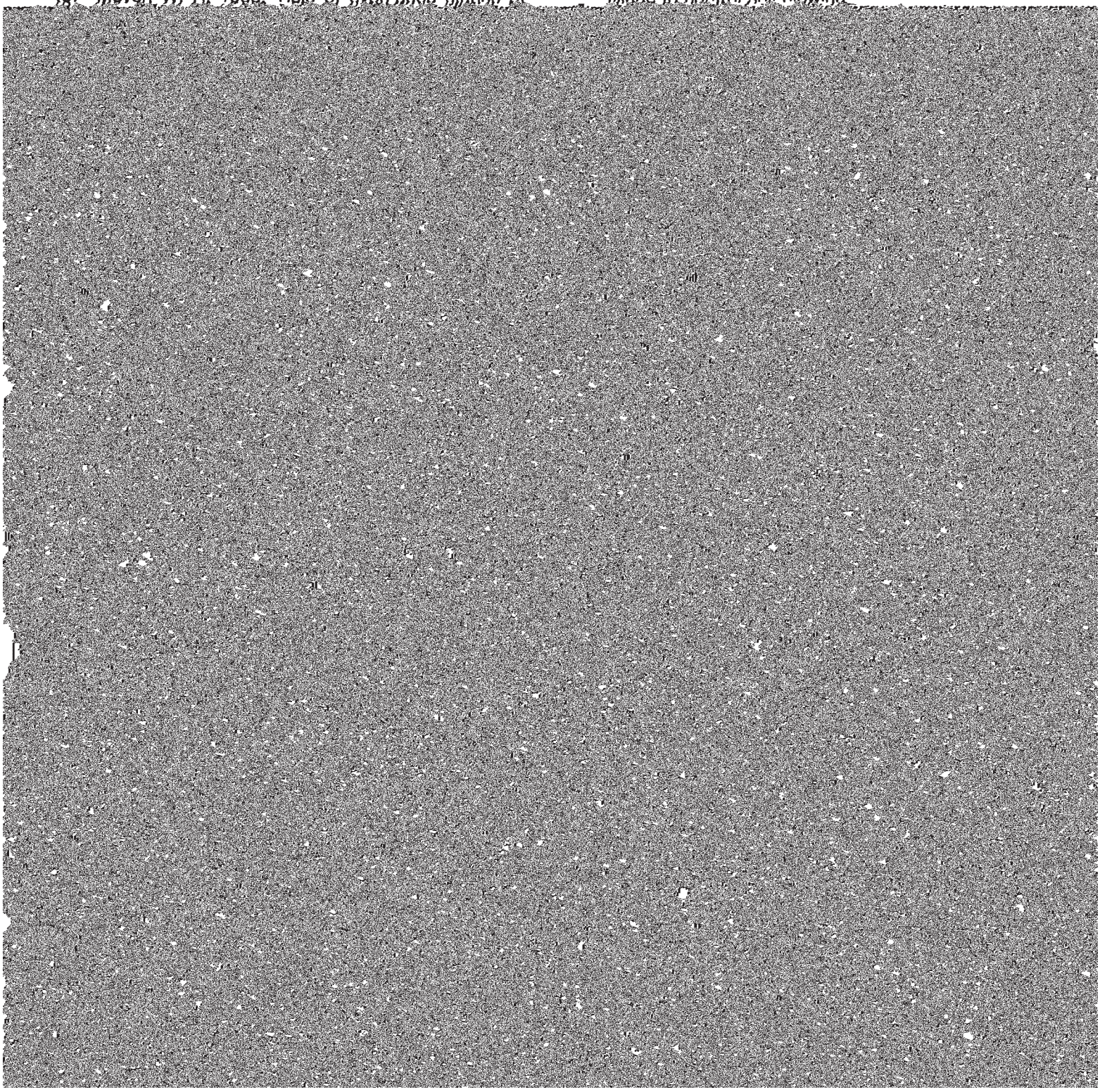
FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness 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.

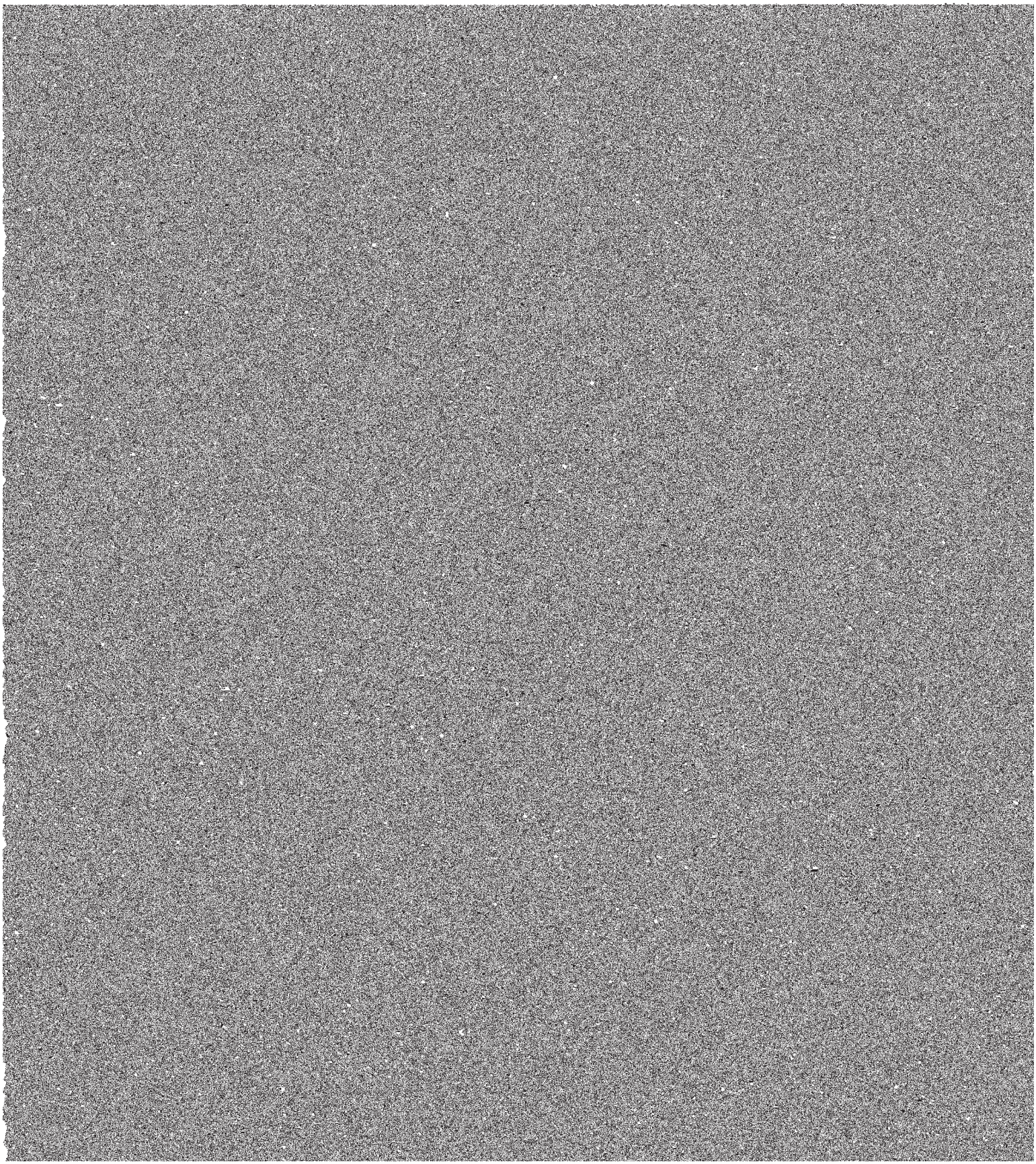


(4) Knechtel, M. M. and S. H. Paterson. 1956. Bentonite Deposits of the Northern Black Hills District, Montana, Wyoming, and South Dakota. U. S. Dep. Inter. Geol. Surv., Miner. Invest. Field Stud. Map MF36.
(5) Meyer, W. H. 1938. Yield of even-aged stands of

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.





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

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.

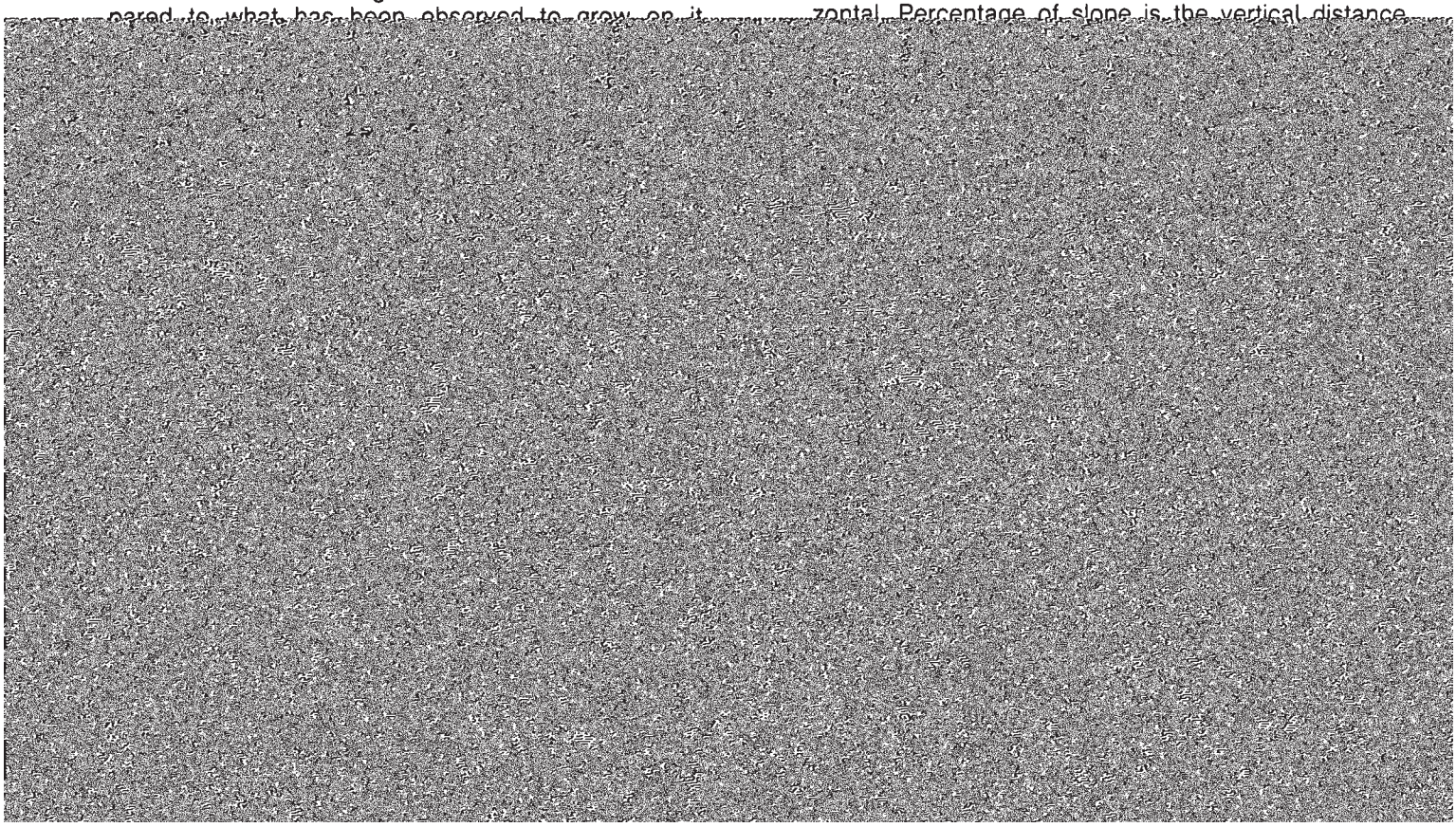
Shale. Sedimentary rock formed by the hardening of a clay deposit.

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



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, ordi-

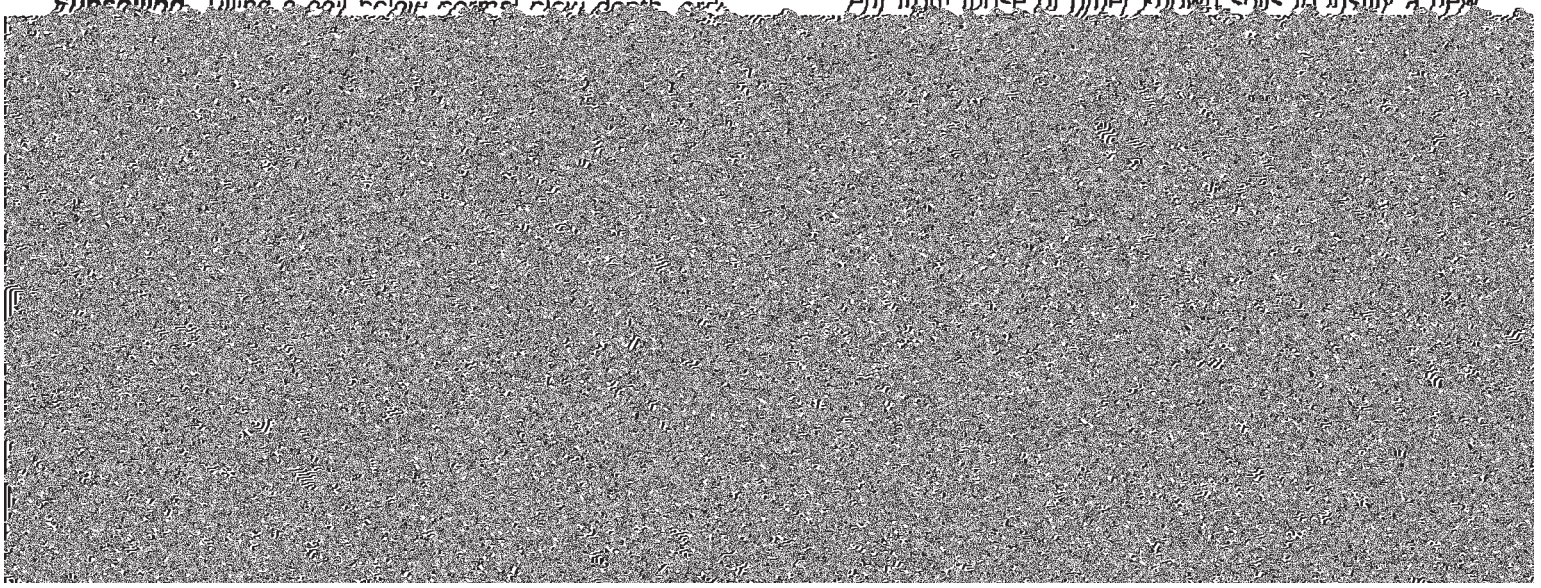
classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," 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



ILLUSTRATIONS

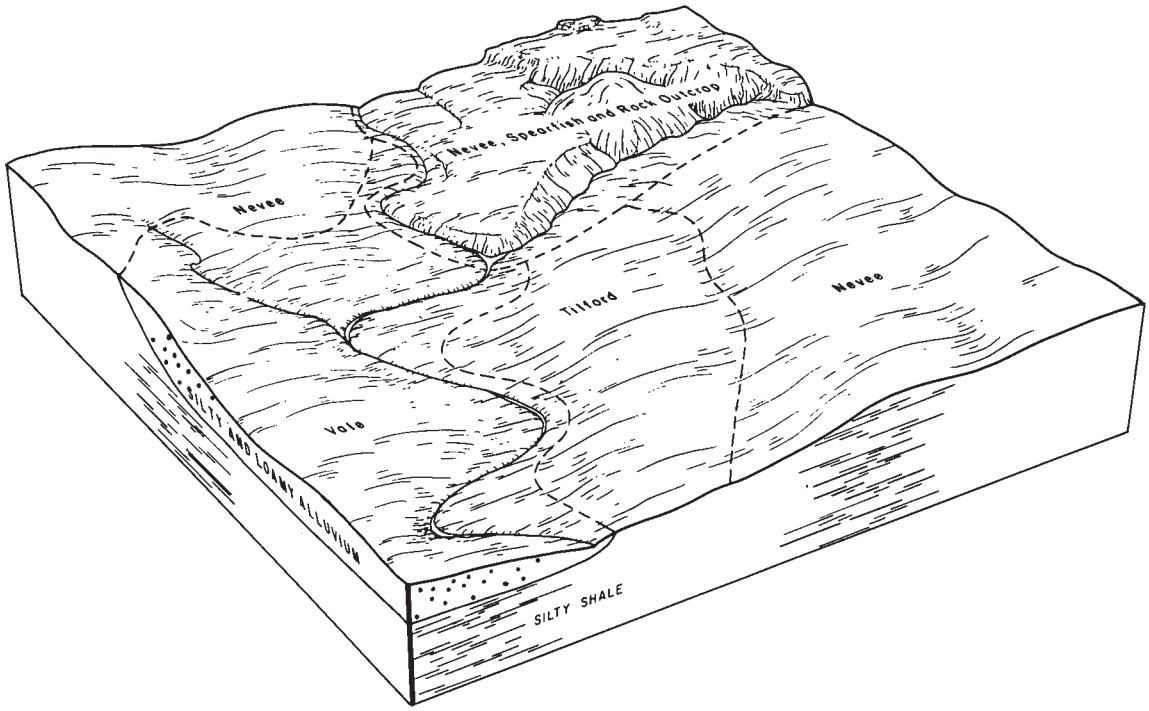


Figure 1.—Pattern of soil landscapes in map unit 1.

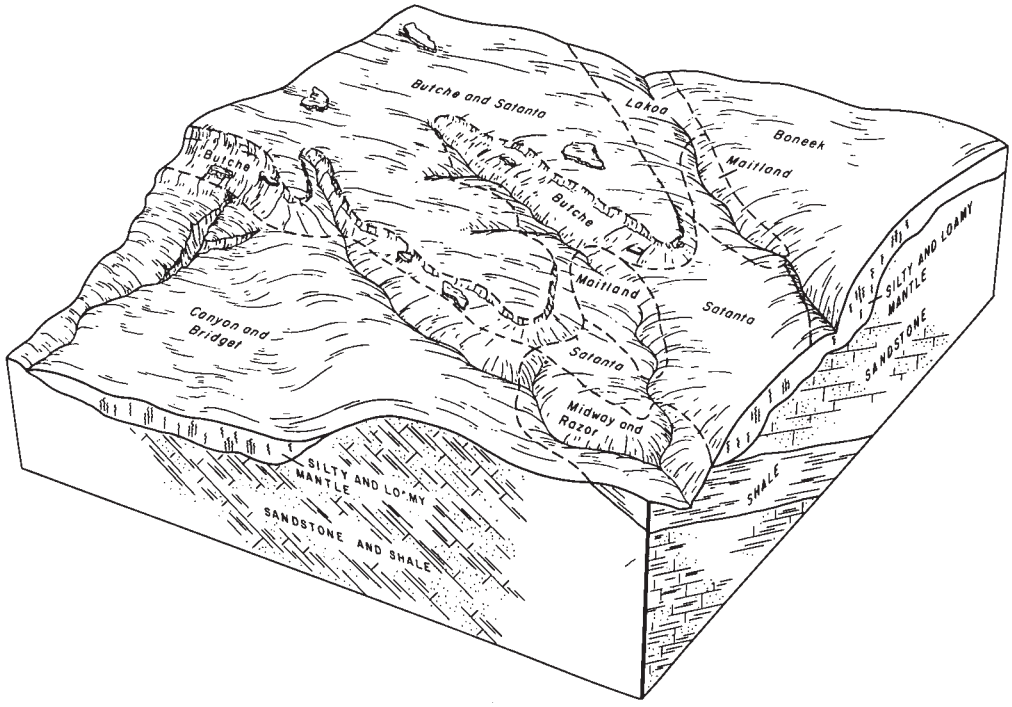


Figure 2.—Pattern of soil landscapes in map unit 2.

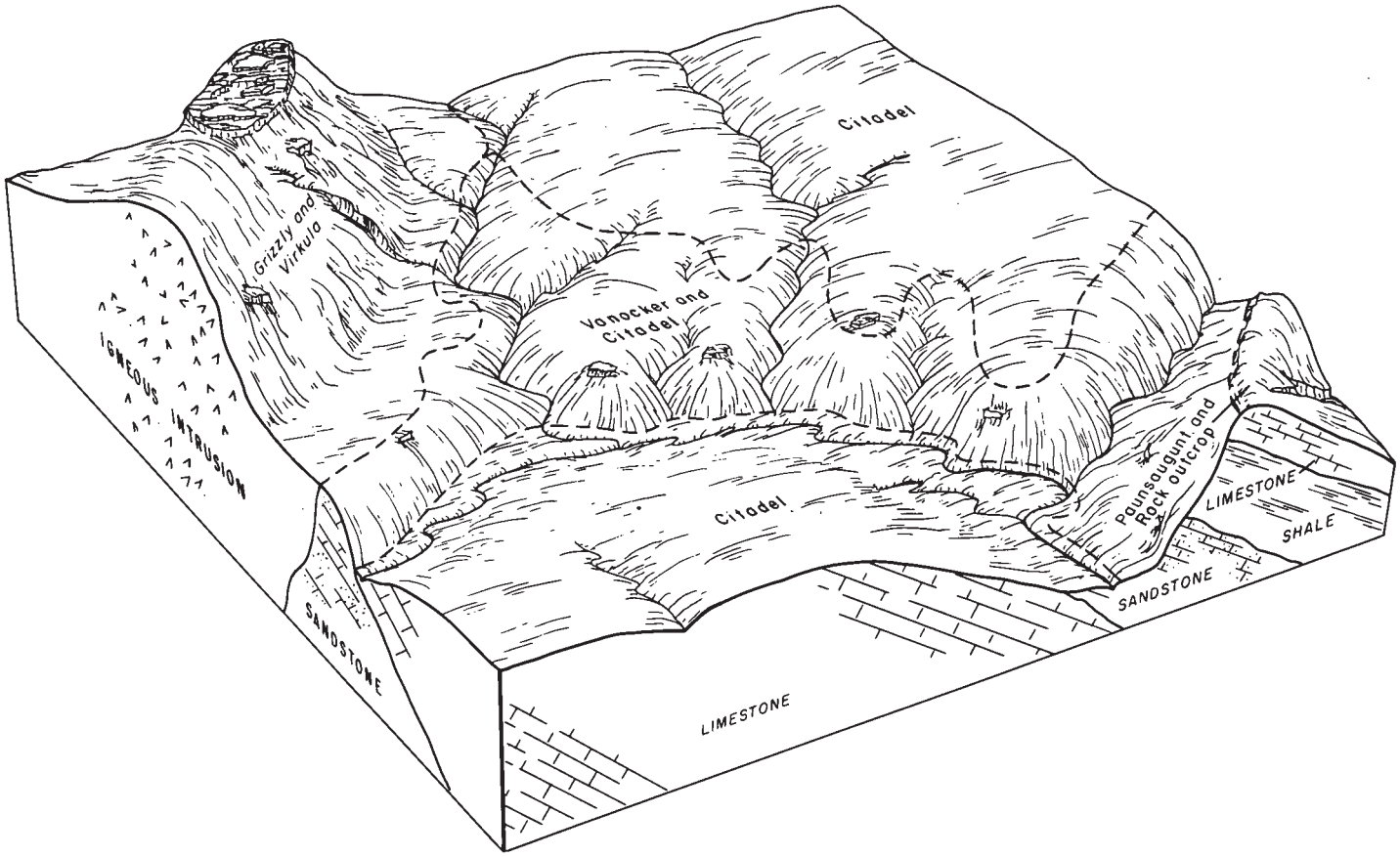


Figure 3.—Pattern of soil landscapes in map unit 8.

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.

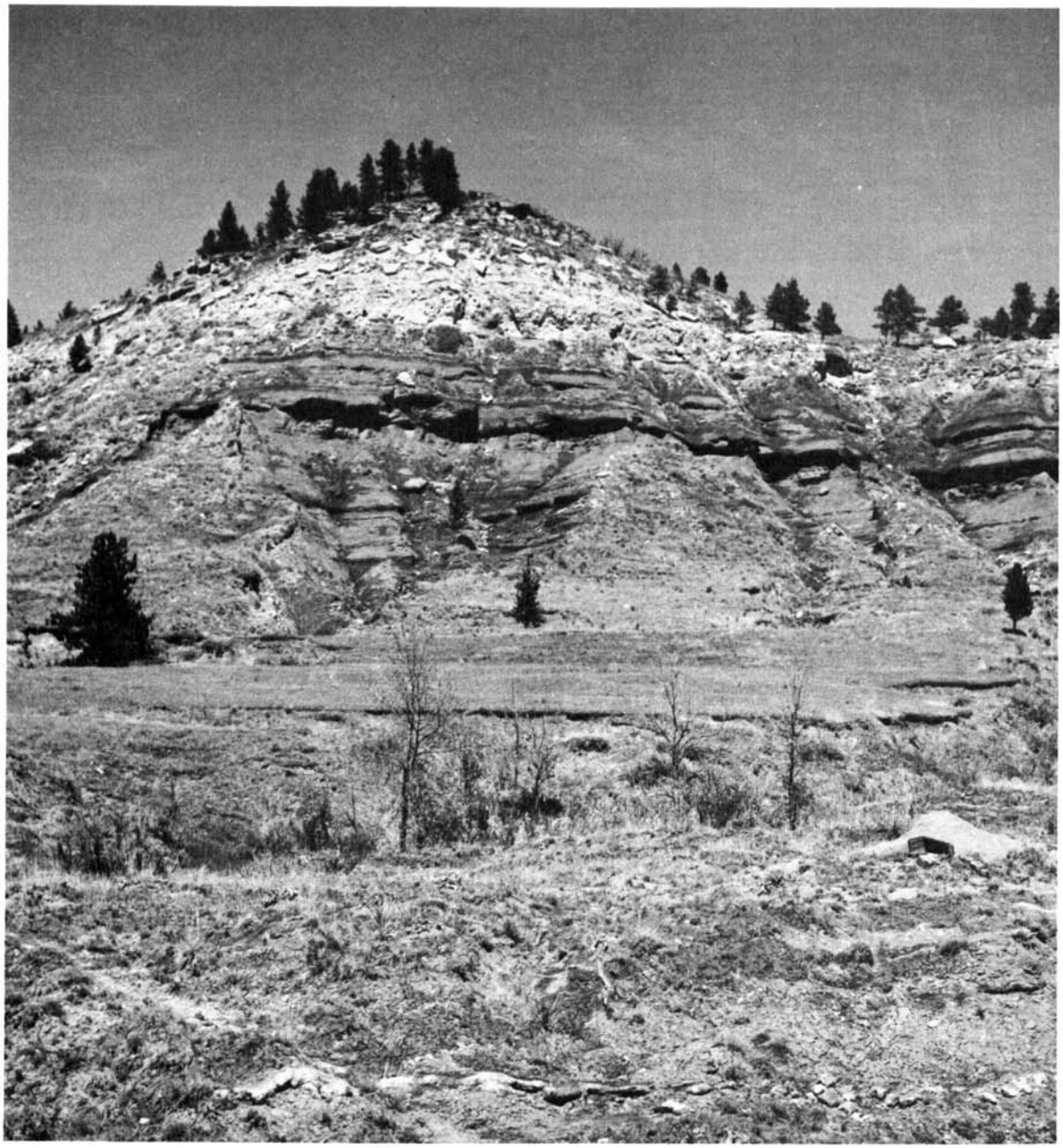


Figure 3. Rock outcrop of gypsum above Rokan and Cuppeyne in Rokan-Cuppeyne Rock outcrop complex, 15 to 50

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

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 [illegible] in 10			

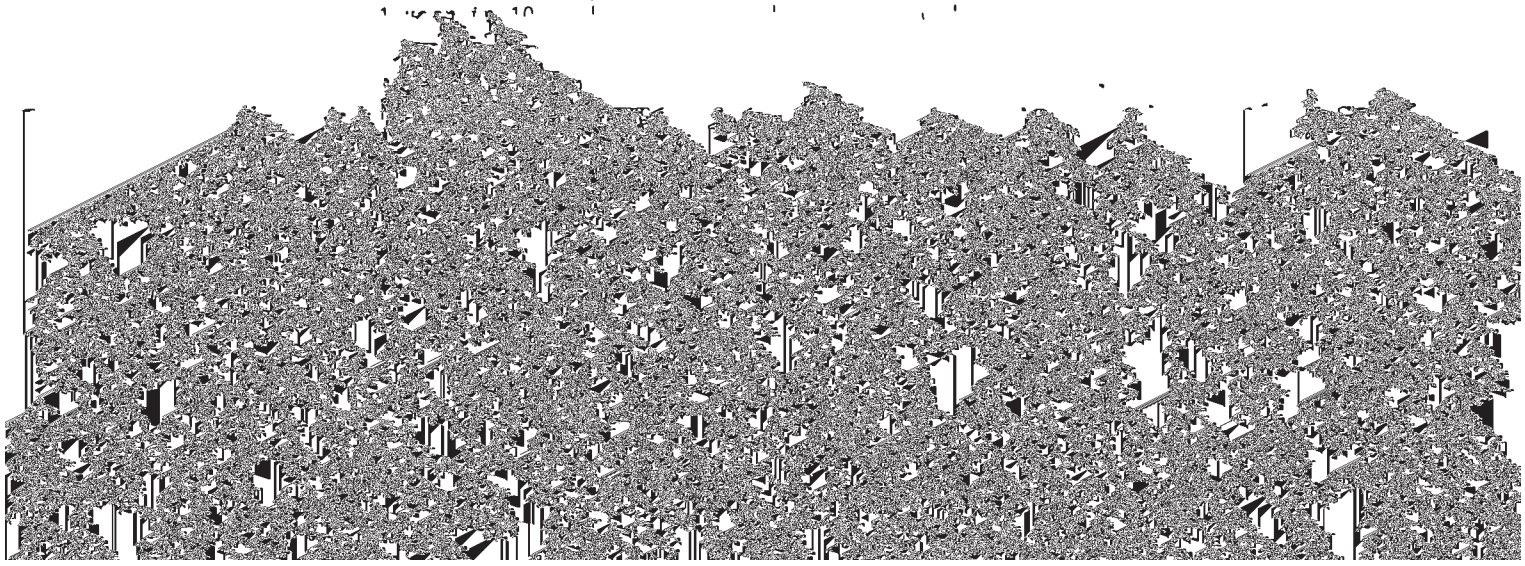


TABLE 5.--GROWING SEASON LENGTH

[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 silty clay, 2 to 6 percent slopes	510	0.1

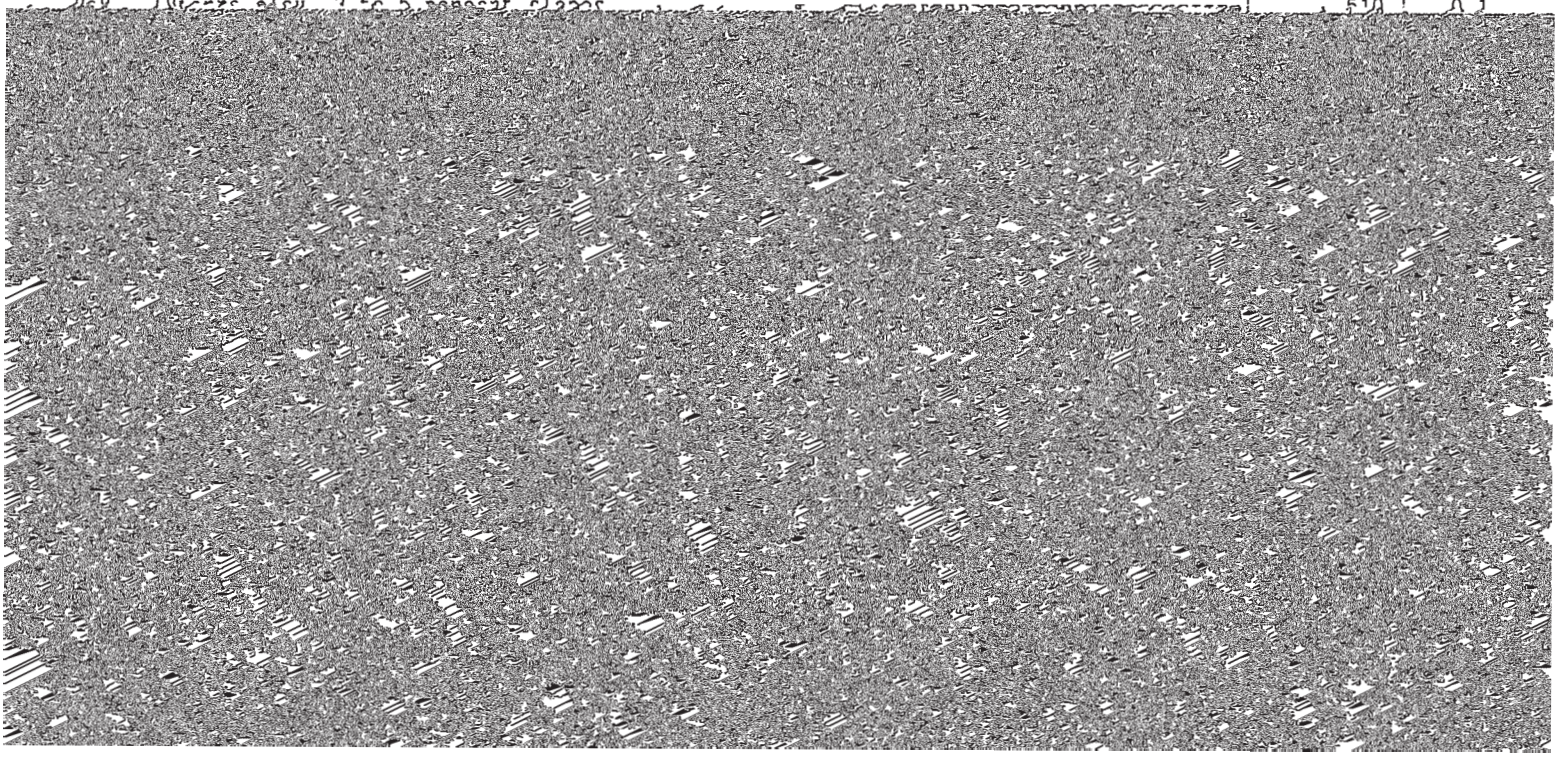


TABLE 8.--YIELDS PER ACRE OF CROPS AND PASTURE

[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
	B	B	B	B	B	B	B	B	Tons	Tons	AUM*	AUM*

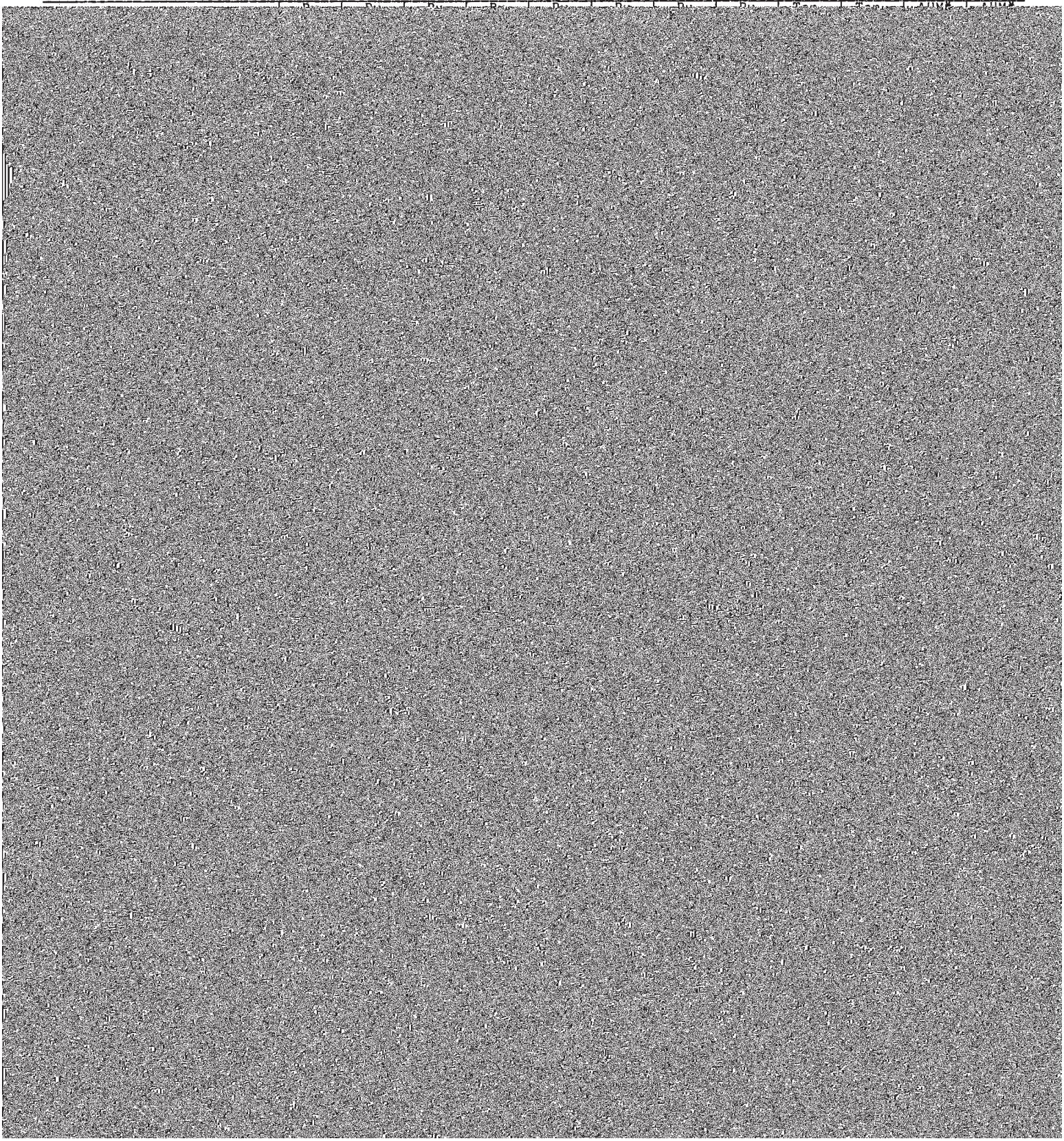


TABLE 8.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

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

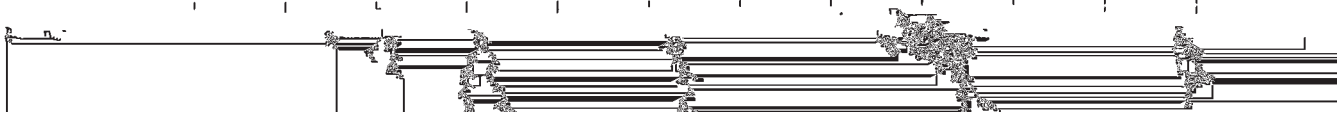


TABLE 8.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

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

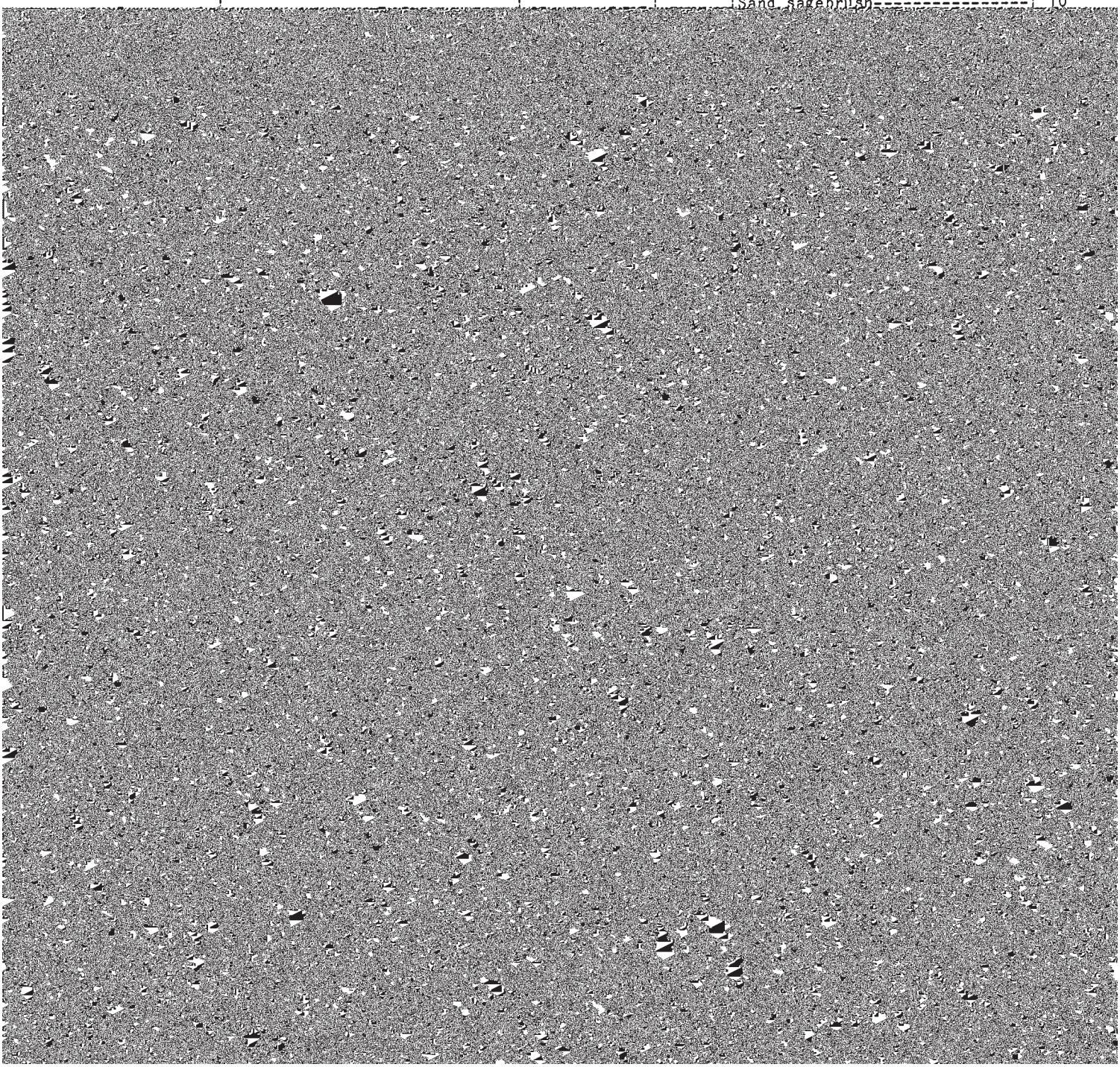


TABLE 9.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight [b/acre		Pct

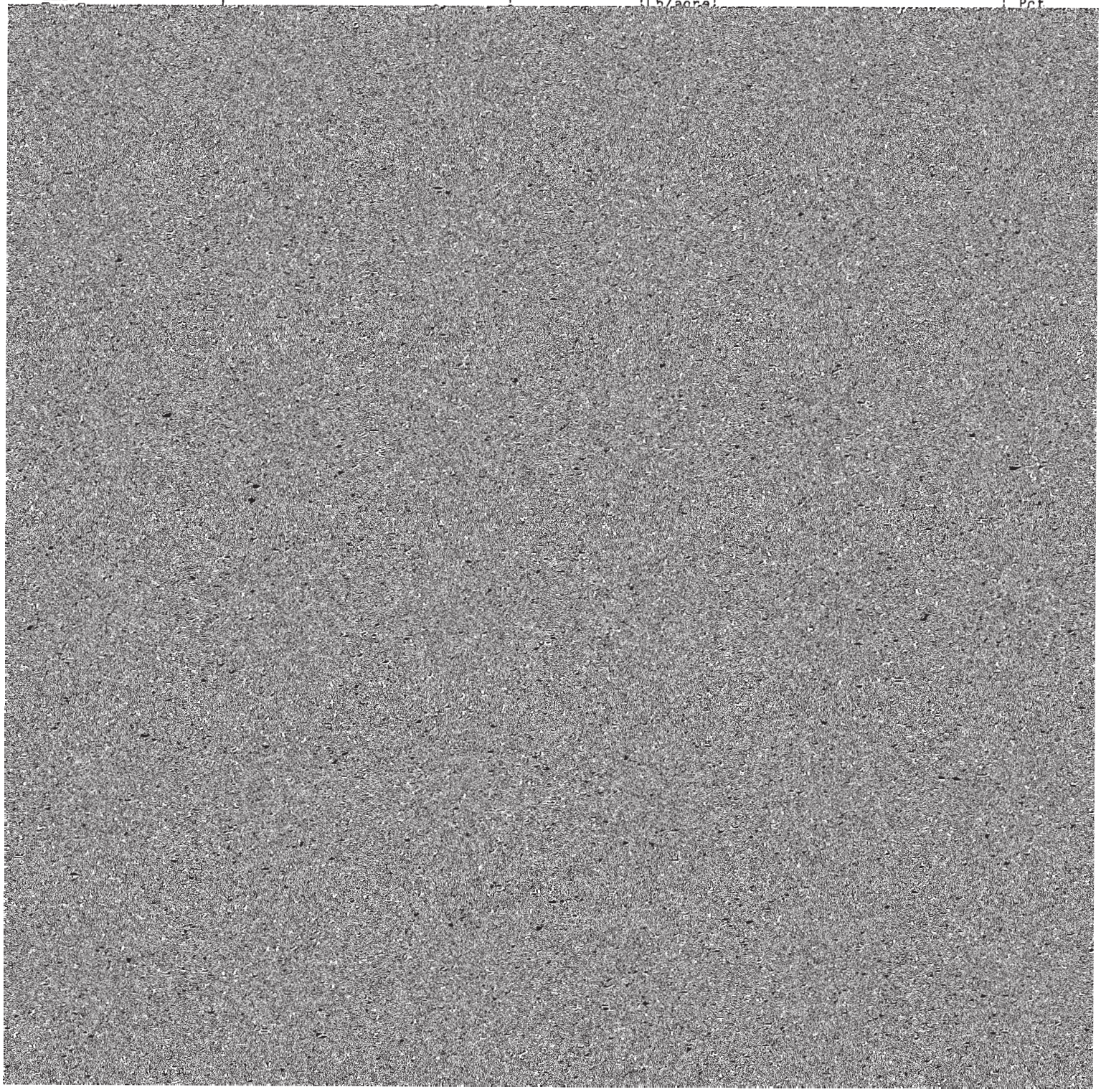


TABLE 9.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

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

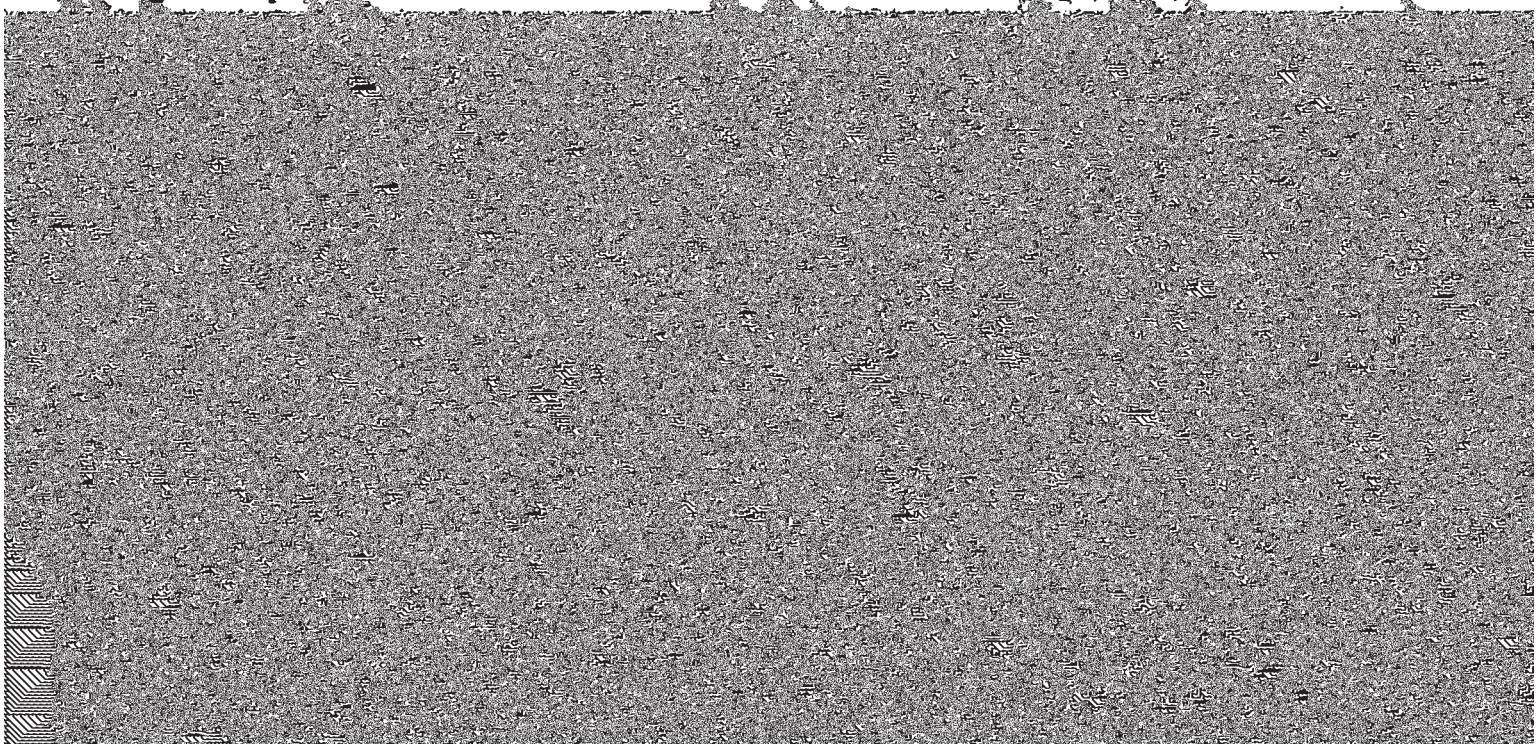


TABLE 9.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

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

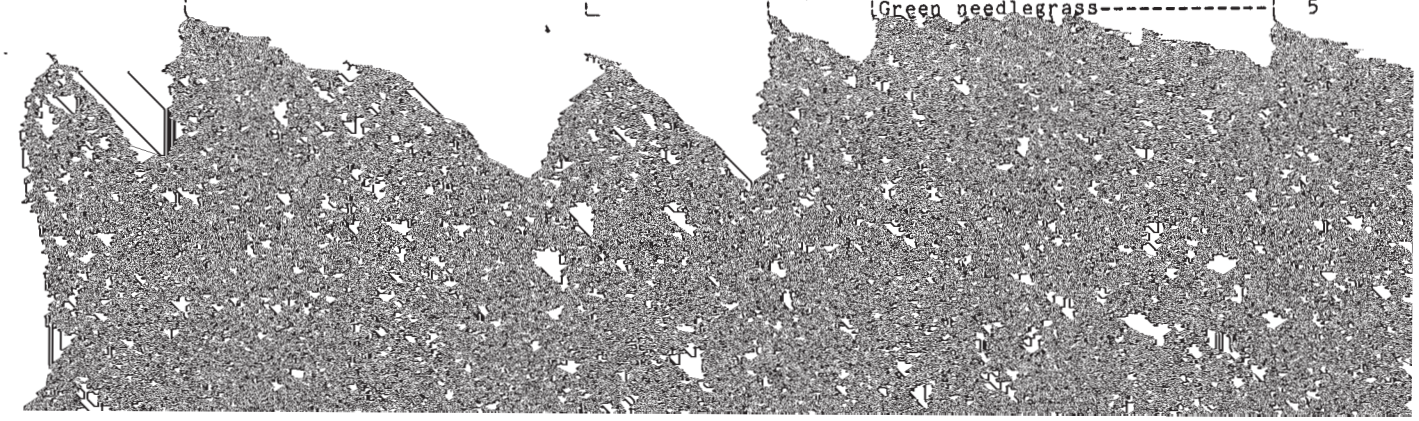


TABLE 10.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[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.
Majtland				

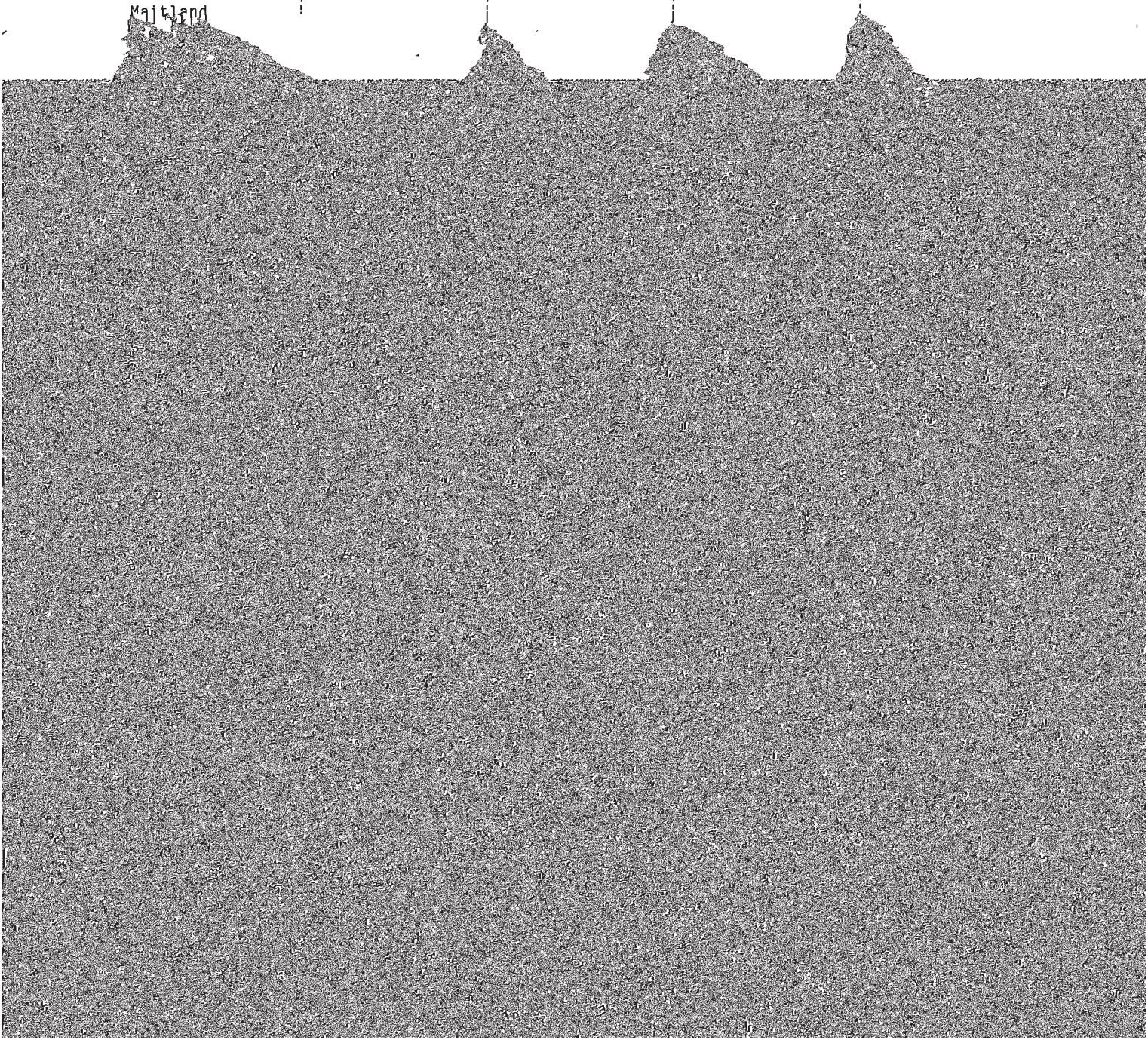


TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

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	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---

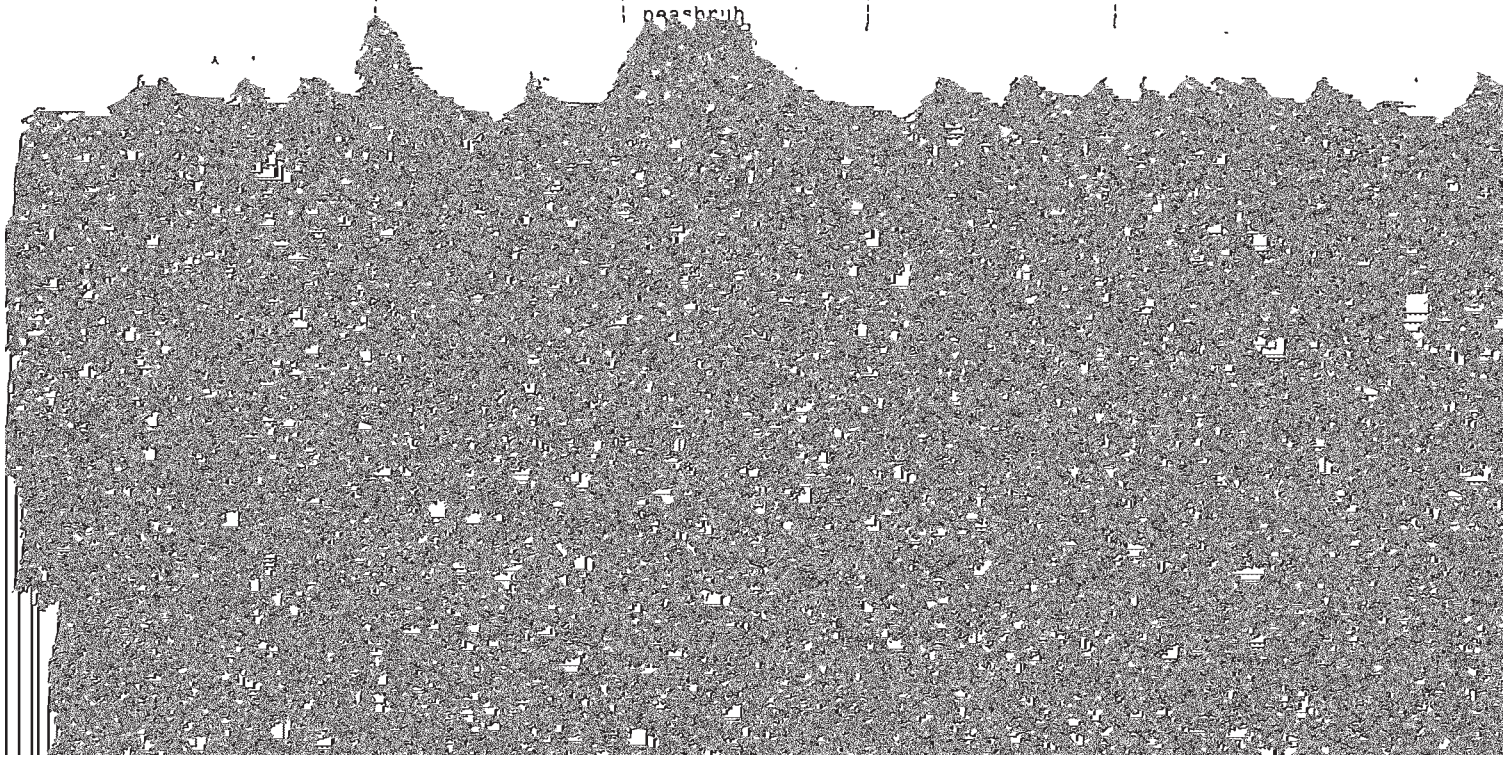


TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

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

	Potential for habitat elements						Potential as habitat for--					

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

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 herba-ceous plants	Hard-wood trees	Conif-erous 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	Very	Very	Good	Very	Very	Fair

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---	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Rock outcrop.				
BeE--- Butche	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock, small stones.	Severe: slope.
BhE*: Butche---	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock, small stones.	Severe: slope.
Rock outcrop.				
BkD*: Butche---	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock, small stones.	Moderate: slope, small stones.
Satanta---	Slight---	Slight---	Severe: slope.	Slight.
CaD*: Canyon---	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Moderate: slope.
Bridget---	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
CaE*: Canyon---	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.
Bridget---	Severe: 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;	Moderate:	Severe:	Moderate:

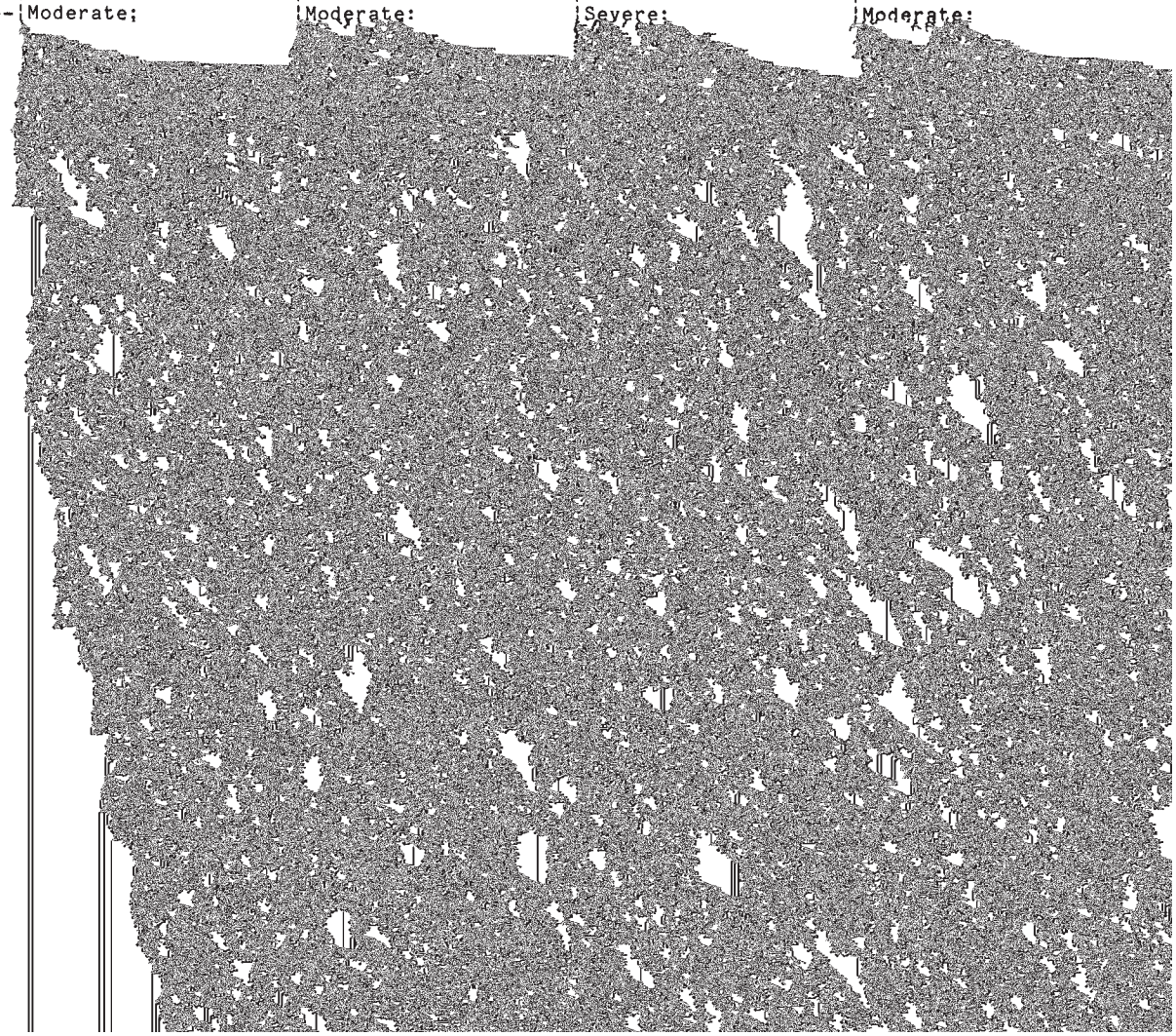


TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

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.
PcD	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Moderate: too clayey, slope.
Pe*.				
Pits				
RaE*:				
Rekop	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gypnevee	Moderate:	Moderate:	Severe:	Moderate:

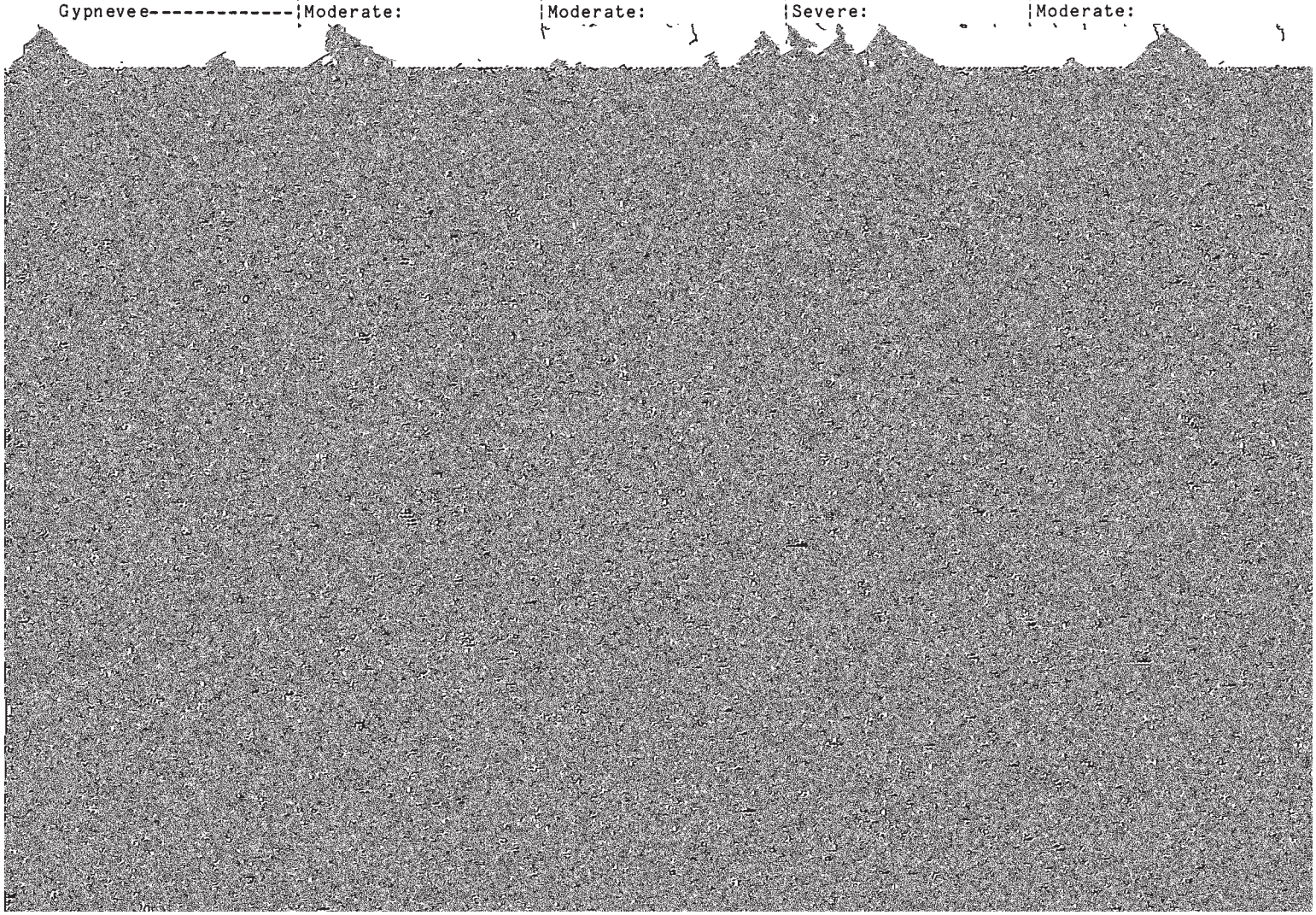


TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

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,	Moderate: shrink-swell,	Moderate: slope,	Severe: low strength

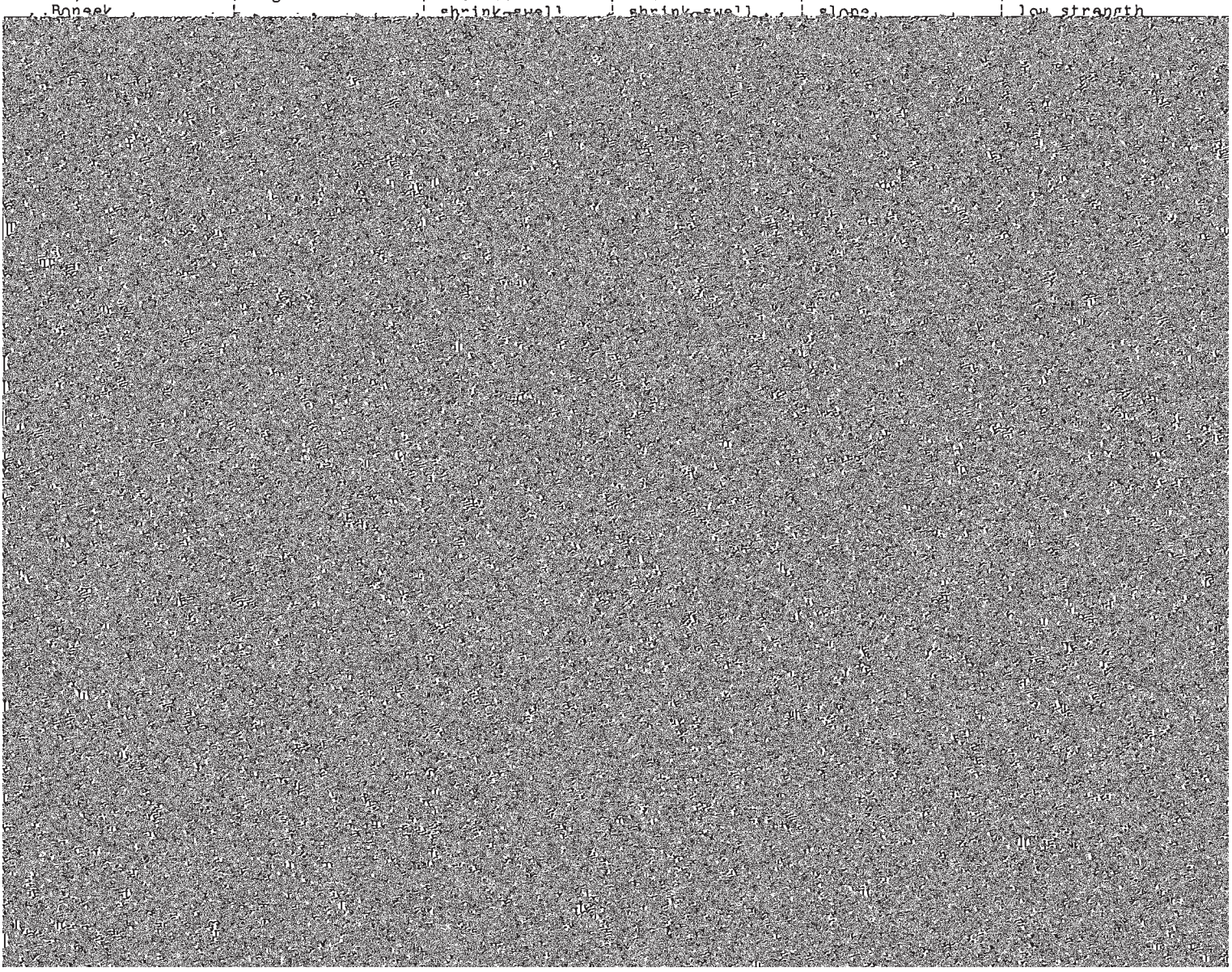


TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

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*:					

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	Severe: slope	Severe: slope	Severe: slope	Poor: [illegible]

TABLE 15.--SANITARY FACILITIES--Continued

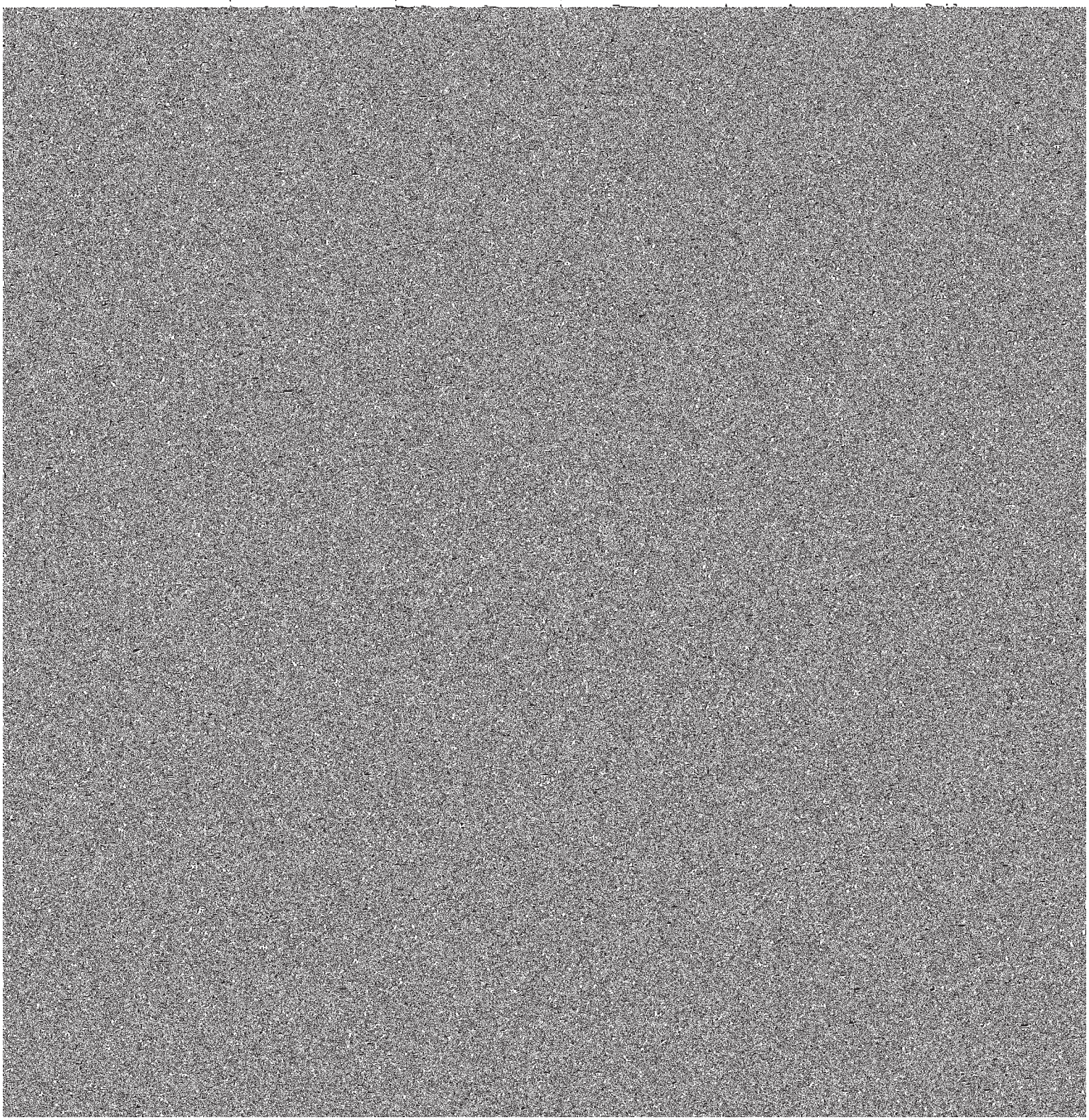


TABLE 15.--SANITARY FACILITIES--Continued

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.

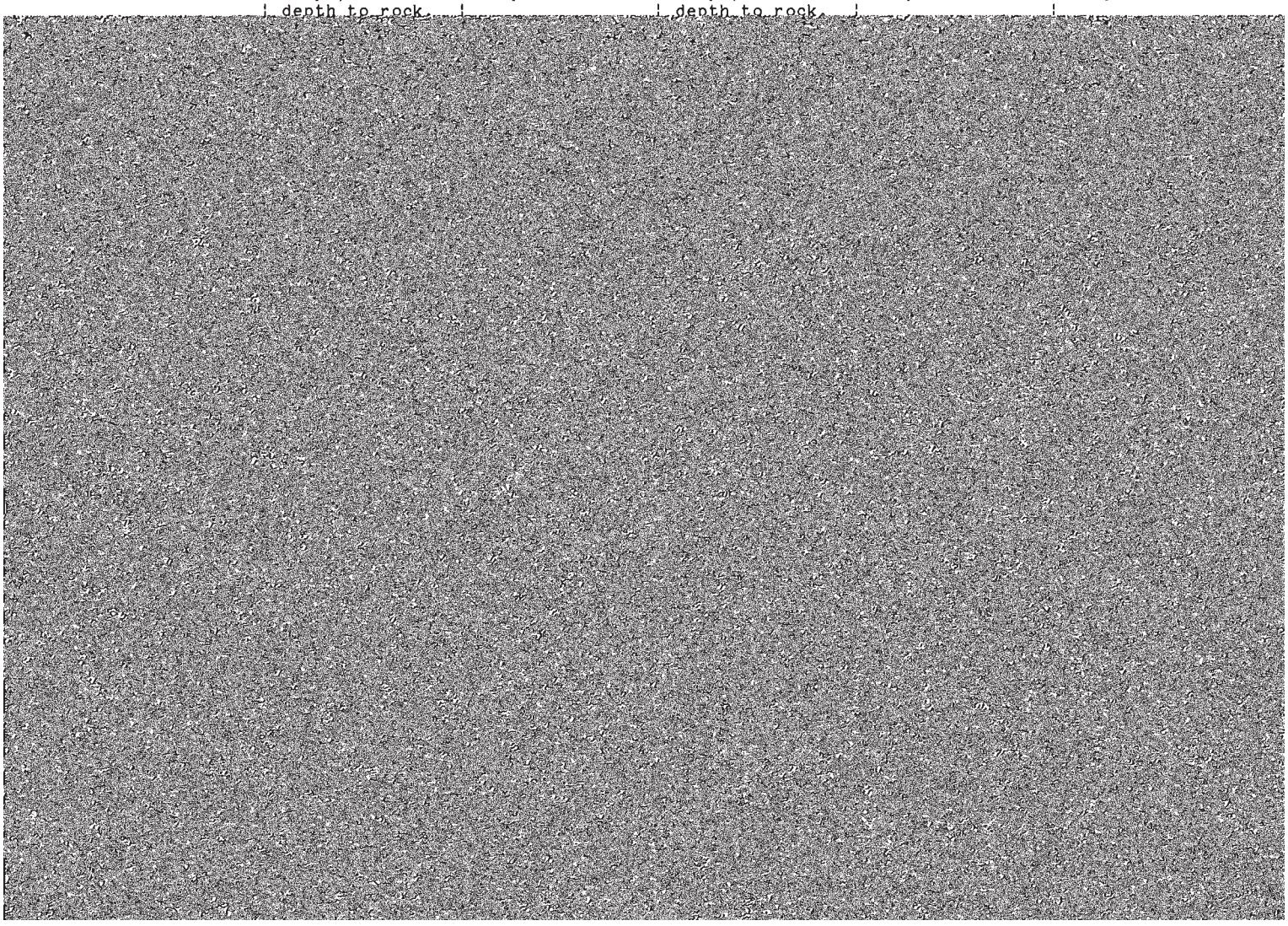


TABLE 15.--SANITARY FACILITIES--Continued

Soil name and	Septic tank	Sewage lagoon	Trench	Area	Daily cover

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.					

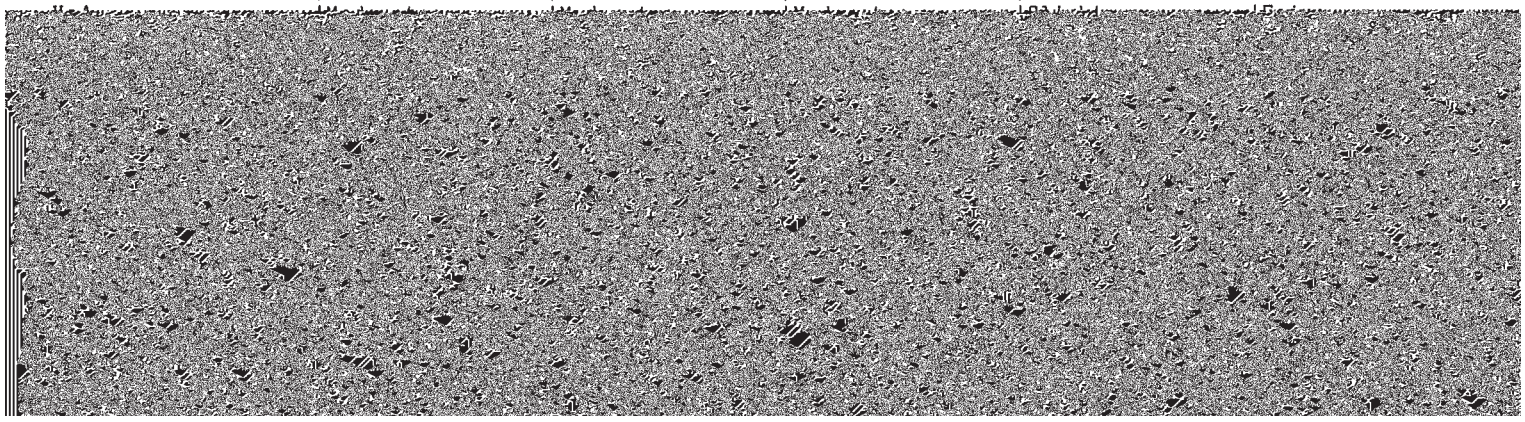


TABLE 15.--SANITARY FACILITIES--Continued

Soil name and	Septic tank	Sewage lagoon	Trench	Area	Daily cover

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.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.

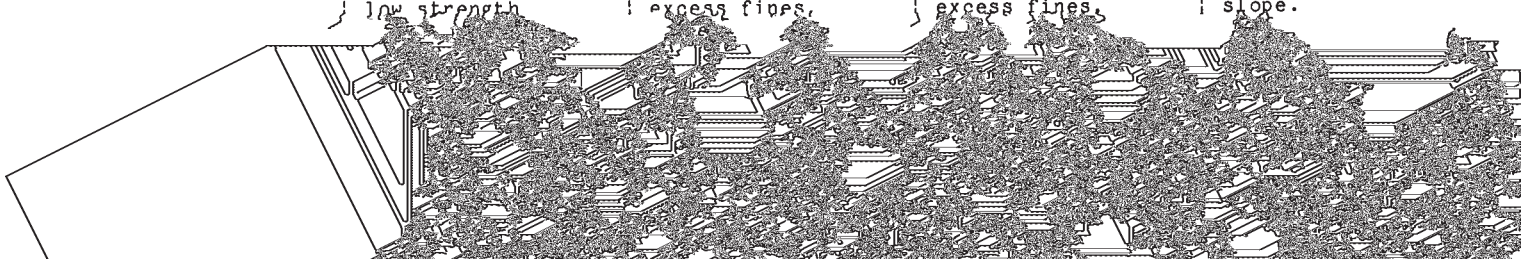


TABLE 16.--CONSTRUCTION MATERIALS--Continued

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:	Unsuited;	Unsuited;	Poor:

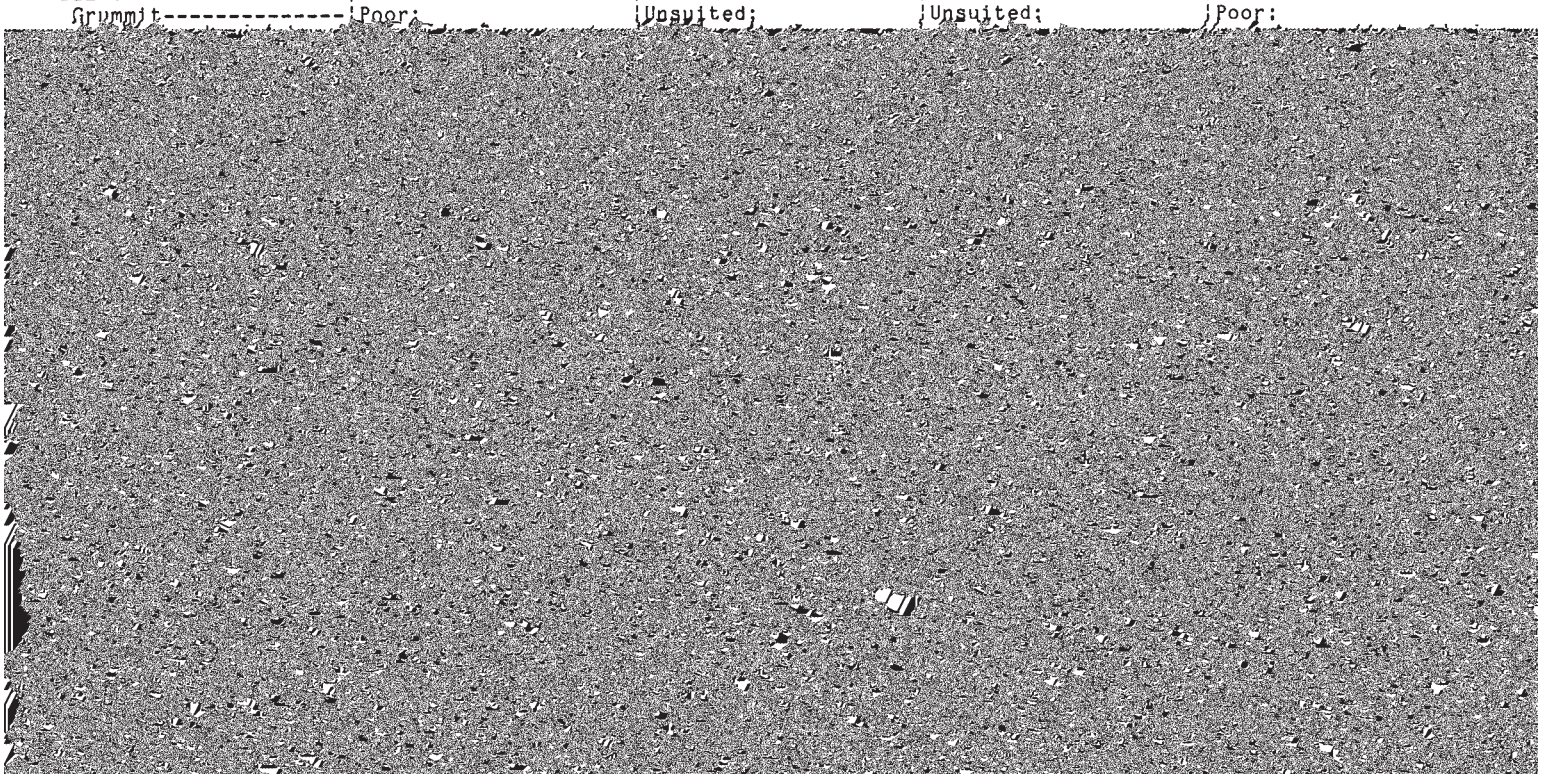


TABLE 16.--CONSTRUCTION MATERIALS--Continued

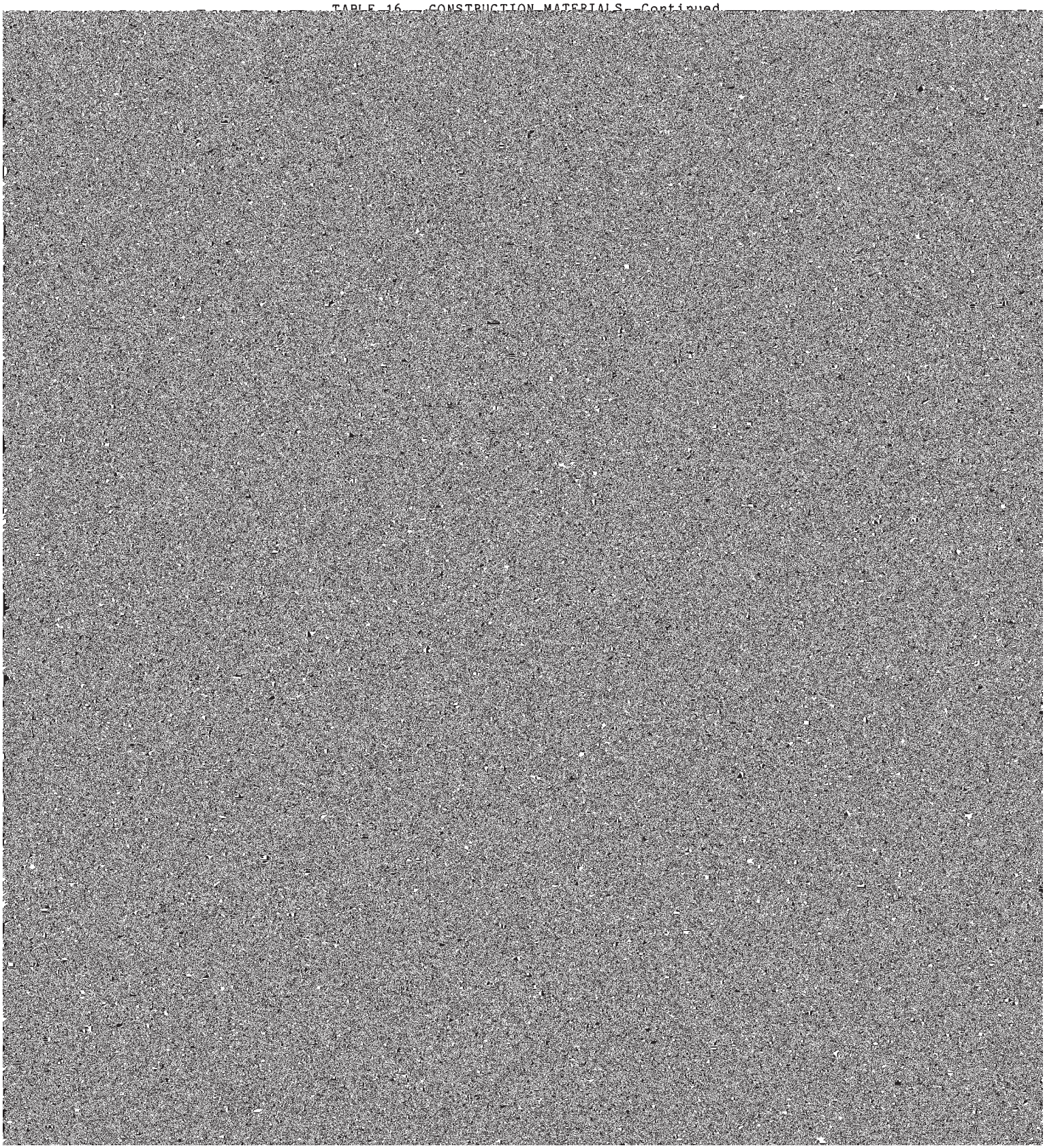


TABLE 16.--CONSTRUCTION MATERIALS--Continued

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:	Unsuited:	Unsuited:	Poor:

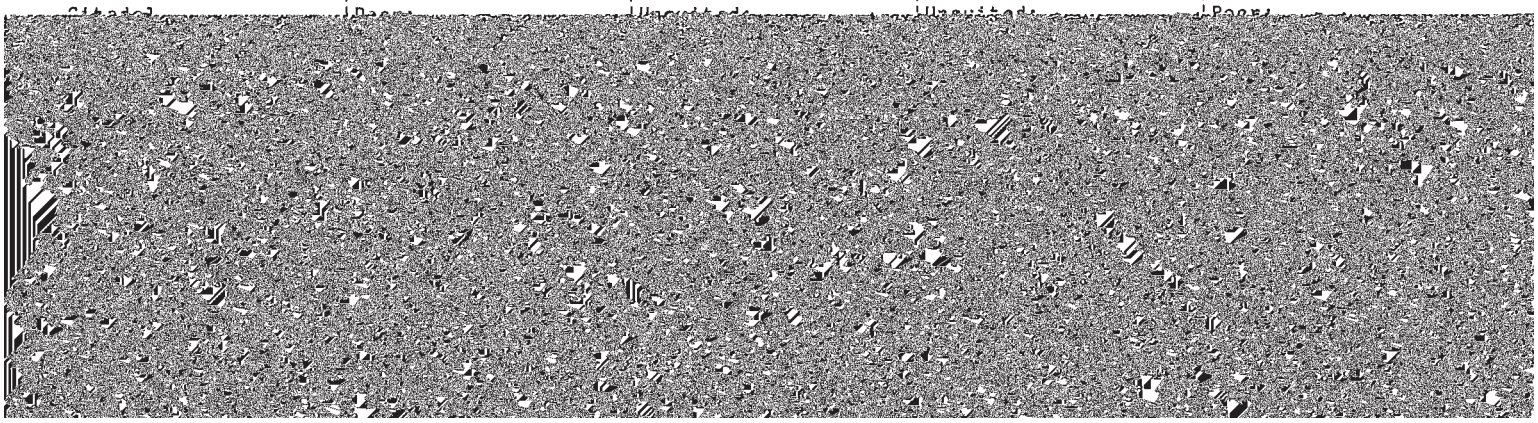


TABLE 17.--WATER MANAGEMENT

[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*:						

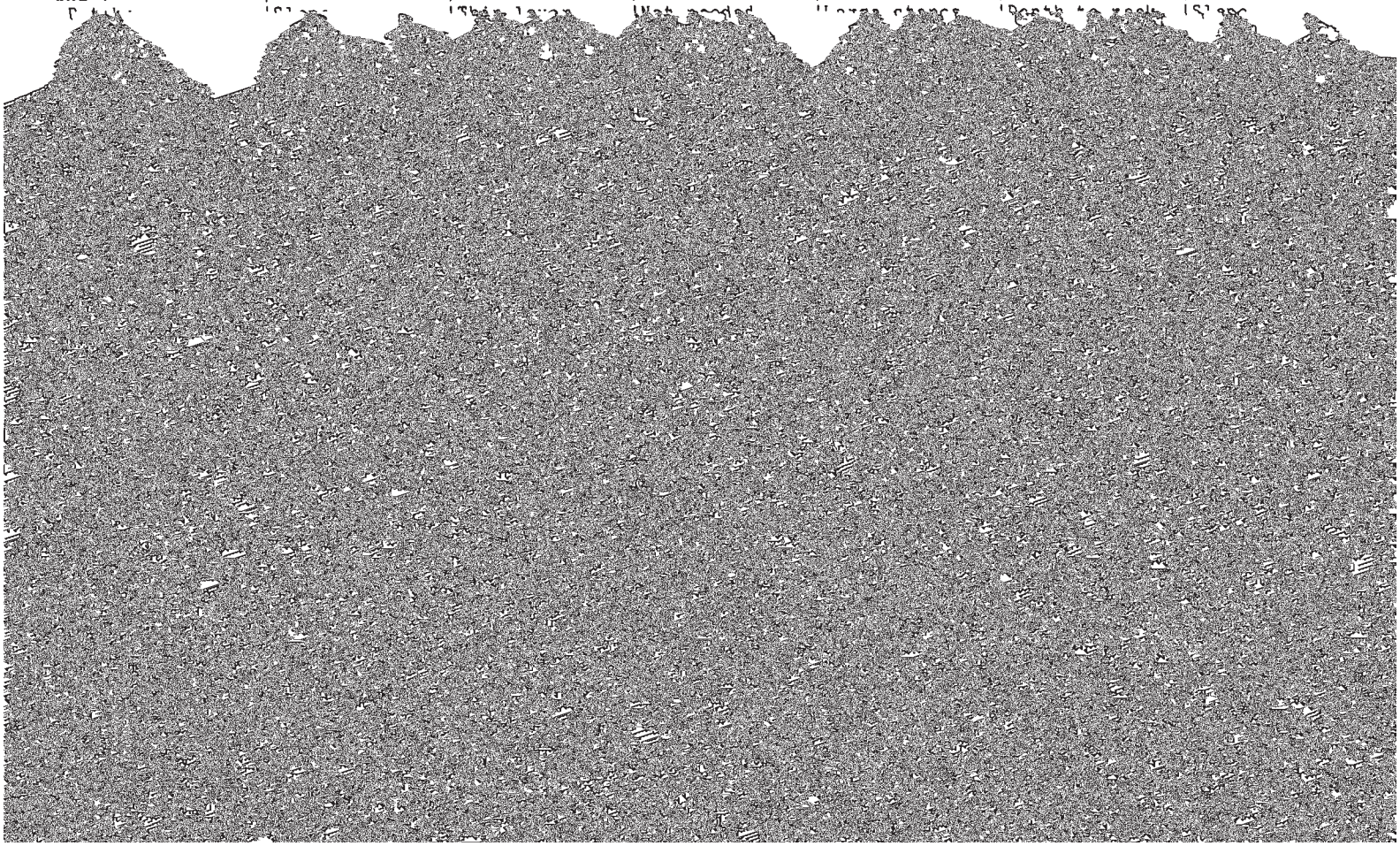


TABLE 17.--WATER MANAGEMENT--Continued

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.
[illegible]	[illegible]	[illegible]	[illegible]	Floods	Not needed	Wetness

TABLE 17.--WATER MANAGEMENT--Continued

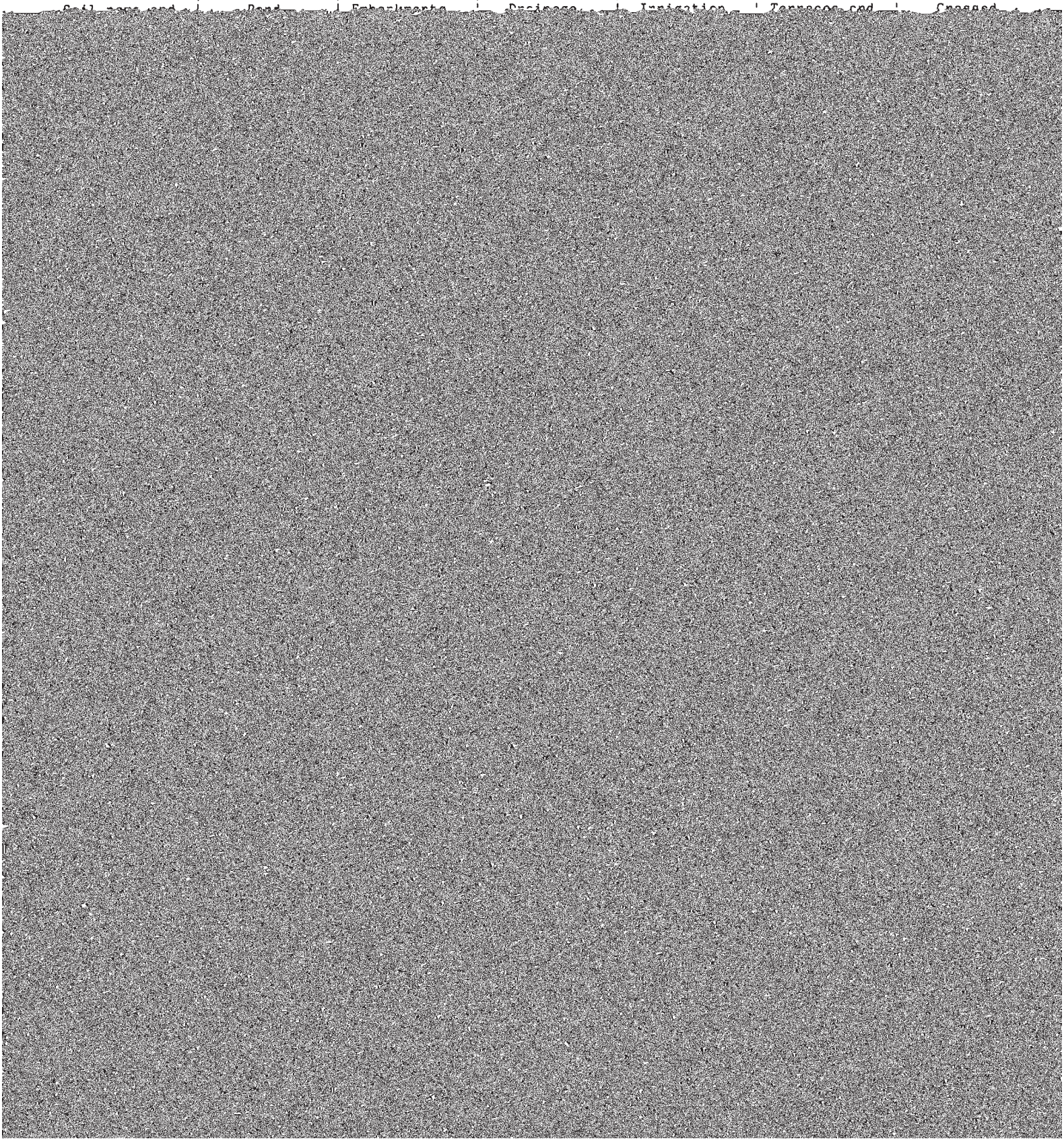


TABLE 17.--WATER MANAGEMENT--Continued

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,	Slope,	Slope,

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,	A-4, A-6	20-50	80-90	80-90	80-90	60-75	20-40	3-20

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	
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
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

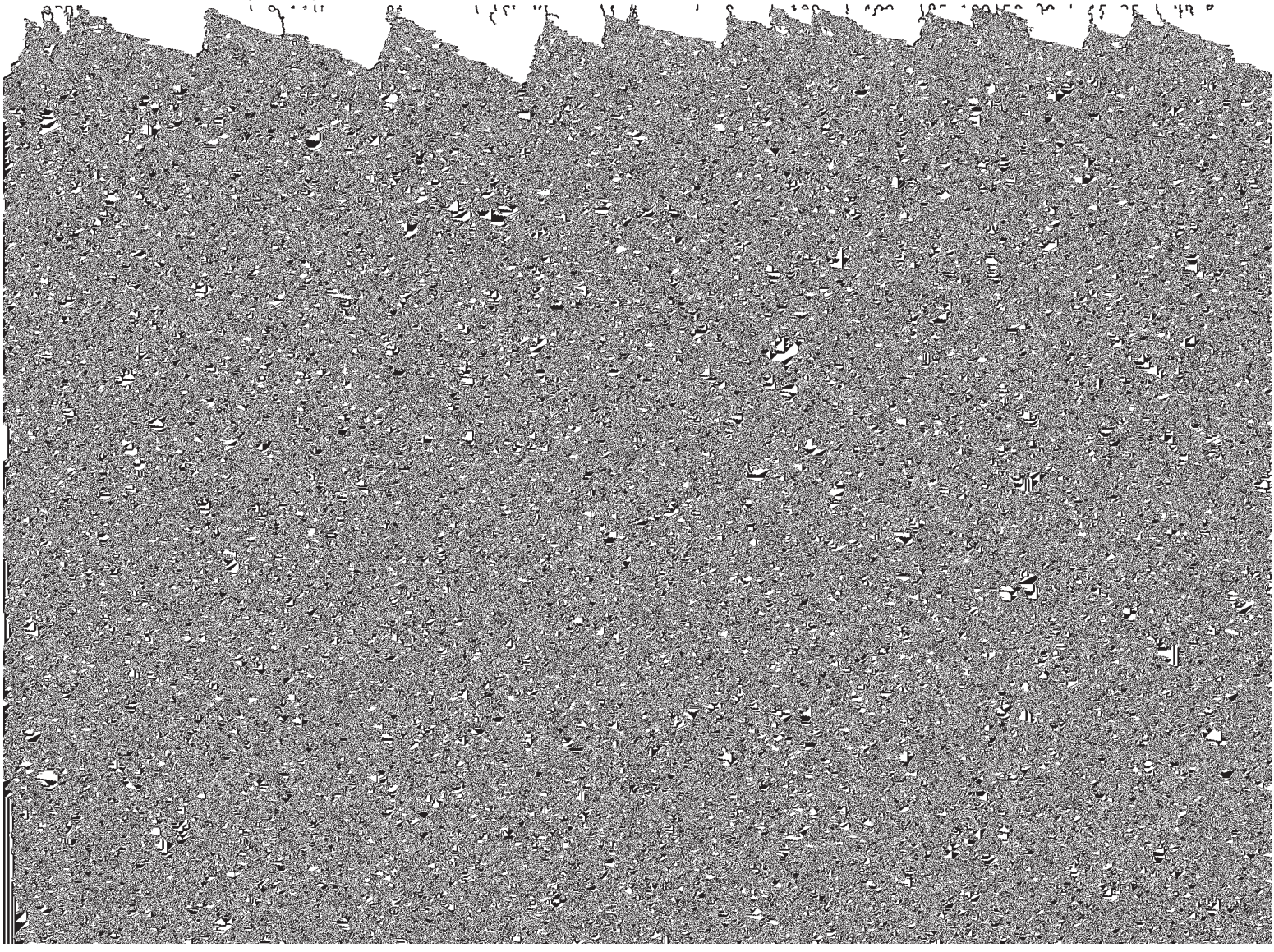


TABLE 18.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

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		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
KaA, KaB---------- Kyle	0-5	Clay----------	CH, MH	A-7	0	100	100	90-100	80-100	50-75	20-45
	5-60	Clay----------	CH, MH	A-7	0	100	100	90-100	80-100	50-85	25-60
LaE---------- Lakoa	0-6	Silt loam, loam	CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-35	5-15
	6-30	Clay loam, sandy clay loam.	CL	A-6, A-7	0-5	95-100	90-100	85-100	50-80	35-45	12-20
	30-42	Loam, clay loam, sandy loam.	CL, SC	A-6, A-4	0-15	90-100	85-100	75-95	45-90	30-40	8-15
	42-60	Weathered bedrock.									
MaC, MaD---------- Maitland	0-11	Loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	85-100	50-90	25-40	5-20
	11-44	Loam, clay loam	CL	A-6, A-7	0	100	100	85-100	60-80	30-45	10-25
	44-60	Loam, fine sandy loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	80-100	50-80	25-40	5-20
MBE*:											
Marshdale----------	0-35	Clay loam, loam	ML, MH	A-4, A-5, A-7	0	100	95-100	90-100	65-85	35-60	5-25
	35-60	Clay loam, loam	ML, MH	A-4, A-5, A-7	0-5	95-100	90-100	85-95	60-85	35-60	5-25
Maitland----------	0-11	Loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	85-100	50-90	25-40	5-20
	11-44	Loam, clay loam	CL	A-6, A-7	0	100	100	85-100	60-80	30-45	10-25
	44-60	Loam, fine sandy loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	80-100	50-80	25-40	5-20
McD*:											
Midway----------	0-16	Silty clay loam,	CL, CH	A-7	0	100	100	90-100	80-95	45-60	20-35

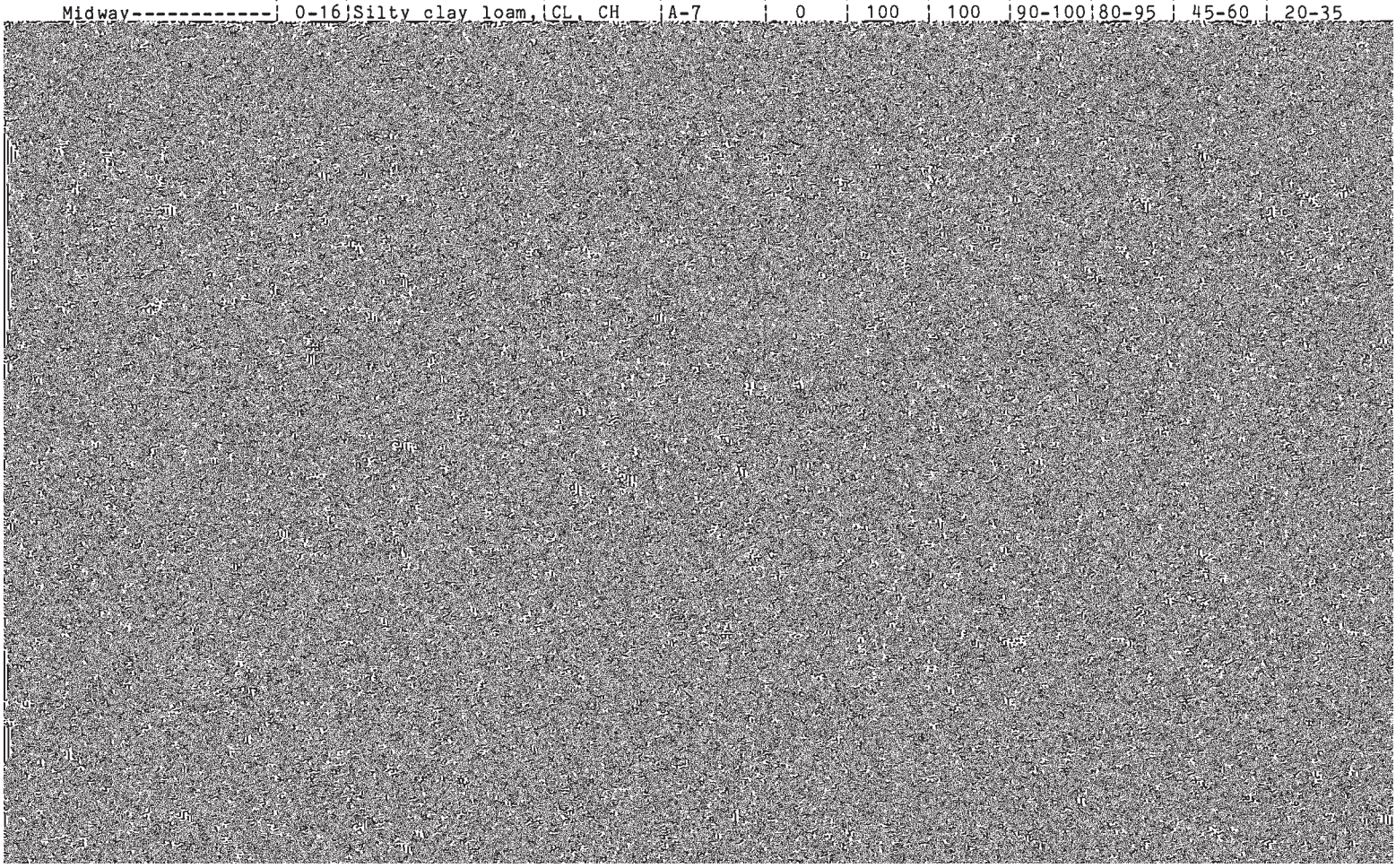


TABLE 18.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

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	
NdA, NdB, NdC------ Nunn	0-5	Clay loam-------	CL, SC	A-6	0-5	95-100	80-95	70-95	45-75	30-40	10-20
	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*---------- 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	45-90	45-75	40-65	30-45	8-20
	22-45	Very channery	ML, CL	A-4	15-45	60-90	55-85	45-70	35-60	30-45	5-20

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	CL, SC, SC	A-6, A-7	10-40	70-95	65-80	50-70	40-60	30-45	8-20

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	
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*:									

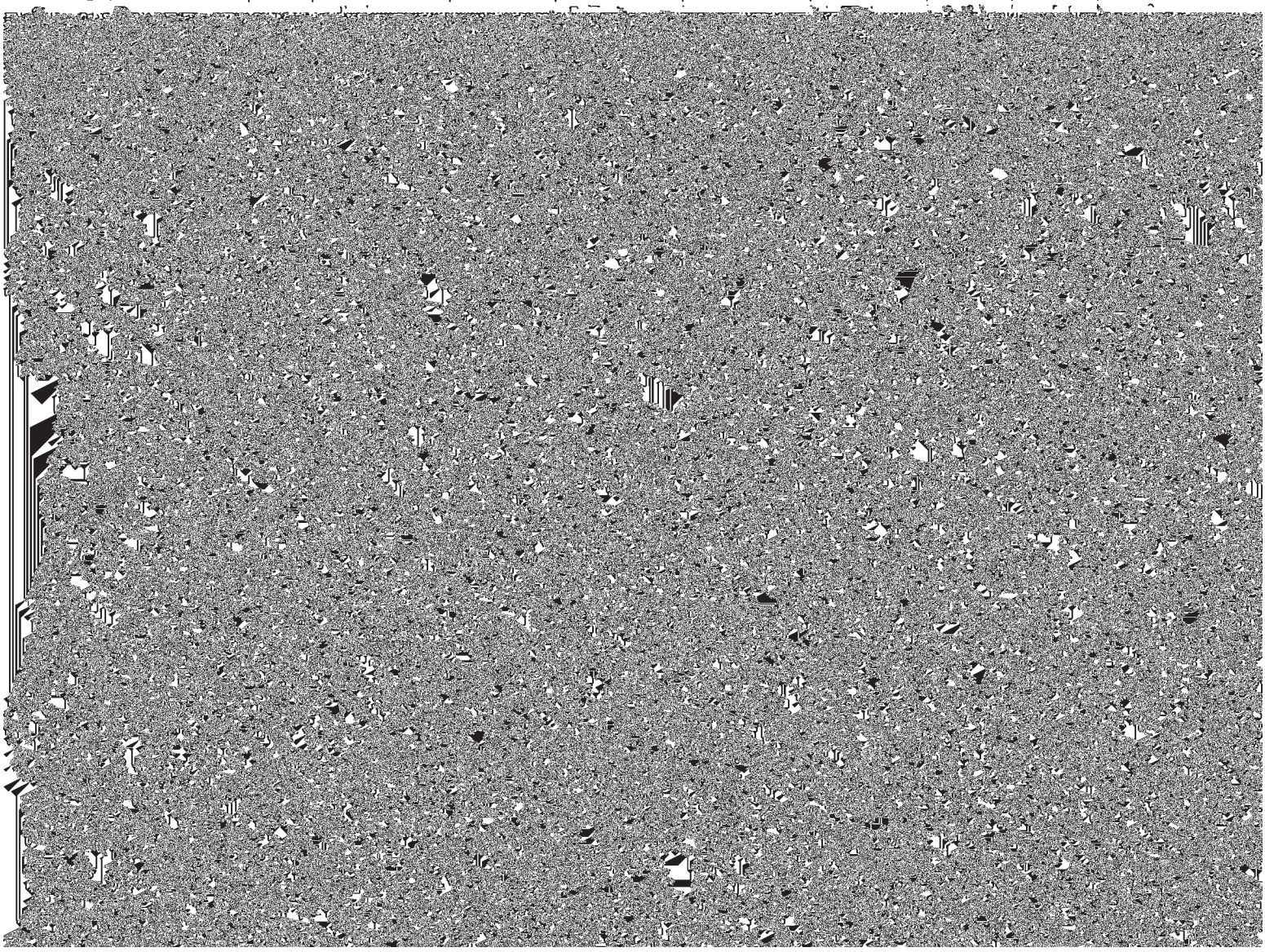


TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water	Soil reaction	Salinity	Shrink-swell	Erosion factors		Wind erodibility

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									
SEF*	0-7	0.6-2.0	0.17-0.20	6.6-7.5	<2	Low	0.37	5	5

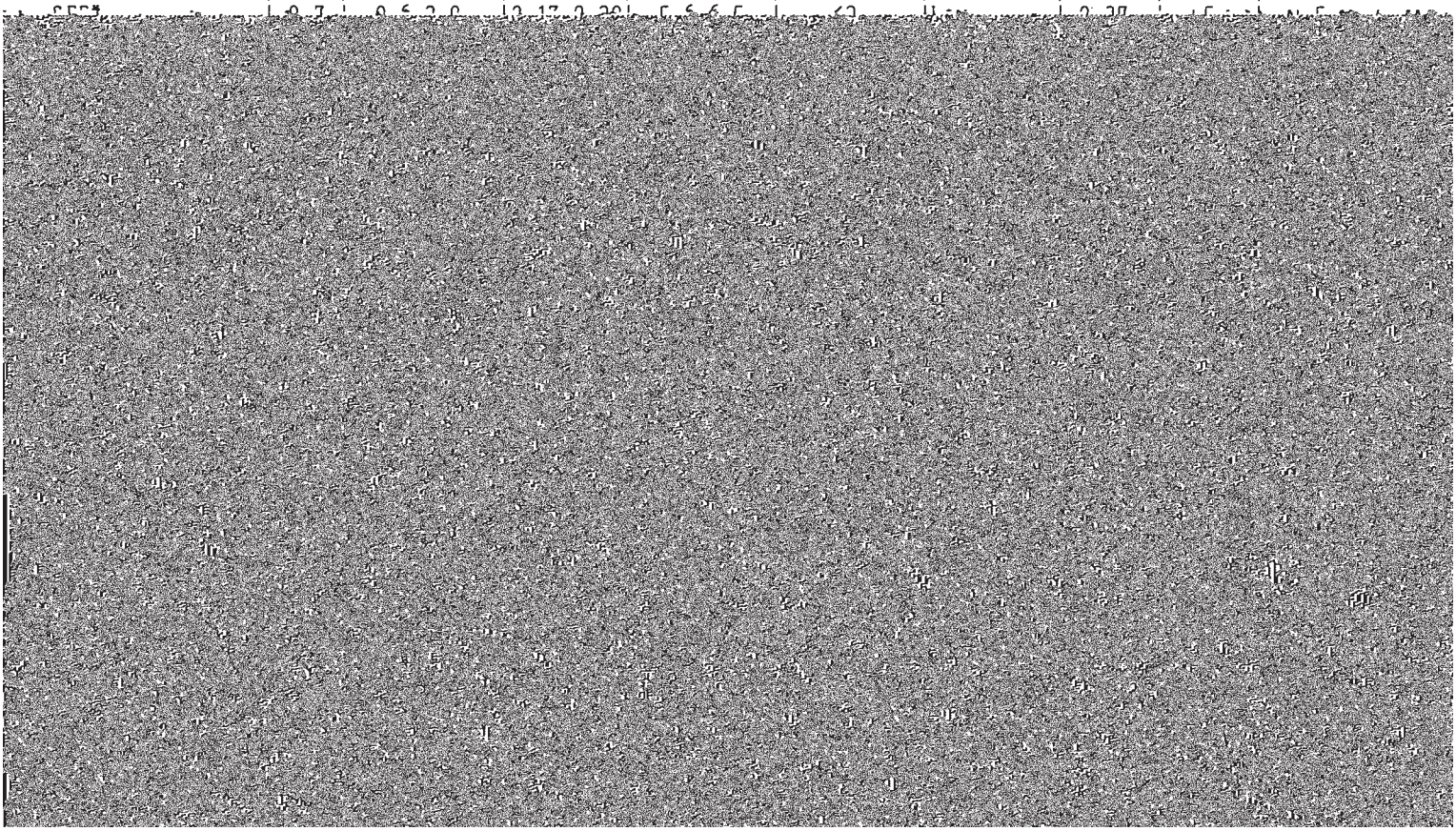
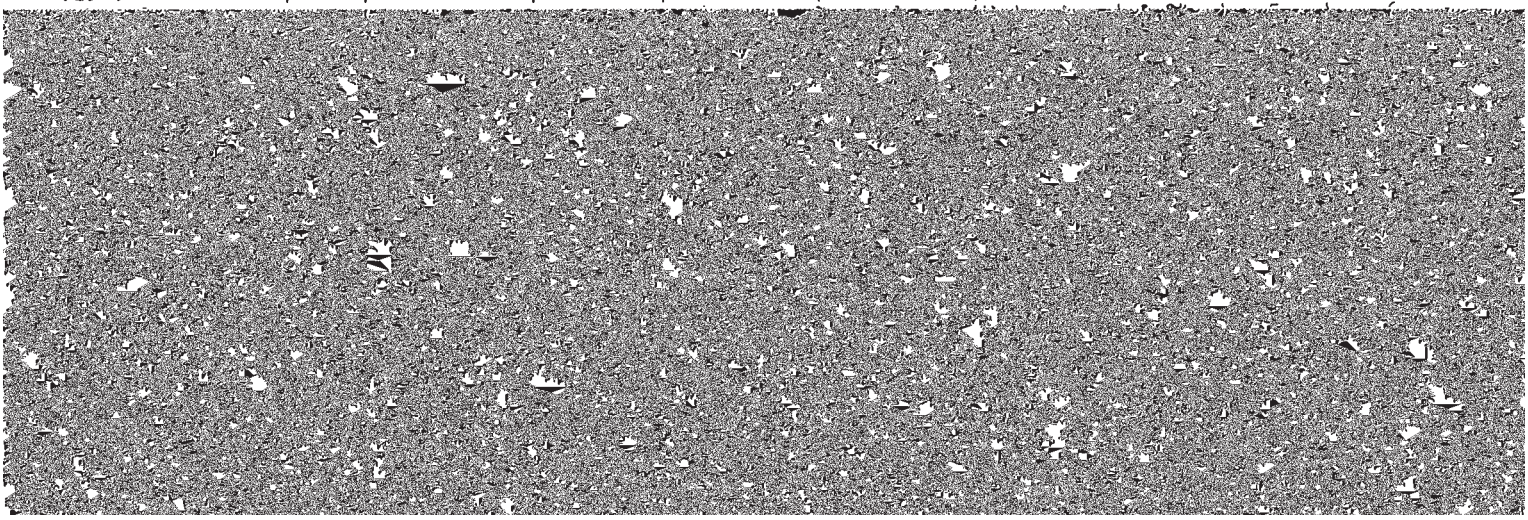


TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

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---- Vale	0-6	0.6-2.0	0.19-0.22	6.1-7.8	<2	Moderate	0.32	5	6
	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*:									



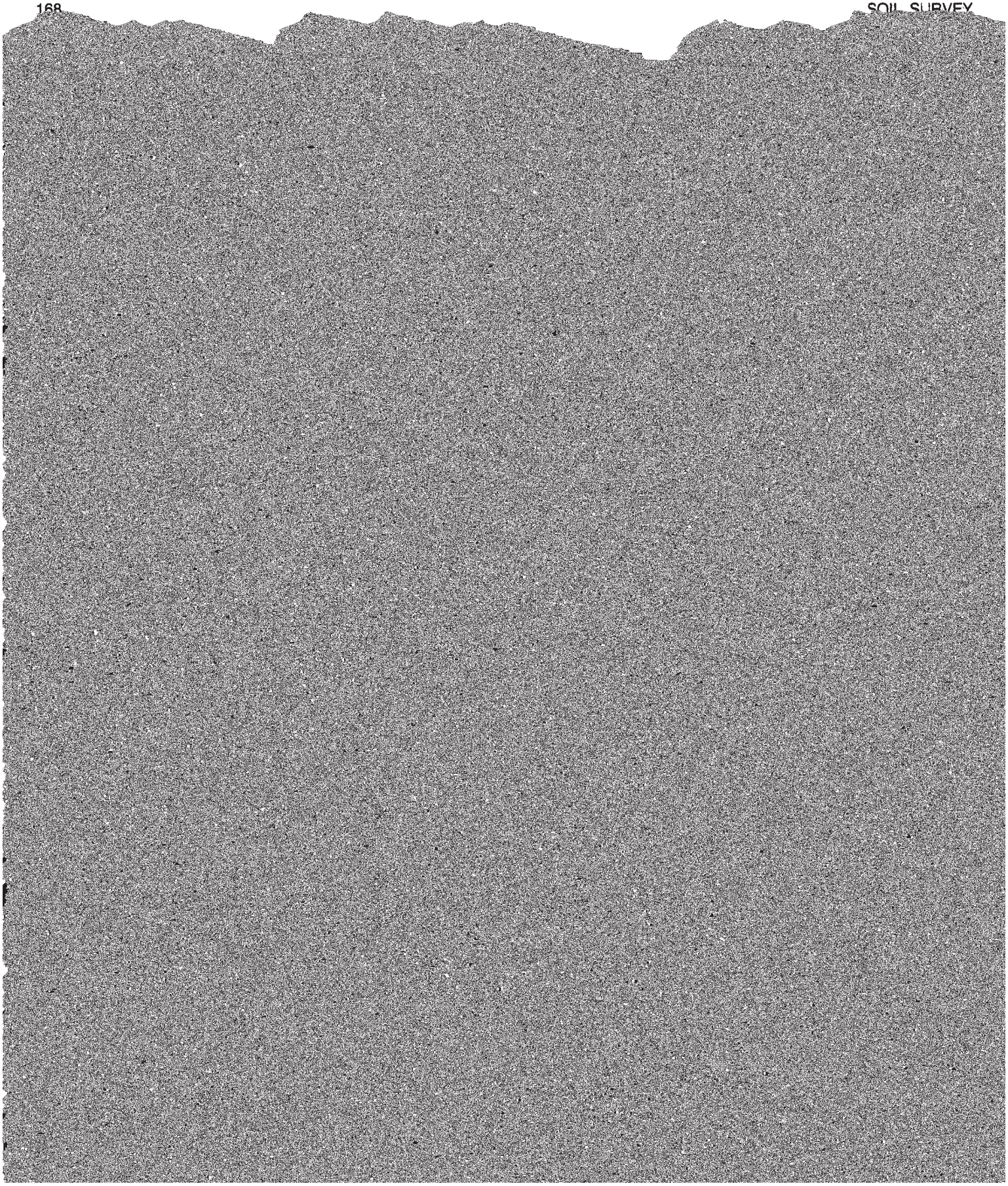


TABLE 20.--SOIL AND WATER FEATURES--Continued

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.

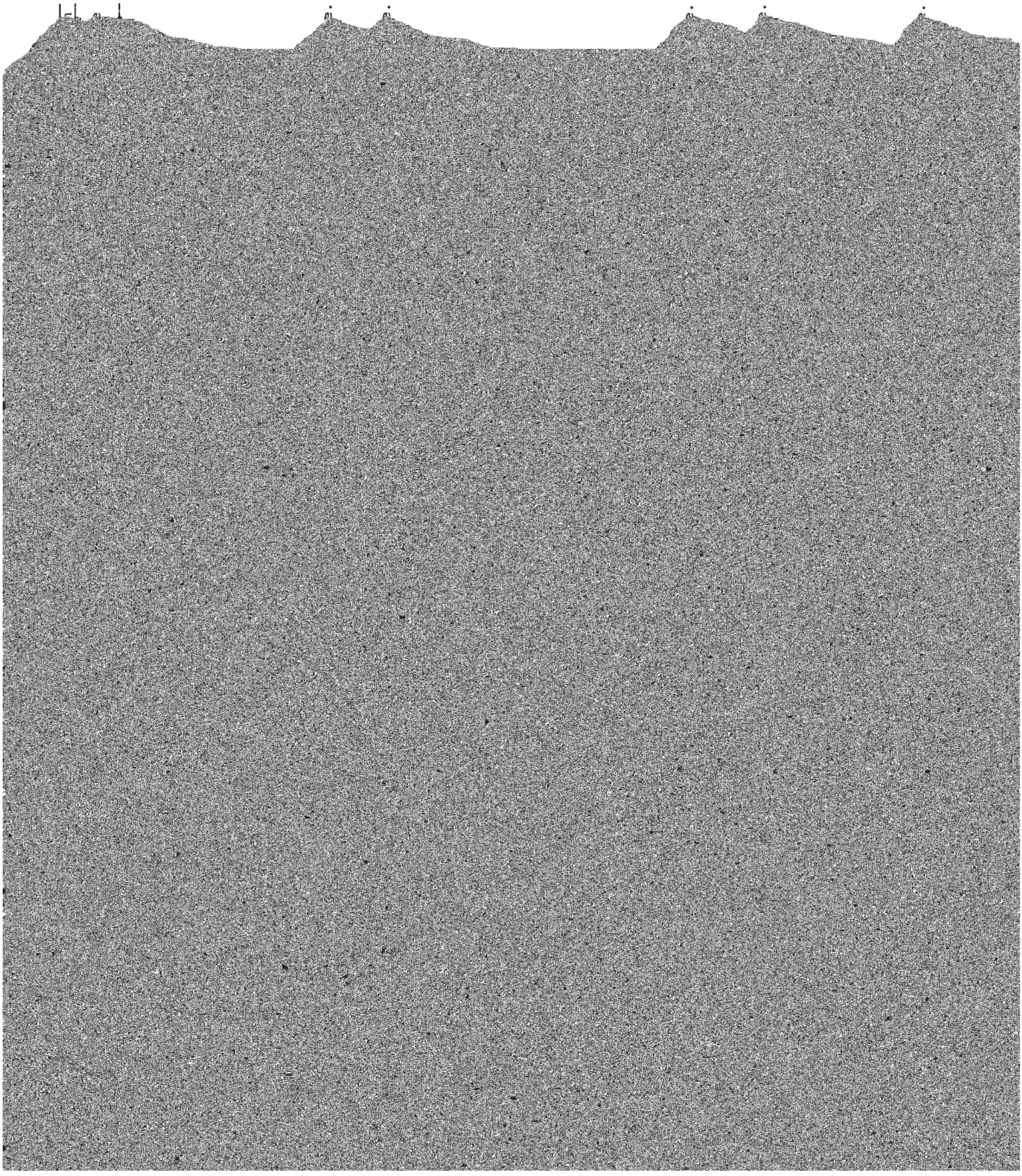


TABLE 20.--SOIL AND WATER FEATURES--Continued

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				
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.

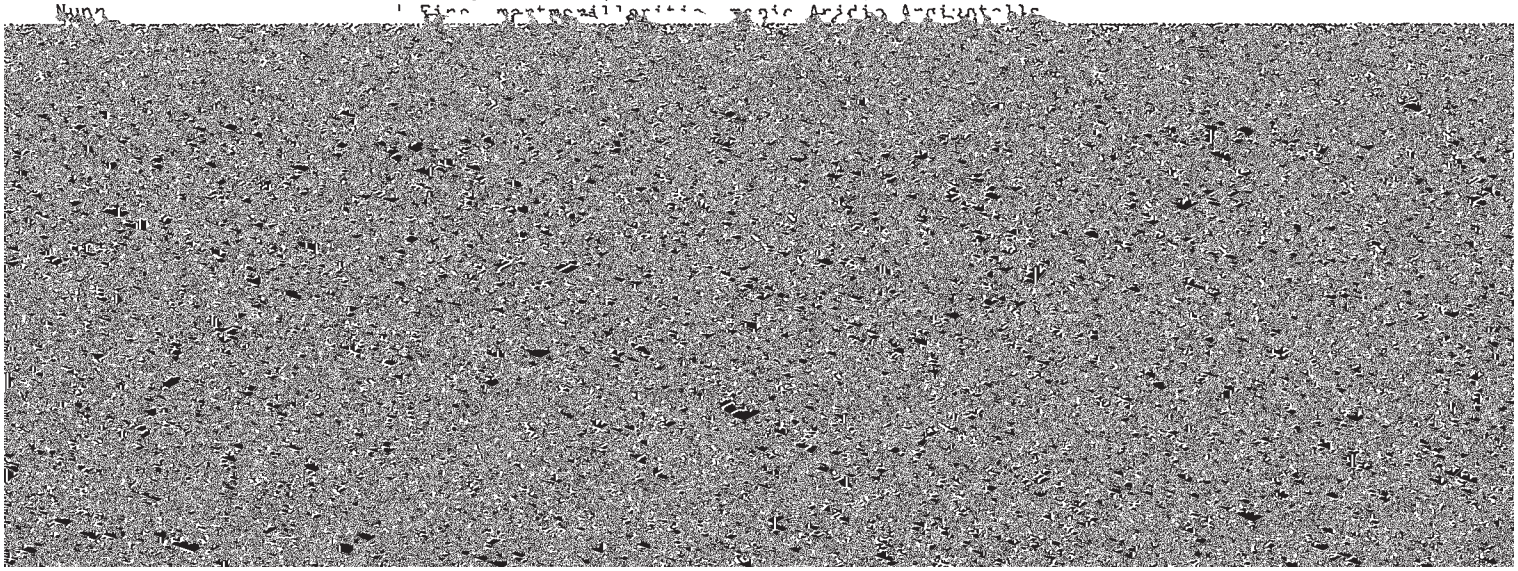
TABLE 21.--ENGINEERING TEST DATA

[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



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