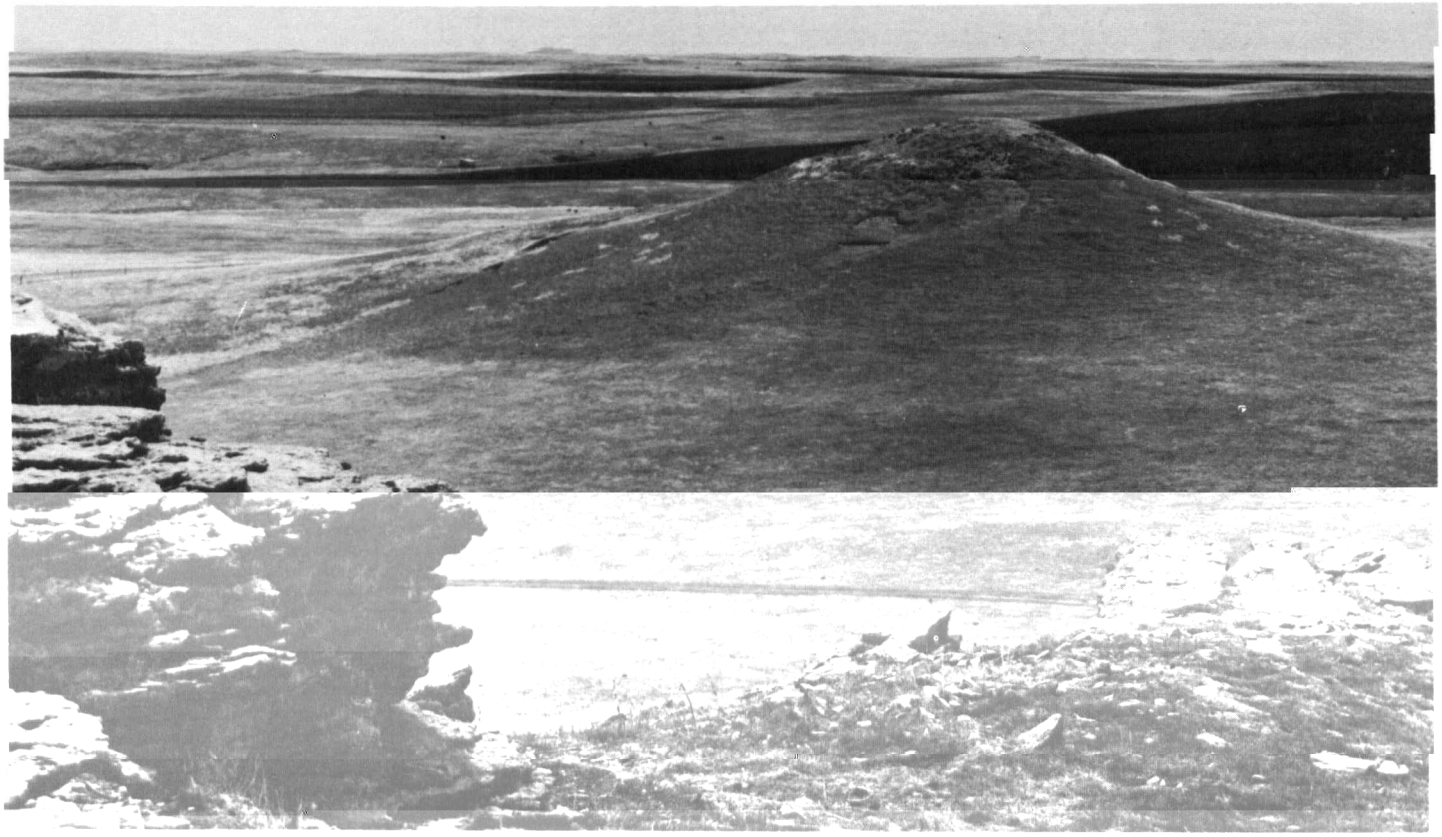
SOIL SURVEY OF

Dewey County, South Dakota



United States Department of Agriculture
Soil Conservation Service
and
United States Department of the Interior
Bureau of Indian Affairs
in cooperation with
South Dakota Agricultural Experiment Station

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.

Major fieldwork for this soil survey was completed in the period 1964–71. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. This survey was made cooperatively by the Soil Conservation Service, the Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Dewey County Conservation District and the Cheyenne Sioux Tribe.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could 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.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, or other structures; and in judging the suitability of tracts of land for farming, industry, or recreation.

Locating Soils

All the soils of Dewey County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all of the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil and each capability unit and range site is described.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitations or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range and the names of many of the plants that grow on each range site.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the range sites, the capability units, the pasture groups, and the windbreak groups.

Foresters and others can refer to the section "Windbreaks," where the soils of the county are grouped according to their suitability for trees and shrubs.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Engineers and builders can find under "Engineering" tables that contain test data, estimates of soil properties, and information about soil features that affect engineering properties.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers to Dewey County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They also may be interested in the general information about the county given in the section "General Nature of the County."

Cover: **View from the top of Dog Butte in the Vebar-Flasher association.**

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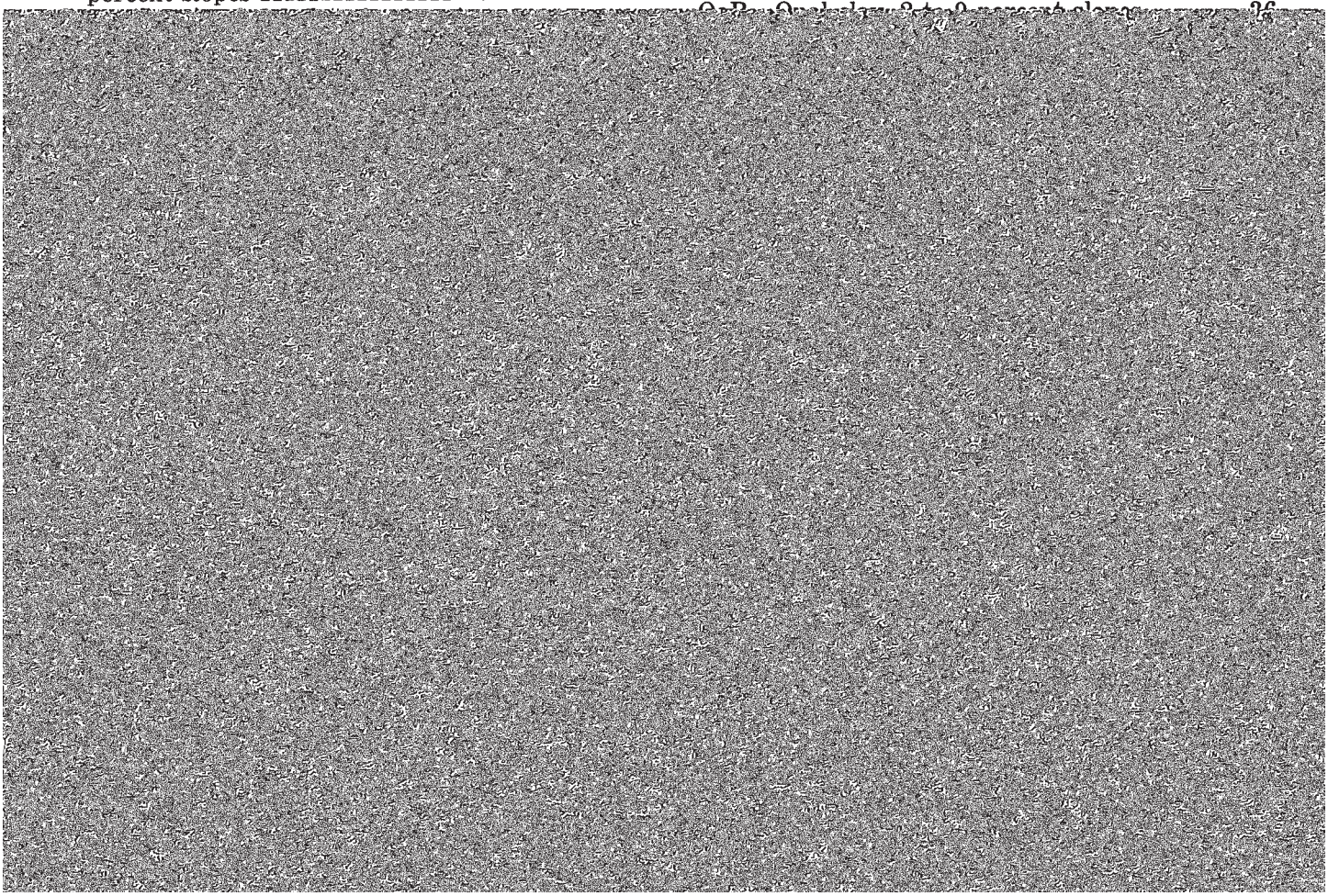

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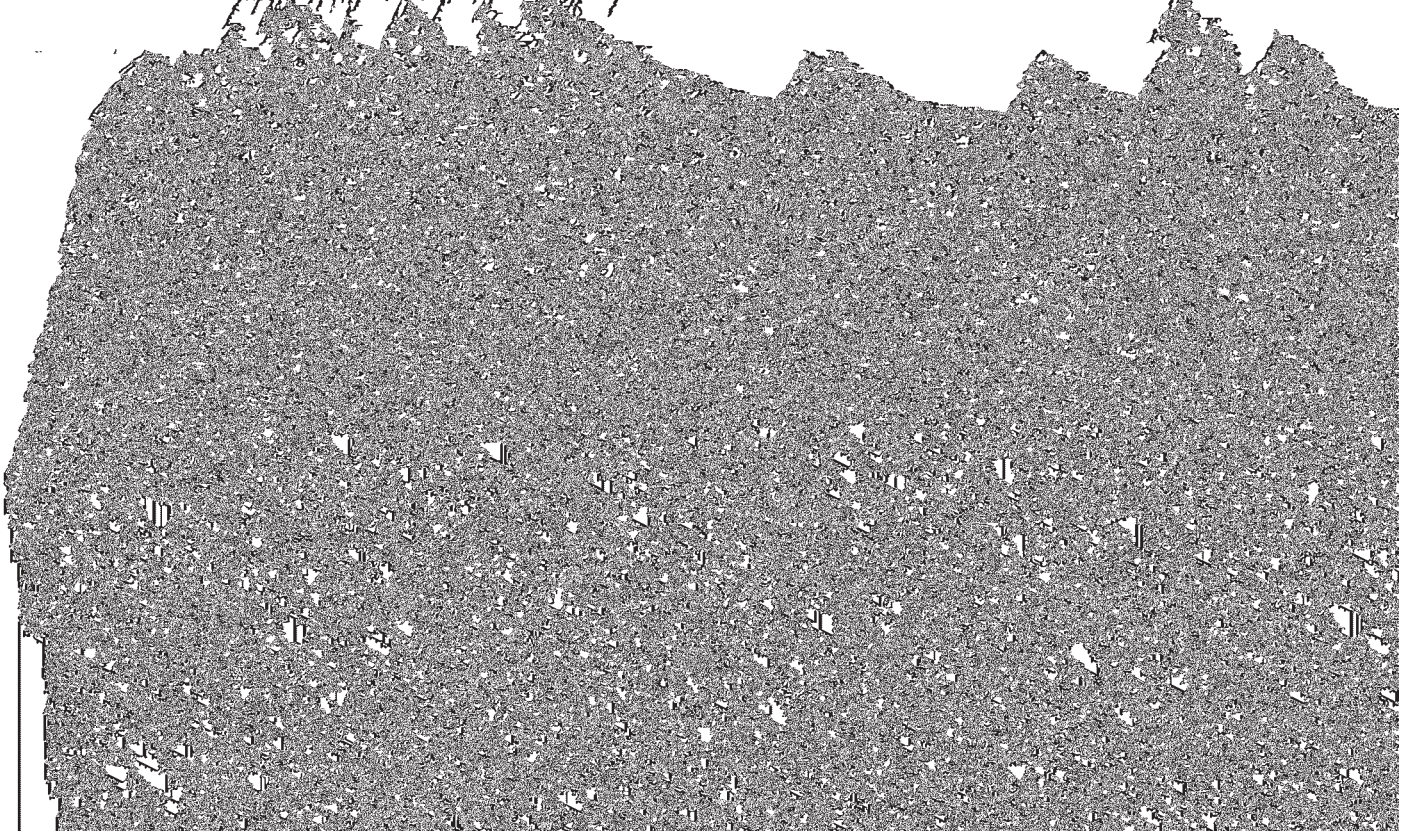


SOIL SURVEY OF DEWEY COUNTY, SOUTH DAKOTA

BY JOHN KALVELS AND PAUL M. BODEN, SOIL CONSERVATION SERVICE [1]

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, AND UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS, IN COOPERATION WITH THE SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

DEWEY COUNTY is in the north-central part of South Dakota (fig. 1). The total area is about 244 square miles, or 1,559,680 acres, of which 55,104 acres is inland water, mainly Lake Oahe. Timber Lake is the county seat and the largest town in the county. All of Dewey County but the northern and southwestern parts is in the Cheyenne River Indian Reservation.

The landscape is a broad plain interrupted by deeply entrenched streams and drainageways and by buttes that rise 100 feet or more above the plain. The relief is nearly level to sloping in the northwestern and southwestern parts of the county and is sloping to steep in much of the rest. The elevation above sea level ranges from 2,460 feet at the northwest corner to about 1,610 feet along Lake Oahe. All the northern part of the county but the extreme northwest corner is drained by the Moreau River, which flows from west to east into Lake Oahe. The eastern and southern parts of the county are drained by tributaries that flow into Lake Oahe, which covers the Cheyenne River and Missouri River Valleys.

About 88 percent of the land area is in nativ grass and is used for range. About 12 percent is cropped. Corn, winter wheat, spring wheat, oats, and alfalfa are the principal crops. Much of the grain and alfalfa is fed to livestock, but about 40 percent of the farm and ranch income in the county is from the sale of crops, mainly wheat. The main concerns in managing cultivated soils are conserving moisture, controlling erosion and soil blowing, and maintaining fertility.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Dewey County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and nature of streams, the kinds of native plants or crops, the kinds of rock and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Morton and Promise, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis

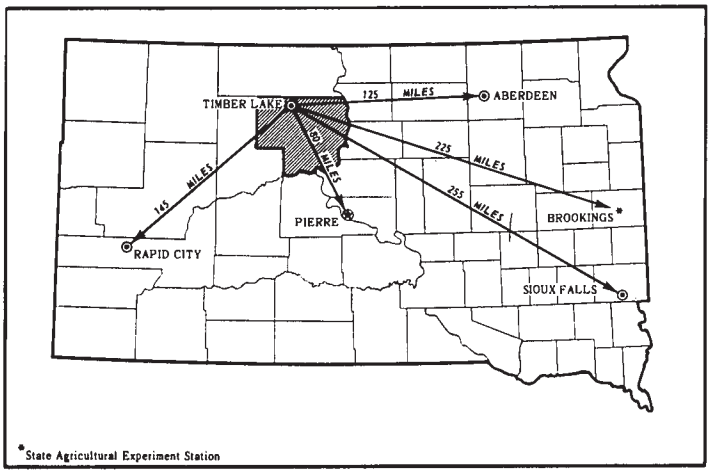


Figure 1.—Location of Dewey County in South Dakota.

[1] Others who assisted in this survey were EARL G. CHAMBERLIN, WILLIAM R. GLOVER, KENNETH J. HEIL, LAURENCE L. KOBRIGER, FRANCISCO MATANZO, DALE A. MELIUS, Soil Conservation Service; E. A. NIESCHMIDT, JUAN P. ORTEGA, and RONALD F. PETERSON, Bureau of Indian Affairs (Missouri River Basin Investigations); and JACK SAFFORD, Bureau of Indian Affairs.

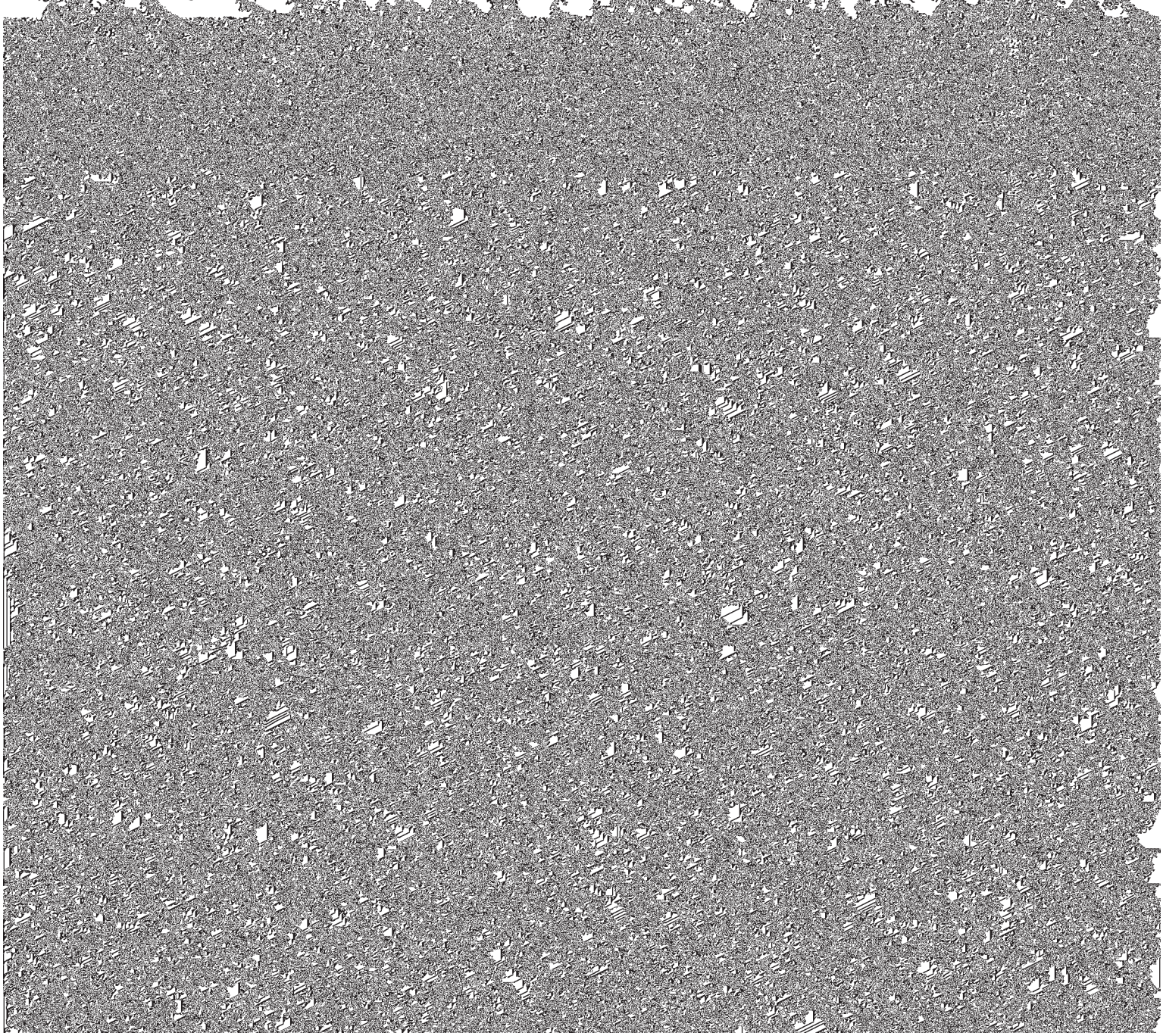
of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Reeder loam, 0 to 2 percent slopes, is one of three phases within the Reeder series.

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

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields a

havior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by



1. Rhoades-Ekalaka association

Deep, moderately well drained and well drained, nearly level to sloping loamy soils that have a claypan subsoil

This association is on uplands. It is mostly gently sloping, but some parts are nearly level and others are sloping. Slopes are long. In much of the association the surface is uneven. Small, low mounds rise several inches above intervening low spots.

This association makes up slightly less than 4 percent of the land area in the county. It is about 35 percent Rhoades soils, 15 percent Ekalaka soils, and 50 percent minor soils.

The gently sloping Rhoades soils have an uneven surface and are moderately well drained. They have a thin surface layer of grayish-brown loam and a claypan subsoil of grayish-brown silty clay. The underlying material is grayish-brown silty clay loam and light brownish-gray silty clay. The lower part of the subsoil and the underlying material are calcareous and commonly contain salts.

The well-drained Ekalaka soils are nearly level to sloping and have a smoother surface than Rhoades soils. They have a thick surface layer of grayish-brown fine sandy loam and a thin subsurface layer of light-gray loamy fine sand. The claypan subsoil is light brownish-gray fine sandy loam or loamy fine sand. The underlying material is light brownish-gray fine sandy loam. The lower part of the subsoil and the underlying material are calcareous and contain salts.

Absher and Archin soils are the most common of the minor soils. Absher soils are on some of the flats and fans, and Archin soils are near Ekalaka soils. Less extensive soils are Belfield and Daglum soils in some of the swales, Tally soils near areas of Ekalaka soils, and Slickspots in some low spots that have little or no plant cover. Mine pits and dumps also are in this association.

Most of the soils in this association have a claypan subsoil that limits their use for crops. The claypan takes in water very slowly or slowly and restricts plant roots. In addition, the Ekalaka soil blows easily. Runoff is medium or slow. Improving tilth and water intake and controlling soil blowing are the main concerns in cultivated areas.

Most of this association is in native grass and is used for range. Small areas, mainly the Ekalaka soil

cent of the land area in the county. It is about 40 percent Belfield soils, 35 percent Daglum soils, and 25 percent minor soils (fig. 2).

Belfield soils, in swales and along the sides of low ridges, are mostly nearly level to gently sloping and are well drained. They have a surface layer of grayish-brown loam and a thin transitional layer of grayish-brown heavy loam. The subsoil is grayish-brown clay loam and silty clay in the upper part and light brownish-gray clay loam in the lower part. The underlying material is light brownish-gray clay loam. The lower part of the subsoil and the underlying material are calcareous and have spots and streaks of soft lime.

Daglum soils, on flats and in swales, are mostly nearly level and are moderately well drained. They have a surface layer of grayish-brown silt loam and a subsurface layer of light brownish-gray silty clay loam. The claypan subsoil is grayish-brown and light brownish-gray silty clay. The underlying material is light olive-gray silty clay. The lower part of the subsoil and the underlying material are calcareous and contain salts.

Minor soils in this association are Absher and Rhoades soils and Slickspots on some of the upland flats, Cabba and Lantry soils on the sides of entrenched drainageways, Havrelon and Lohler soils on bottom land, Morton and Reeder soils on low ridges, and a few areas of Regent and Ridgeview soils.

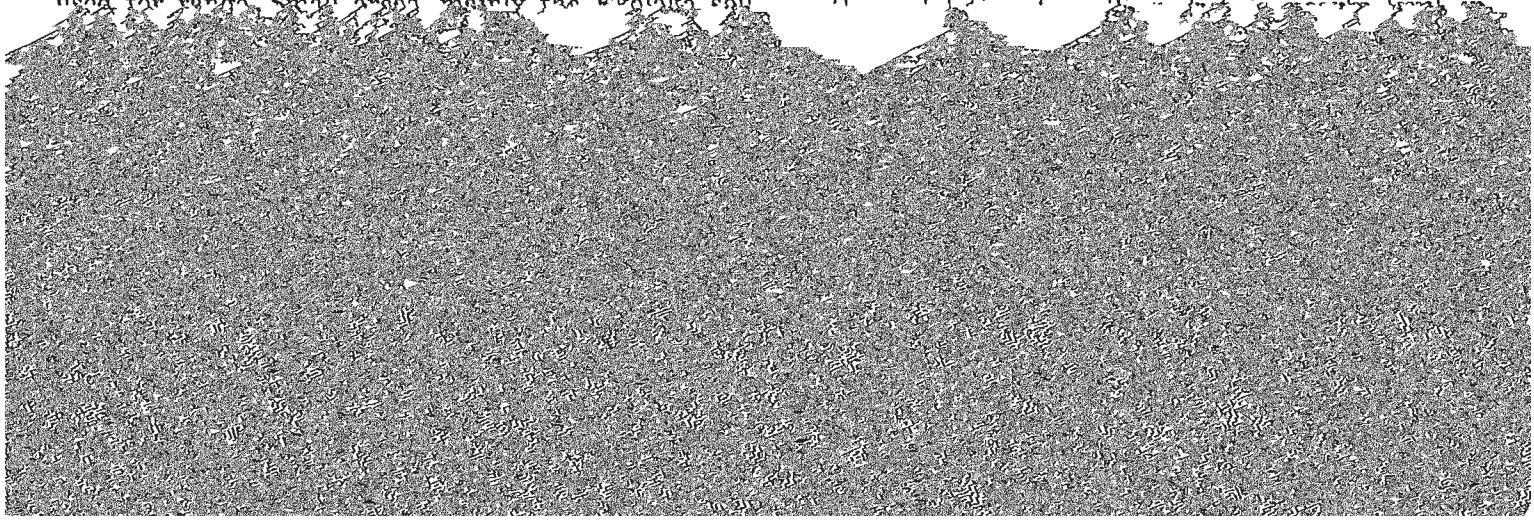
The major soils in this association take in water slowly or very slowly. The Daglum soil has poor tilth, and its claypan subsoil restricts roots. Runoff is slow or medium. The Daglum soil has a low potential for crops, but the Belfield soil is moderately well suited to dryfarmed crops. Conserving moisture, controlling erosion, and improving tilth and water intake are concerns in management.

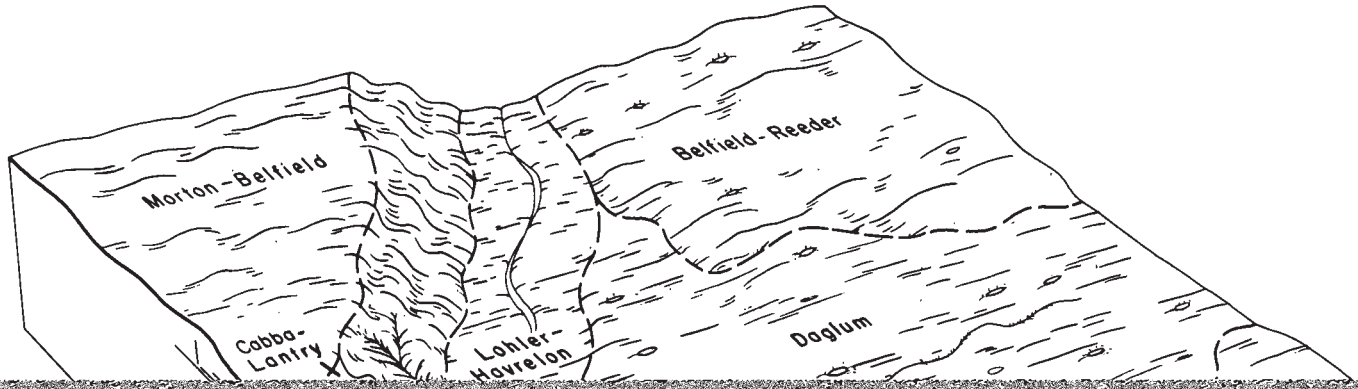
This association is used for range and for crops, mainly small grain and alfalfa. Some corn is grown on the Belfield soil and on some of the minor soils. Livestock ranching is the main enterprise. Some wheat is grown for cash income.

3. Vebar-Flasher association

Moderately deep and shallow, well-drained and somewhat excessively drained, nearly level to rolling loamy and sandy soils

This association is an upland plain. It is mostly




Morton-Belfield
Belfield-Reeder
Cabba-Lantry
Lohler-Havrelon
Doglum

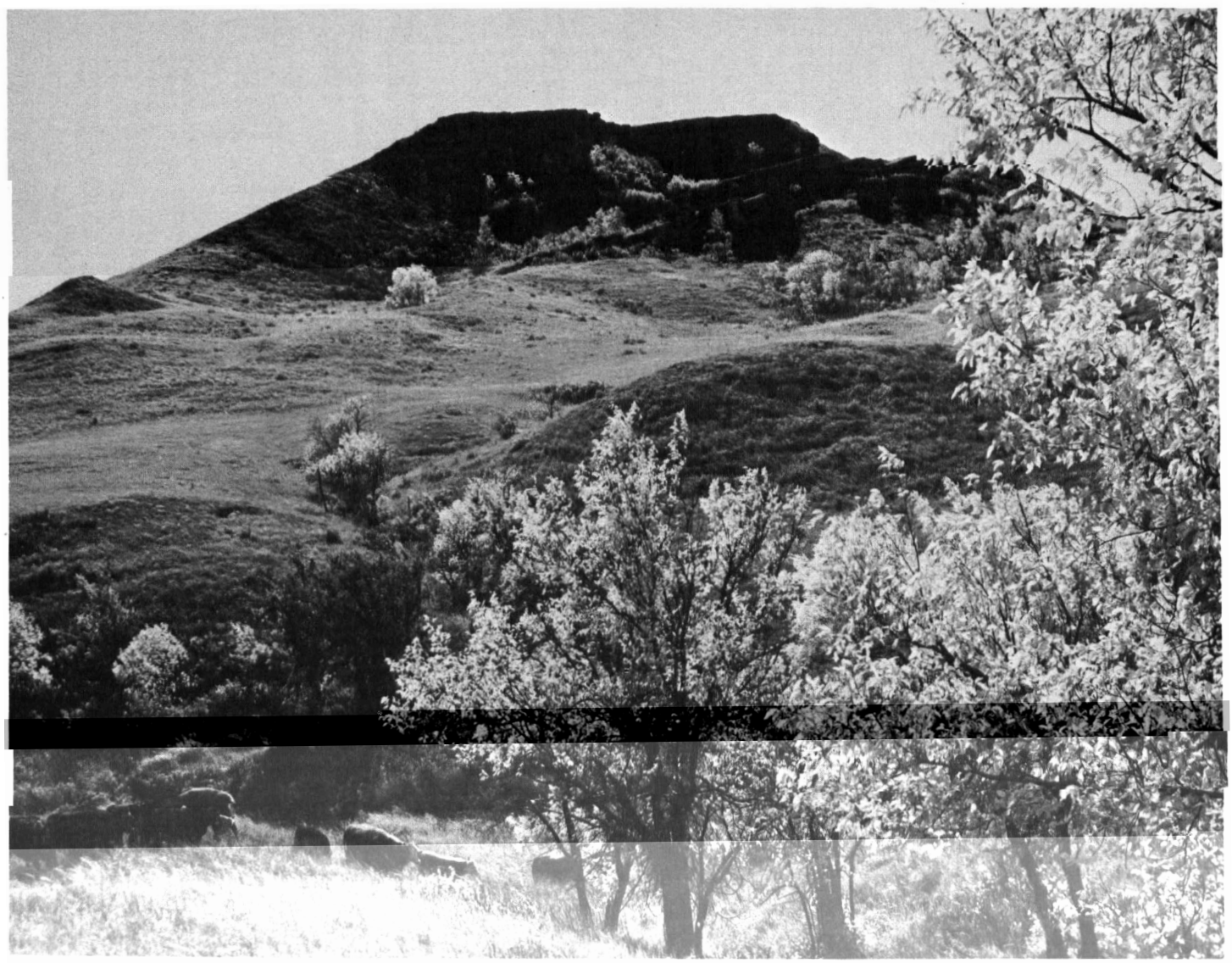


Figure 3.—**Castle Butte is a prominent feature in the Vebar-Flasher association.**

ately permeable and are suitable for dryfarming. Runoff is medium on much of the association, but is slow on the nearly level soils. Controlling erosion and soil blowing and conserving moisture are the main concerns in cultivated areas.

Some areas are in native grass and are used for range, but many are cultivated. Small grain, corn, and alfalfa are the main crops. Wheat farming and live-

This association makes up about 6 percent of the land area in the county. It is about 35 percent Wayden soils, 20 percent Cabba soils, and 45 percent minor soils (fig. 5).

Wayden soils have short, strongly convex slopes. They are excessively drained. The surface layer is grayish-brown silty clay. The underlying material is grayish-brown clay and light brownish-gray shaly clay.

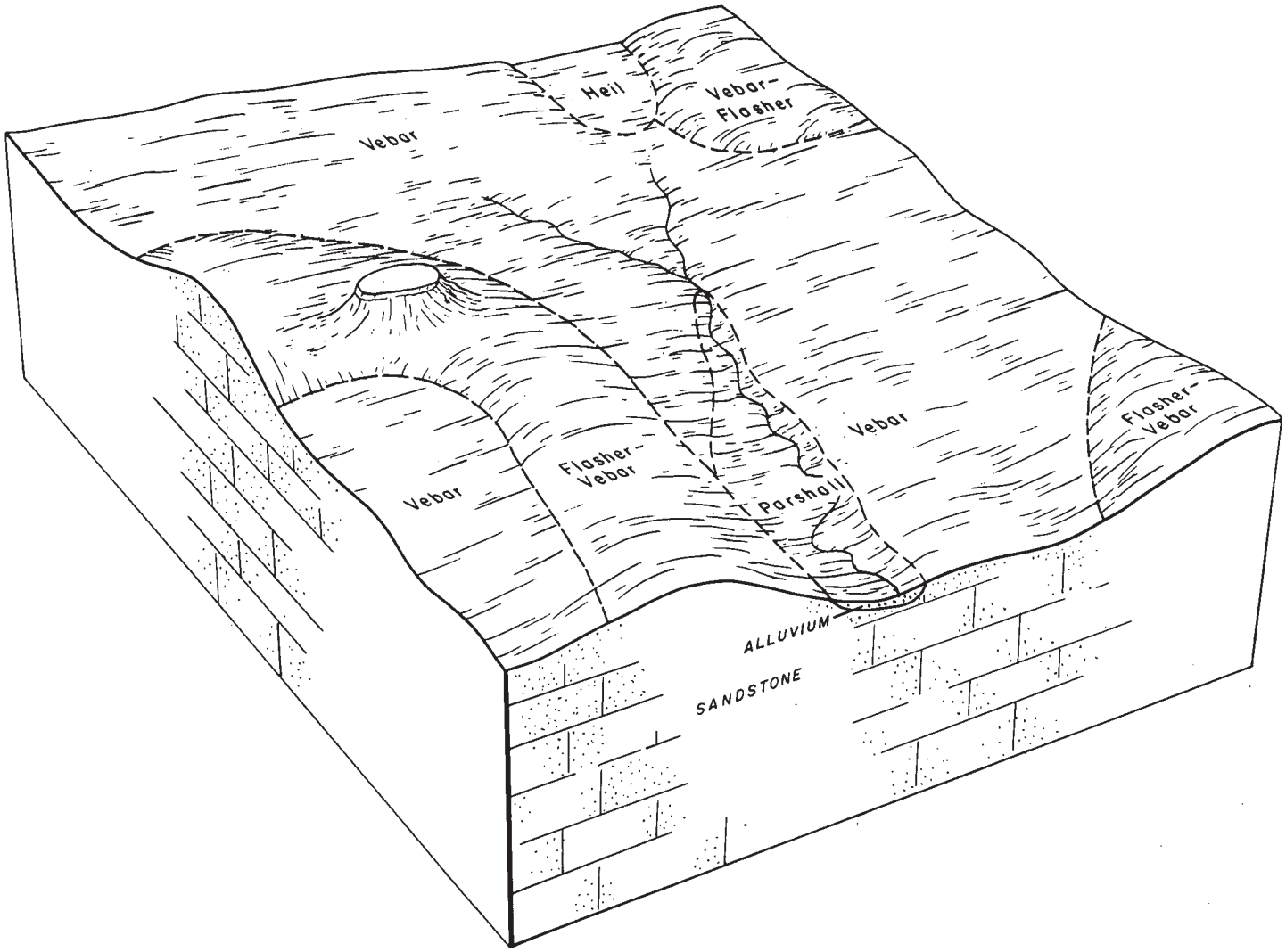


Figure 4.—**Pattern of soils and underlying material in association 3.**

of ridges below Cabba soils, Moreau soils intermingled with Wayden soils, and Morton and Regent soils on drainage divides above the Cabba and Wayden soils.

The dominant soils in this association are low in fertility. They have rapid runoff and very low or low available water capacity. They are highly susceptible to erosion and are too steep for cultivation.

Almost all of this association is in native grass and is used for range. Livestock ranching is the main enterprise.

6. Regent-Ridgeview association

Moderately deep and deep, well-drained, nearly level to sloping silty soils

This association is a drainage divide in the central part of the county. It is mostly gently sloping. Slopes are long and smooth.

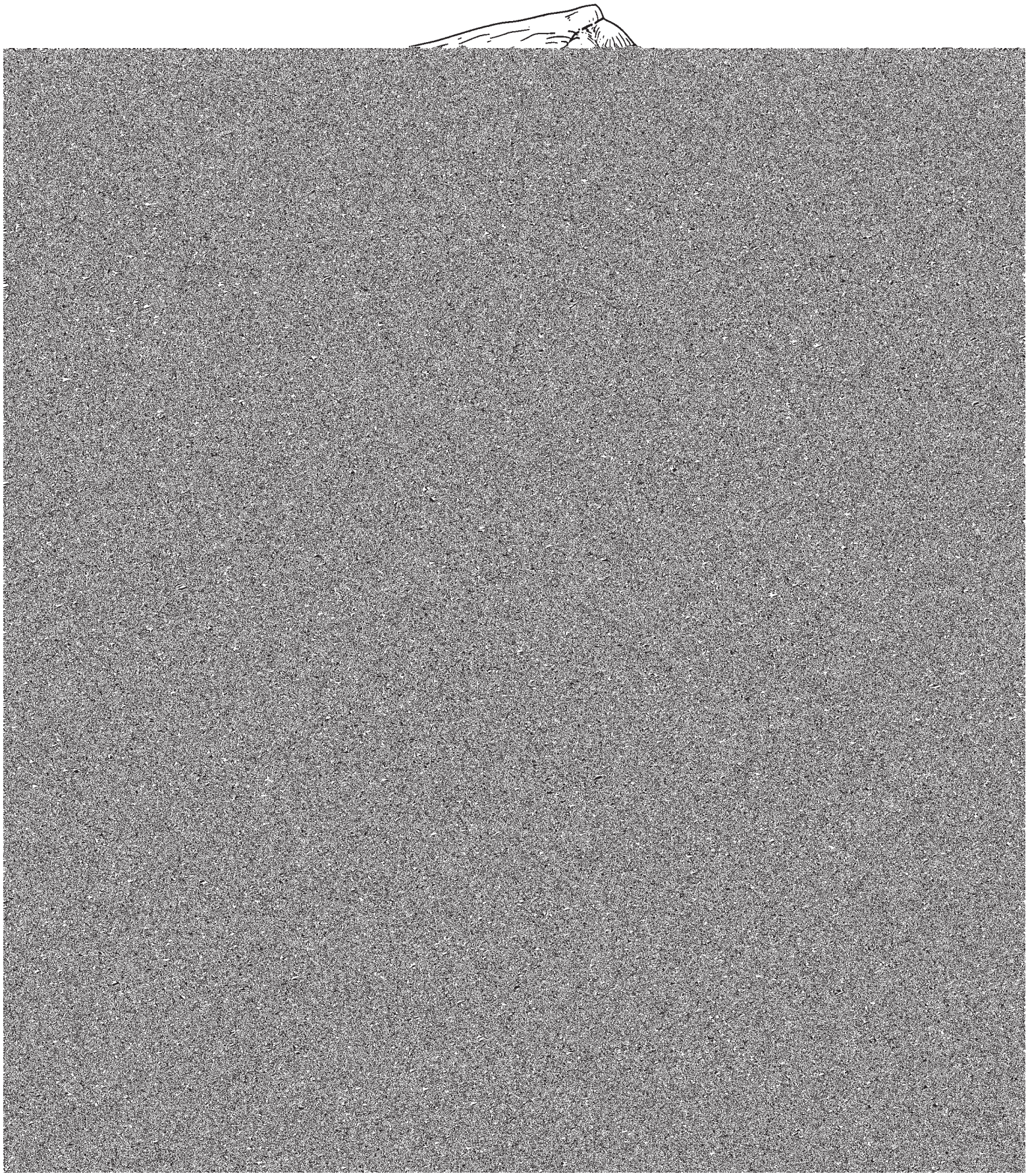
This association makes up slightly more than 3 percent of the land area in the county. It is about 50 percent Regent soils, 40 percent Ridgeview soils, and 10 percent minor soils.

Regent soils have a surface layer of grayish-brown silty clay loam and a subsoil of grayish-brown and light brownish-gray silty clay. At a depth of 38 inches is grayish-brown shale.

Ridgeview soils are on the lower parts of the same landscape. They have a surface layer of dark-gray silty clay loam and a subsoil of grayish-brown and light brownish-gray silty clay and clay. The underlying material is grayish-brown, calcareous clay.

Minor soils in this association are Belfield and Daglum soils in swales and on low flats, Heil soils in closed depressions, Moreau soils on ridges and knolls, Morton soils in places where the underlying shale is silty, and Promise soils on the lower parts of the landscape, especially in the eastern and southern parts of the association.

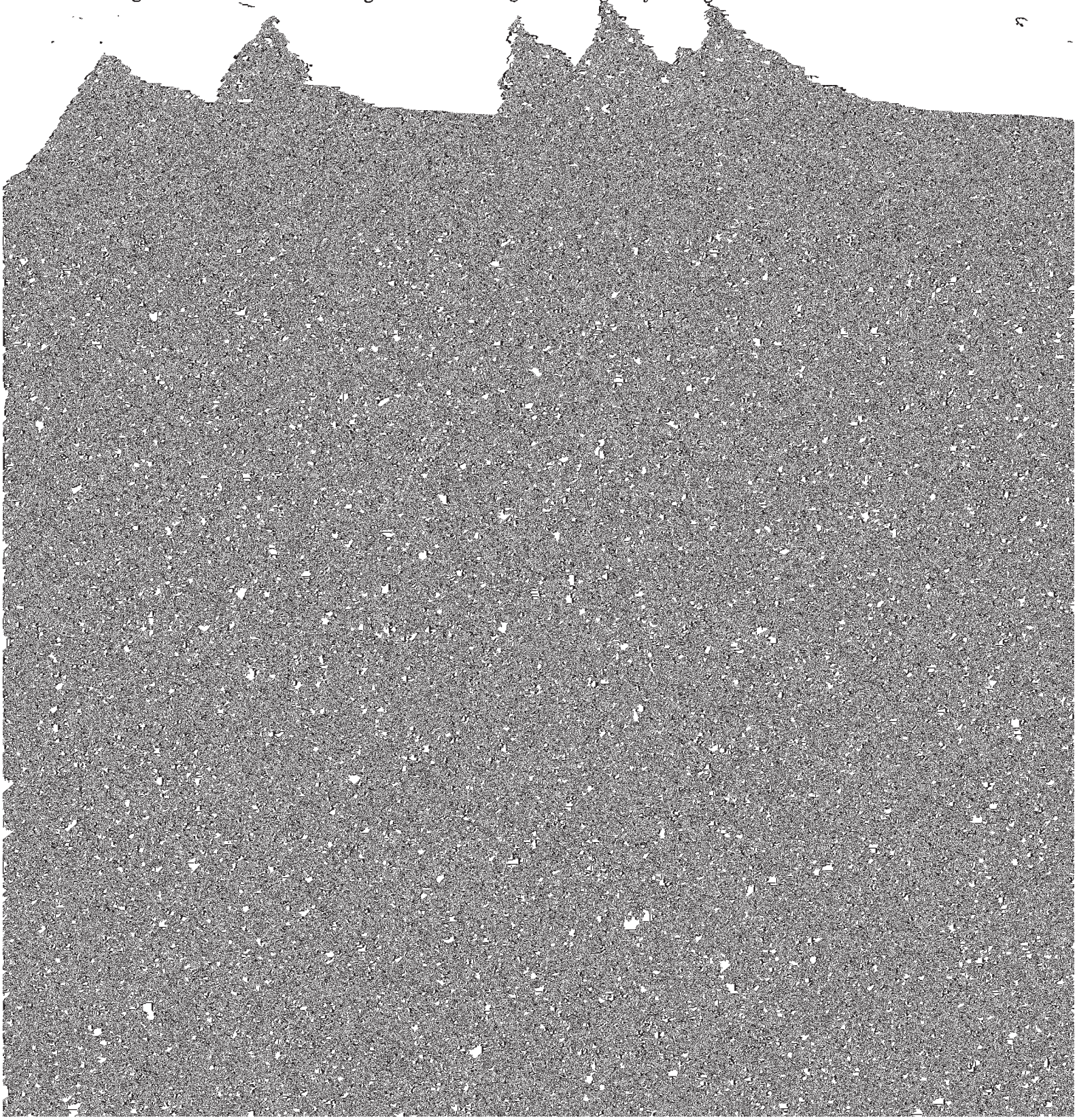
The dominant Regent and Ridgeview soils are slowly permeable and release moisture slowly to plants. Runoff is medium over much of the area. Controlling erosion and soil blowing are the main concerns in cultivated areas.



soils and Slickspots in drainage sags and on upland flats.

These soils are difficult to work and are very slowly or slowly permeable. Available water capacity ranges from very low to moderate. Runoff is medium on much of the association, but is rapid on the steeper soils. Controlling erosion and soil blowing and conserving

strongly sloping to moderately steep. Slopes in much of the association are short and convex. The less sloping parts are the sides of the drainage divides, and the steeper parts are the sides of entrenched drainageways. Many small draws flow into the entrenched drainageways (fig. 6). In some areas the draws and drainageways are gullied.



Minor soils in this association are Agar, Canning, and Reliance soils on isolated high terraces near Lake Oahe, Chantier and Swanboy soils on fans below steeper soils, Hurley soils and Slickspots in shallow drainage sags, and Promise soils on nearly level drainage divides and also near Swanboy soils on low terraces and fans along the larger drainageways. Also in this association are small areas of Shale land on the sides and around the heads of some drainageways.

The dominant Sansarc and Opal soils are slowly or very slowly permeable and have very low or low available water capacity. Runoff is rapid over much of the area. The Sansarc soil is not suitable for cultivation, and most of the Opal soil in this association is too steep for cultivation.

Most of this association is in native grass and is used for range. Small areas of the Opal soil and some minor soils are used for small grain and alfalfa. The small areas of the Canning soil are a potential source

are subject to flooding in some years, but generally the extra moisture is beneficial. About 25 percent of the acreage is cultivated. The rest is in native vegetation and is used for range, hay, and wildlife.

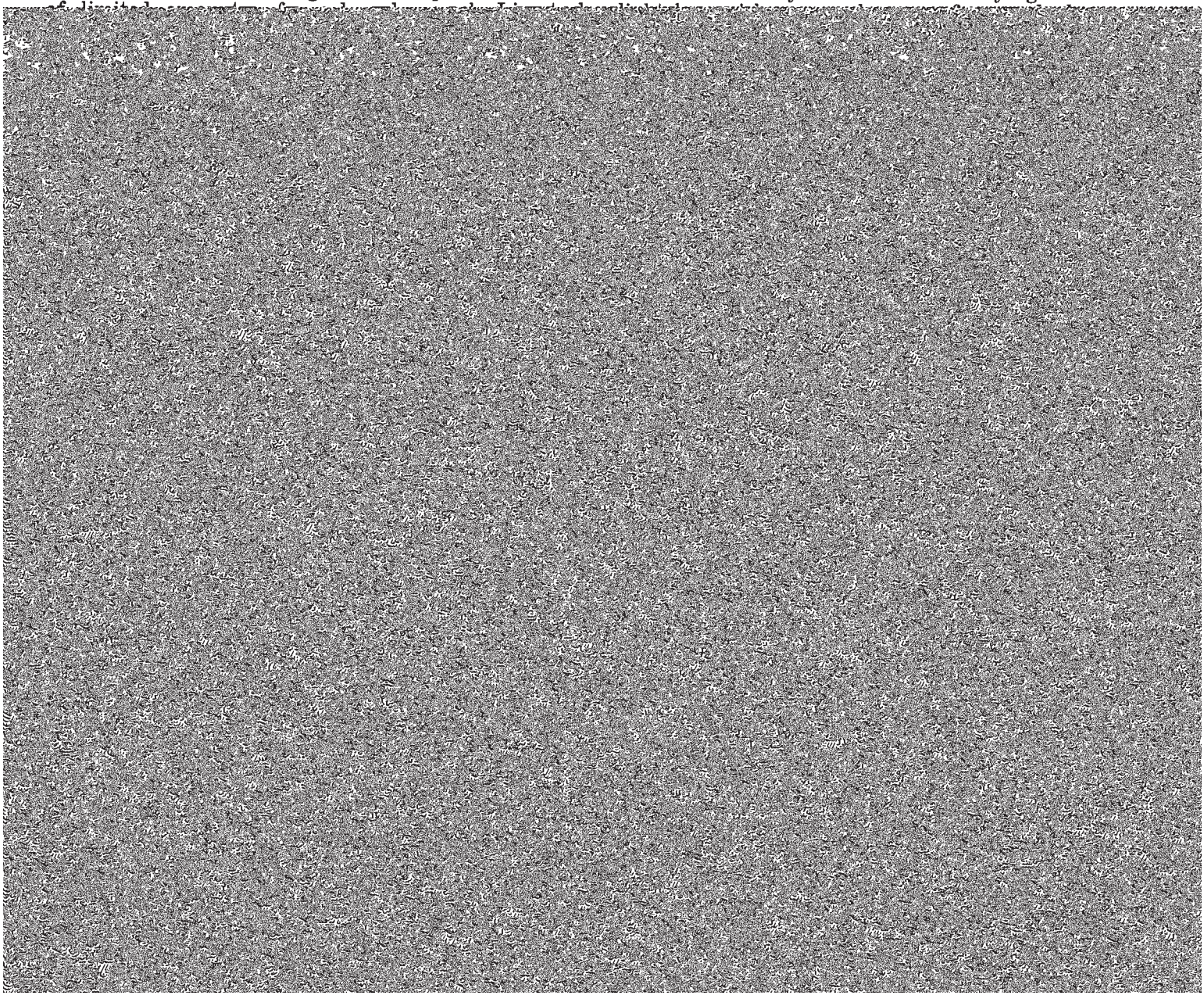
10. Trembles-Havrelon association

Deep, well drained and moderately well drained, nearly level loamy soils

This association makes up about 2 percent of the along the Moreau River. It is nearly level or level, but in places is broken by low hummocks and partly filled, secondary flood channels.

This association is on bottom land and low terraces land area in the county. It is about 35 percent Trembles soils, 15 percent Havrelon soils, and 50 percent minor soils.

Trembles soils are well drained and in places are hummocky. They have a thin surface layer of grayish-brown fine sandy loam. The underlying material is



the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for dry soil unless otherwise stated. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit differs from the one described for the series, the differences are stated in describing the mapping unit, or they are apparent in the name of the mapping unit.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Intermittent lakes and Shale land, for example, do not belong to a soil series, but nevertheless, are listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, and windbreak group to which the mapping unit has been assigned. The page on which each mapping unit, capability unit, and range site is described can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown on table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*5*).[2]

Absher Series

The Absher series consists of deep, well-drained, nearly level soils that have a claypan subsoil. These soils formed in alluvium and are on terraces and up-

roots; mildly alkaline; gradual, wavy boundary.

B3cacs—11 to 21 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; extremely hard, very firm, sticky; many segregations of gypsum; few segregations of lime; slight effervescence; mildly alkaline; gradual, wavy boundary.

C1cs—21 to 41 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, sticky; few segregations of gypsum; slight effervescence; mildly alkaline; diffuse, wavy boundary.

C2cs—41 to 60 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, sticky; many segregations of gypsum and other salts; slight effervescence; mildly alkaline.

Depth to lime and gypsum ranges from 10 to 22 inches. Depth to shale commonly is more than 60 inches, but in places it is at a depth ranging from 40 to 60 inches. In places the soil has a thin A1 horizon. The A2 horizon ranges from grayish brown to light yellowish brown in hue of 2.5Y or 10YR. It is silt loam or silty clay loam and ranges from 1 to 4 inches in thickness. The B2t horizon ranges from grayish brown to light yellowish brown in hue of 2.5Y or 10YR. It is silty clay or clay. It has columnar structure that is moderate or strong and ranges from medium to very

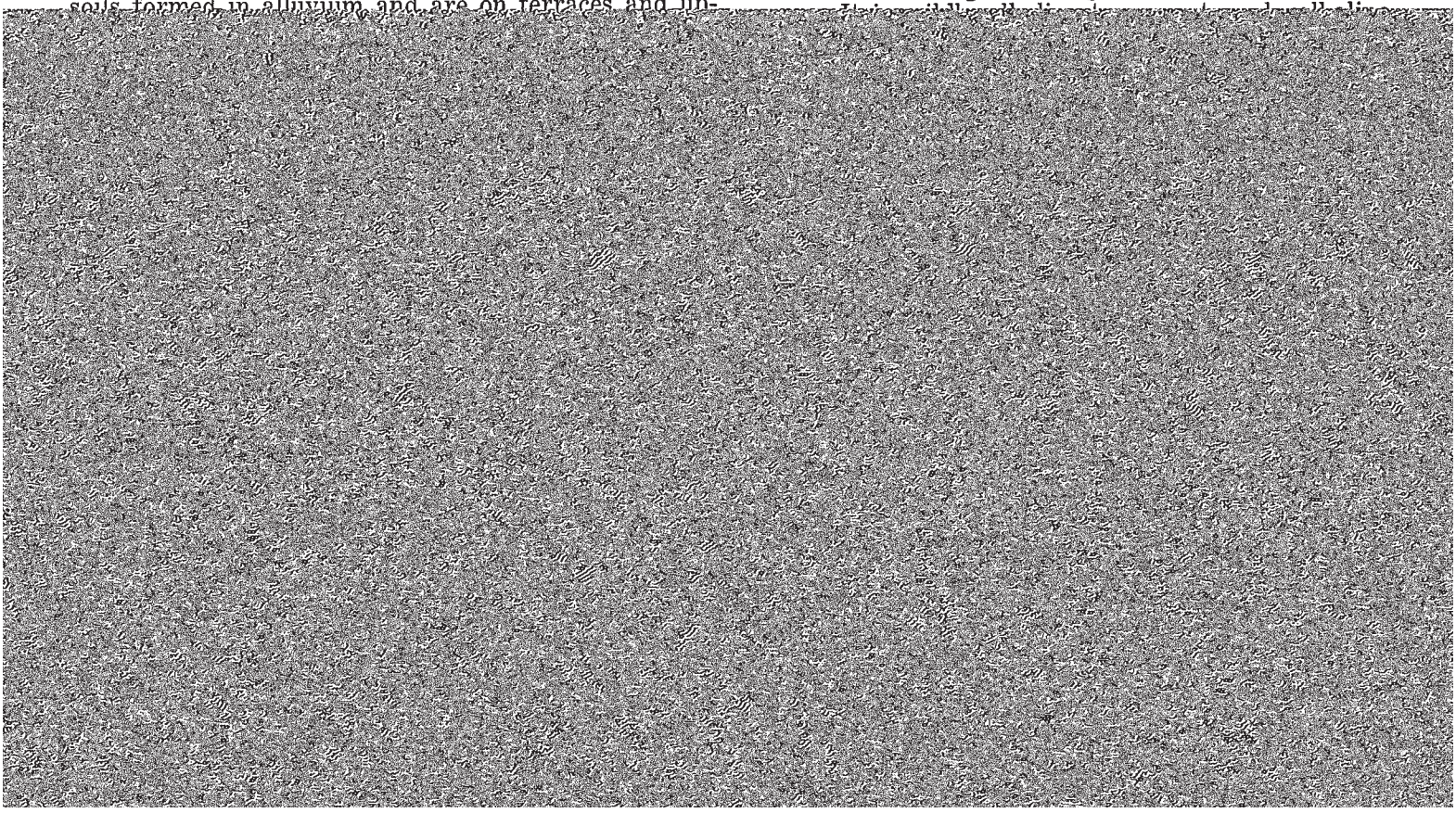
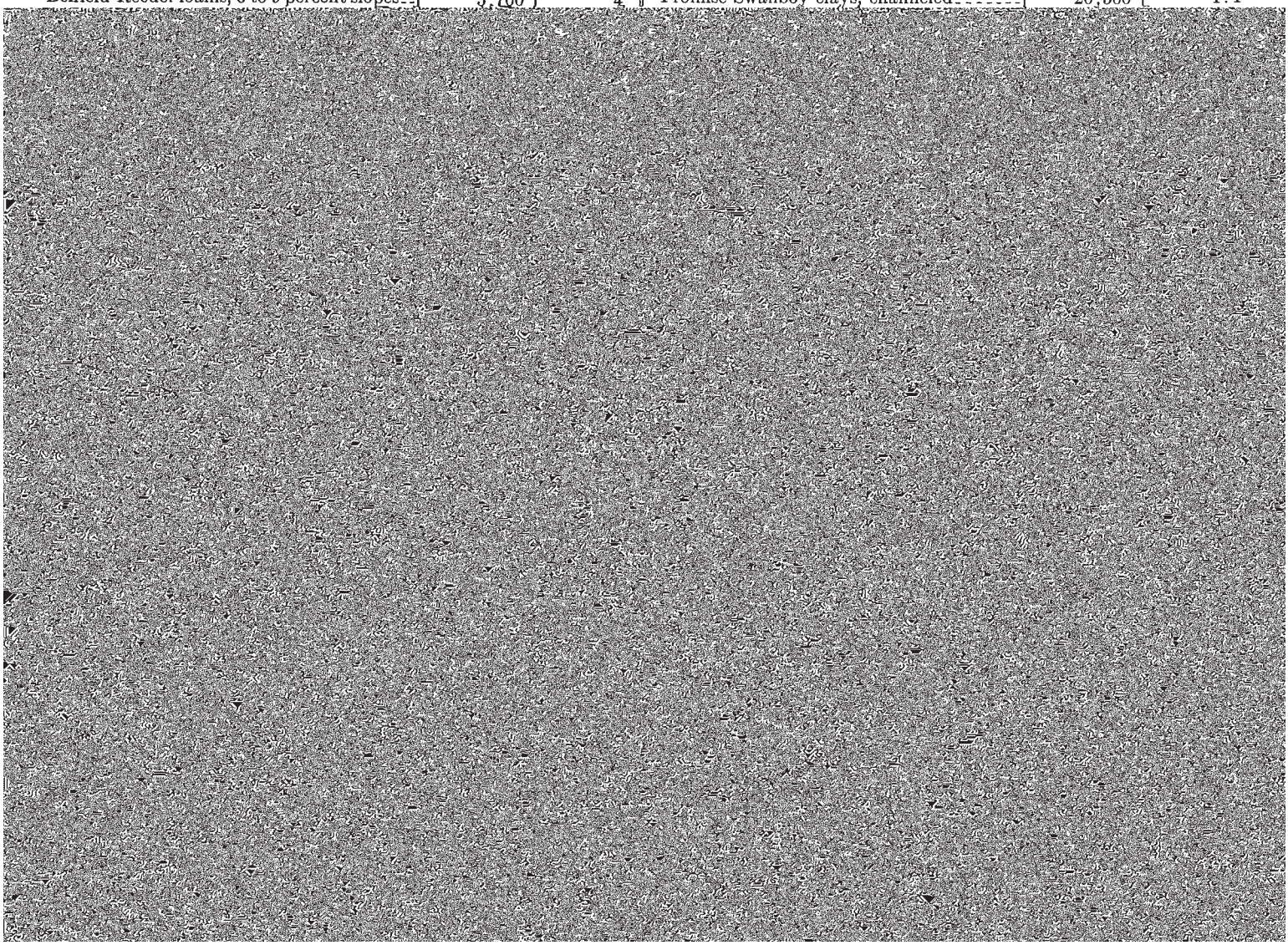


TABLE 1.—*Acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Absher silt loam, 0 to 2 percent slopes	12,900	0.9	Opal clay, 2 to 9 percent slopes	87,000	5.8
Absher-Slickspots complex, 0 to 2 percent slopes	1,360	.1	Opal-Hurley complex, 0 to 9 percent slopes	34,750	2.3
Agar silt loam, 2 to 6 percent slopes	5,200	.3	Opal-Promise clays, 1 to 4 percent slopes	3,050	.2
Archin-Slickspots complex, 2 to 9 percent slopes	5,200	.3	Opal-Sansarc clays, 6 to 15 percent slopes	84,500	5.6
Arvada-Slickspots complex, 0 to 3 percent slopes	7,300	.5	Opal-Slickspots complex, 2 to 6 percent slopes	6,100	.4
Belfield-Daglum silt loams, 0 to 2 percent slopes	8,100	.5	Parshall fine sandy loam	4,400	.3
Belfield-Reeder loams, 0 to 2 percent slopes	4,850	.3	Parshall-Ekalaka fine sandy loams	2,100	.1
Belfield-Reeder loams, 2 to 6 percent slopes	24,000	1.6	Promise clay, 0 to 2 percent slopes	17,100	1.1
Belfield-Reeder loams, 6 to 9 percent slopes	5,700	.4	Promise clay, 2 to 6 percent slopes	18,400	1.2
			Promise-Slickspots complex, 0 to 2 percent slopes	2,600	.2
			Promise-Swanboy clays, channeled	20,500	1.4



Most areas are in native grass and are used for range. Thin Claypan range site; capability unit VIs–1; windbreak group 10.

AcA—Absher-Slickspots complex, 0 to 2 percent slopes. This mapping unit is about 50 percent Absher soil, 40 percent Slickspots, and 10 percent other soils. Areas are irregular in shape and range from 10 to 300 acres in size. Slopes are mostly less than 2 percent, but in small included areas they are as much as 6 percent. The surface is uneven because many low mounds rise several inches above the low spots. The Absher soil is on the mounds, and Slickspots are in the low spots. The surface layer of the Absher soil is silt loam. In places it has been removed by soil blowing. Slickspots have a puddled or "slicked-over" surface and commonly have salts within a few inches of the surface.

Included with these soils in mapping were small areas of Daglum and Rhoades soils, both of which are on mounds.

These soils have poor tilth and take in water very slowly. Runoff typically ponds on the Slickspots and remains until the water evaporates. These soils are not suitable for cultivation. All areas are in native grass and are used for range. Little or no vegetation grows on Slickspots. Absher soil in Thin Claypan range site, capability unit VIs–1, windbreak group 10; Slickspots in capability unit VIIIs–3, not assigned to a range site or windbreak group.

Agar Series

The Agar series consists of deep, well-drained, gently sloping silty soils on uplands. These soils formed in silty loess. The native vegetation was mainly mid and short grasses.

In a representative profile the surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil, about 15 inches thick, is dark grayish-brown silty clay loam in the upper 2 inches, brown silty clay loam in the next 8 inches, and brown silt loam in the lower 5 inches. The upper part is very hard when dry and friable when moist. The underlying material is calcareous, light brownish-gray silt loam.

Agar soils are medium in fertility and moderate in content of organic matter. Runoff is medium, and permeability is moderate. Available water capacity is high.

Many areas are cultivated. Others are in native grass and are used for range and hay.

Representative profile of Agar silt loam, 2 to 6 percent slopes, in native grass, 200 feet east and 200 feet north of the southwest corner of sec. 24, T. 16 N., R. 30 E.

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak, very fine, granular structure; soft, very friable, slightly sticky; many roots; neutral; clear, irregular boundary.

B21t—6 to 8 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; very hard, friable, sticky; many roots; thin patchy clay films on faces of peds; neutral; gradual, wavy boundary.

B22t—8 to 16 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate, medium and coarse, prismatic structure parting to moderate, fine and medium, subangular blocky; very hard, friable, sticky; many roots; thin continuous clay films on faces of peds; neutral; gradual, wavy boundary.

B3—16 to 21 inches, brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium and coarse, prismatic structure parting to weak, medium, subangular blocky; hard, very friable, sticky; many roots; neutral; clear, smooth boundary.

C1ca—21 to 44 inches, light brownish-gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/3) moist; weak, medium, prismatic structure; hard, very friable, sticky; few roots; common fine segregations of lime; violent effervescence; mildly alkaline; clear, smooth boundary.

C2—44 to 60 inches, light brownish-gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/3) moist; massive, some vertical cleavage; slightly hard, very friable, sticky; few fine segregations of lime; violent effervescence; moderately alkaline.

Depth to free carbonates ranges from 16 to 26 inches. Depth to bedded shale or siltstone commonly is more than 60 inches, but in places soft shale or siltstone is at a depth of 40 to 60 inches. The A horizon is dark grayish brown or grayish brown and is 4 to 8 inches thick. The B2t horizon is silty clay loam or heavy silt loam having an average clay content of 25 to 35 percent. It ranges from 8 to 18 inches in thickness. In places the soil has a B3ca horizon. The C horizon is light brownish gray or pale brown in hue of 2.5Y or 10YR. It is silt loam or silty clay loam.

Agar soils are similar to Farland and Morton soils and are near Lowry and Reliance soils. They have a more silty C horizon than Farland soils and are deeper over bedrock than Morton soils. They contain more clay in the B horizon than Lowry soils and less clay than Reliance soils.

AgB—Agar silt loam, 2 to 6 percent slopes. This soil is on uplands and high terraces near Lake Oahe. It is dominantly gently sloping. Slopes are long and smooth. Areas are irregular in shape and range from 10 to 300 acres in size.

Included with this soil in mapping were small areas of Reliance soils on the lower parts of the landscape. Also included are small closed depressions less than 3 acres in size, which are identified by wet spot symbols on the soil map. These inclusions make up no more than 20 percent of any given area.

This Agar soil is easy to work and has high available water capacity. Controlling water erosion is the main concern in management.

About half the acreage is cultivated. Wheat, alfalfa, and corn are the main crops. Other areas are in native grass and are used for range and hay. Silty range site; capability unit IIe–1; windbreak group 3.

Archin Series

The Archin series consists of deep, well-drained, gently undulating to undulating loamy soils that have a claypan subsoil. These soils formed in alluvium and

coarse segregations of lime and gypsum; strong effervescence; mildly alkaline; gradual, wavy boundary.

C1—22 to 37 inches, grayish-brown (2.5Y 5/2) heavy fine sandy loam, dark grayish

and mid grasses and some forbs.

In a representative profile the surface layer is light brownish-gray silt loam about 2 inches thick. The subsoil, about 15 inches thick, is grayish-brown clay. The upper part is very hard when dry and firm when moist. The lower part is calcareous. The underlying material is gray calcareous clay.

Arvada soils are low in fertility and moderately low in content of organic matter. Runoff is medium, and permeability is very slow. Available water capacity is low or moderate.

Almost all areas are in native grass and are used for range.

Representative profile of Arvada silt loam, in an area of Arvada-Slickspots complex, 0 to 3 percent slopes, in native grass, 2,640 feet south and 2,140 feet west of the northeast corner of sec. 6, T. 11 N., R. 25 E.

A2—0 to 2 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak platy structure; slightly hard, friable, slightly sticky; many roots; neutral; abrupt, wavy boundary.

B2t—2 to 10 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, very coarse, columnar structure parting to weak, medium, subangular blocky; very hard, firm, sticky; few roots; neutral; gradual, wavy boundary.

B3—10 to 17 inches, grayish-brown (2.5Y 5/2) clay, dark gray (2.5Y 4/1) moist; weak, fine and medium, subangular blocky structure; extremely hard, very firm, sticky; few roots; slight effervescence;

flats. It is about 50 percent Arvada soil, 40 percent Slickspots, and 10 percent less extensive soils. Areas are irregular in shape and range from 20 to 500 acres in size. The Arvada soil, on very slight rises, is closely intermingled with Slickspots, which are in slightly depressed spots ranging up to 50 feet in diameter. The Arvada soil has a very thin surface layer of silt loam. Slickspots have a puddled or "slicked-over" surface and have salts within a few inches of the surface.

Included with these soils in mapping were small areas of Hurley and Swanboy soils, both of which are on slight rises.

The soils in this unit are not suitable for cultivation. They have very poor tilth and take in water very slowly. Runoff is medium and ponds on Slickspots until the water evaporates.

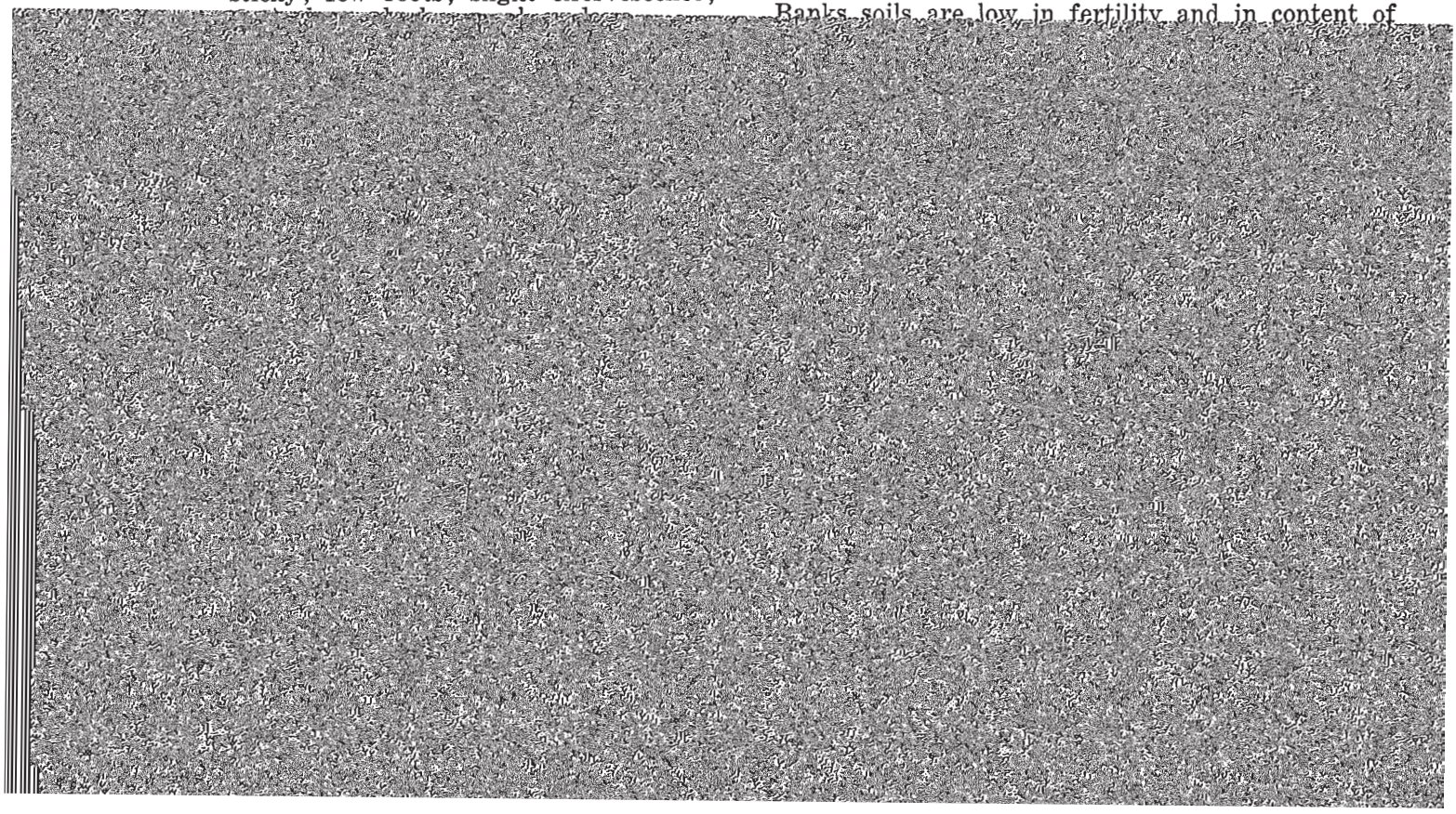
Almost all areas are in native grass and are used for range. Slickspots are bare or nearly bare of vegetation. Arvada soil in Thin Claypan range site, capability unit VIs–1, windbreak group 10; Slickspots in capability unit VIIIs–3, not assigned to a range site or windbreak group.

Banks Series

The Banks series consists of deep, somewhat excessively drained, nearly level sandy soils on low terraces and bottom lands. These soils formed in sandy alluvium. The native vegetation is mainly tall and mid grasses.

In a representative profile the surface layer is grayish-brown loamy fine sand about 5 inches thick. The underlying material is light brownish-gray, calcareous fine sand and sand.

Banks soils are low in fertility and in content of



in thickness. The C horizon commonly is stratified with thin lenses of finer or coarser textured material. In places thin strata of gravel are at depths below 30 inches.

Banks soils are more sandy than the nearby Havrelon and Trembles soils.

Belfield Series

The Belfield series consists of deep, well-drained, nearly level to undulating loamy soils on uplands. These soils formed in material weathered from siltstone and soft shale. The native vegetation was mainly mid and

4/2) moist; massive; hard, firm, very sticky; few roots; many fine segregations of lime; strong effervescence; mildly alkaline; clear boundary.

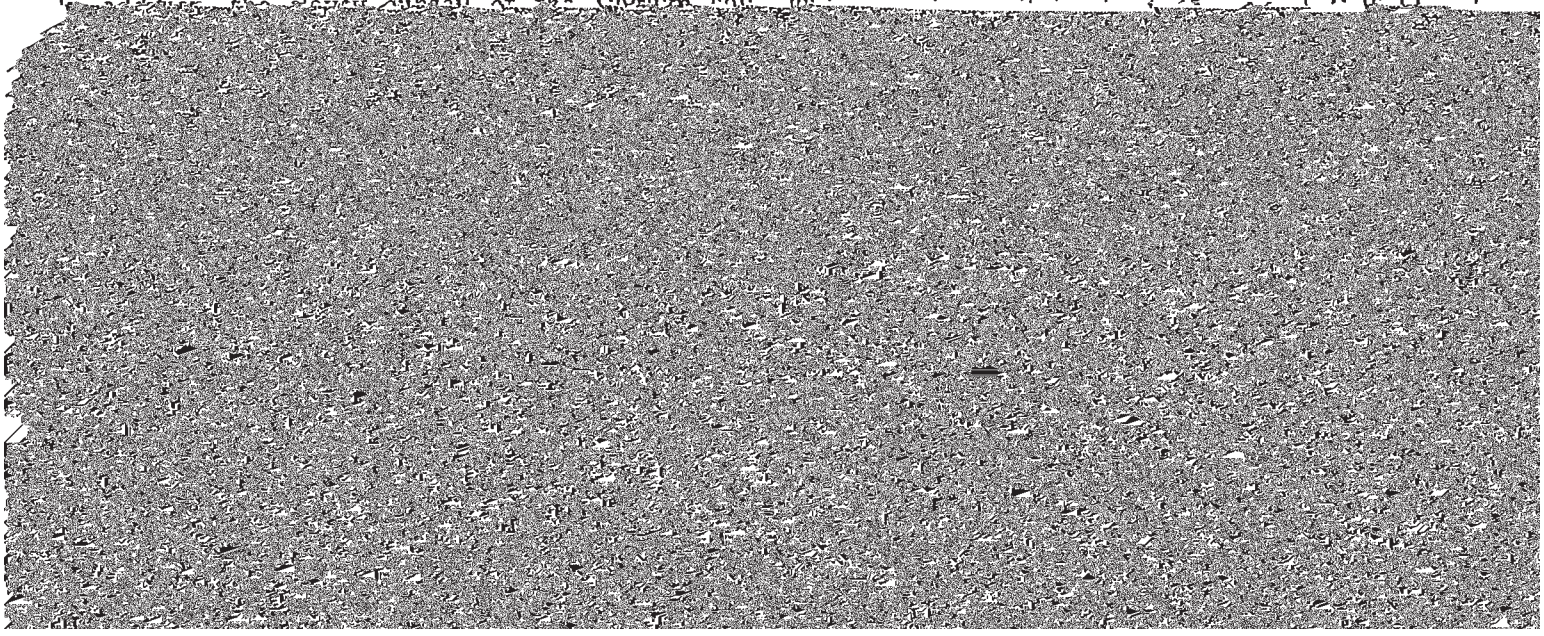
C2—41 to 60 inches, light brownish-gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky; few fine segregations of lime; strong effervescence; mildly alkaline.

Depth to carbonates ranges from 20 to 35 inches. The A1 horizon is grayish-brown or dark grayish-brown loam or silt loam. It ranges from 6 to 10 inches in thickness. The B&A horizon is gray to light brownish-gray heavy loam or clay loam 2 to 4 inches thick. The B2t horizon is dark grayish brown or grayish brown. It ranges from neutral to moderately alkaline in reaction and from 10 to 20 inches in thickness. Average clay content is 35 to 45 percent. Segregations of lime in the B3 horizon range from few to many. The B3ca and C horizons range from mildly alkaline to strongly alkaline.

Belfield soils are mapped with Daglum, Morton, and Reeder soils and are near Ridgeview soils. They have a thicker A horizon than Ridgeview soils and differ from those soils in having a B&A horizon. They have a more clayey B horizon than Morton and Reeder soils. They differ from Daglum soils in not having columnar structure.

BdA—Belfield-Daglum silt loams, 0 to 2 percent slopes. This mapping unit is on uplands in swales that range from 10 to 150 acres in size. It is about 60 percent Belfield soil, 20 percent Daglum soil, and 20 percent other soils. The Belfield soil is on slight rises. The Daglum soil is on the lower flatter parts of the landscape. The Belfield soil has a surface layer of silt loam, but otherwise has a profile similar to the one described as representative of the series. Included with these soils in mapping, in narrow bands at the edge of swales, were small areas of Farland, Morton, and Reeder soils.

Runoff is slow, and most areas receive extra moisture in the form of runoff from adjacent soils. Moisture penetrates the clayey subsoil in both soils slowly. In addition, the clayey subsoil of the Daglum soil



closed depressions, which are identified on the soil map by a wet spot symbol. Morton soils are on some of the slight rises.

Runoff is slow. The clayey subsoil of the Belfield soil takes in water slowly and releases it slowly to plants. Improving water intake and conserving moisture are the main concerns in farming.

Many areas of this unit are cultivated. Wheat, other small grain, and alfalfa are the main crops. Some corn is grown for silage. Other areas remain in native grass and are used for range and hay. Capability unit IIIs–1; Belfield soil in Clayey range site, windbreak group 4; Reeder soil in Silty range site, windbreak group 3.

BrB—Belfield-Reeder loams, 2 to 6 percent slopes. This mapping unit is about 45 percent Belfield soil, 40 percent Reeder soil, and 15 percent other soils. It is in irregularly shaped areas that range from 10 to several hundred acres in size. The Belfield soil is in the mid and lower parts of the landscape and has long, smooth slopes. Its profile is the one described as representative of the series. The Reeder soil, on the higher parts of the landscape, has shorter, more convex slopes. It has a clay loam subsoil, but otherwise has a profile similar to the one described as representative of the series.

Included with these soils in mapping were small areas of Absher, Daglum, Heil, and Morton soils. Absher and Daglum soils are mostly on the lower parts of the landscape along drainageways. Heil soils are in small, closed depressions, which are identified on the soil map by wet spot symbols. In some areas Morton soils are on the higher parts of the landscape.

The clayey subsoil of the Belfield soil takes in water slowly and releases it slowly to plants. Runoff is medium. Controlling erosion and improving water intake are the main concerns in management.

Many areas are cultivated. Wheat, other small grain, and alfalfa are the main crops. Some corn is grown for silage. Other areas are in native grass and are used for range and hay. Capability unit IIIe–3; Belfield soil in Clayey range site, windbreak group 4; Reeder soil in Silty range site, windbreak group 3.

BrC—Belfield-Reeder loams, 6 to 9 percent slopes.

soil in Clayey range site, windbreak group 4; Reeder soil in Silty range site, windbreak group 3.

Cabba Series

The Cabba series consists of shallow, well-drained to somewhat excessively drained, moderately steep to steep silty soils on uplands. These soils formed in material weathered from soft sandstone and siltstone. The native vegetation is mainly short and mid grasses.

In a representative profile the surface layer is dark grayish-brown silt loam about 2 inches thick. Next is a transitional layer of about 5 inches of grayish-brown silt loam. The underlying material to a depth of 17 inches is calcareous, light brownish-gray very fine sandy loam. Below this is light brownish-gray sandstone.

Cabba soils are low in fertility and in content of organic matter. Runoff is rapid, and permeability is moderate. Available water capacity is very low or low.

All areas are in native grass and are used for range.

Representative profile of Cabba silt loam, in an area of Cabba-Lantry silt loams, 15 to 25 percent slopes, in native grass, 10 feet south and 2,500 feet east of the northwest corner of sec. 24, T. 13 N., R. 23 E.

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; slightly hard, very friable, slightly sticky; many roots; neutral; abrupt, smooth boundary.

AC—2 to 7 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium, prismatic structure parting to moderate, medium and fine, granular; slightly hard, very friable, slightly sticky; many roots; neutral; clear, smooth boundary.

C1ca—7 to 17 inches, light brownish-gray (2.5Y 6/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, very friable, slightly sticky; few roots; few fine segregations of lime; violent effervescence; mildly alkaline; clear smooth boundary.

C2ca—17 to 23 inches, light brownish-gray (2.5Y soft sandstone, dark grayish brown (2.5Y 4/2) moist; massive, crushes easily; many fine segregations of lime; strong effervescence; mildly alkaline; gradual, smooth boundary.

the C horizon has indistinct to very distinct bedding planes.

Cabba soils are mapped with Lantry soils and are near Flasher, Morton, and Wayden soils. They are less sandy than Flasher soils. They are shallower over bedrock than Lantry and Morton soils. They contain less clay than Wayden soils.

CbE—Cabba-Lantry silt loams, 15 to 25 percent slopes. This mapping unit is on upland ridges and the sides of entrenched drainageways. It is about 50 percent Cabba soil, 35 percent Lantry soil, and 15 percent less extensive soils. Areas are irregular in shape and range from 20 to several hundred acres in size. The Cabba soil is on the higher parts of the landscape. It has the profile described as representative of the series. The Lantry soil commonly is below the Cabba soil on the middle parts of the landscape.

Included with these soils in mapping were small areas of Moreau, Morton, and Wayden soils. Moreau and Wayden soils are on the lower parts of the landscape that are underlain by clayey shale. Morton soils are in the lower parts of some areas and also on smooth ridgetops.

The soils in this unit are not suitable for cultivation. They are low in fertility and have very low or low available water capacity. Runoff is rapid and the soils erode easily.

All areas are in native grass and are used for range. Capability unit VIIs–1, windbreak group 10; Cabba soil in Shallow range site, Lantry soil in Thin Upland range site.

CbF—Cabba-Lantry silt loams, 25 to 40 percent slopes. This mapping unit is mainly on the upper part of the breaks along the Moreau River and its tributaries. It is about 65 percent Cabba soil, 20 percent Lantry soil, and 15 percent less extensive soils. Areas are irregular in shape and range from 20 to several hundred acres in size. Slopes commonly are short and convex (fig. 8). The Cabba soils are on the tops and upper sides of ridges. The Lantry soils are on the mid and lower parts of the landscape. The profiles of both soils are shallower over sandstone than the ones described as representative of their respective series.

Included with these soils in mapping were small areas of Moreau, Morton, and Wayden soils. Moreau and Wayden soils are on the lower parts of the landscape that are underlain by clayey shale. Morton soils are in the lower parts of some areas and are also on flattened ridgetops.

The soils in this unit are not suitable for cultivation. They are low in fertility and have very low or low available water capacity. Runoff is rapid, and the risk of erosion is very severe.

All areas are in native grass and are used for range.

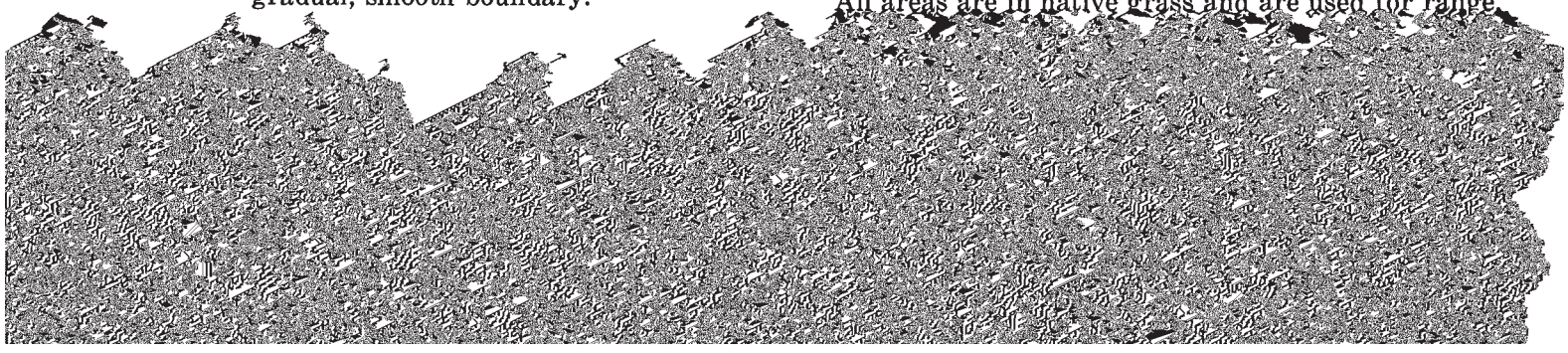


Figure 8.—**An area of Cabba-Lantry silt loams, 25 to 40 percent slopes.**

terraces. The native vegetation was mainly mid and short grasses.

In a representative profile the surface layer is grayish-brown loam about 6 inches thick. The subsoil, about 20 inches thick, is dark grayish-brown clay loam in the upper 8 inches, grayish-brown clay loam in the next 8 inches, and grayish-brown gravelly loam in the lower 4 inches. The upper part is hard when dry and firm when moist. The lower part is calcareous. The underlying material is calcareous, multicolored gravel and coarse sand.

Canning soils are medium in fertility and moderate in content of organic matter. Runoff is slow. Permeability is moderate in the subsoil and rapid in the underlying gravel and sand. Available water capacity is low or moderate.

About half the acreage is cultivated. Other areas are in native grass and are used for range.

Representative profile of Canning loam, 0 to 2 percent slopes, in native grass, 200 feet north and 500 feet west of the southeast corner of sec. 17, T. 15 N., R. 26 E.

A1—0 to 6 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, very fine and fine, granular structure; slightly hard, friable, sticky; common roots; slightly acid; clear, wavy boundary.

B21t—6 to 14 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to weak, fine and medium, subangular blocky; hard, firm, sticky and plastic; common roots; thin patchy clay films; neutral; gradual, wavy boundary.

B22t—14 to 22 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, prismatic structure parting to weak, fine, subangular blocky; very hard, firm, very sticky and plastic; common roots; thin patchy clay films; slight effervescence; neutral; clear, wavy boundary.

B3ca—22 to 26 inches, grayish-brown (2.5Y 5/2) gravelly loam, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure parting to weak, fine, subangular blocky; slightly hard, very friable, slightly sticky; few roots; thin

patchy clay films; few fine segregations of lime and salt; slight effervescence; mildly alkaline; abrupt, wavy boundary.

IIC—26 to 60 inches, multicolored gravel and coarse sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose; few fine segregations of lime and salt; slight effervescence; mildly alkaline.

Depth to gravel and sand ranges from 20 to 40 inches. The A horizon is grayish-brown or dark grayish-brown loam or silt loam and ranges from 4 to 8 inches in thickness. In places the B21t horizon is silty clay loam. The B22t horizon ranges from grayish brown to light yellowish brown in hue of 2.5Y or 10YR. In places few to many segregations of lime are concentrated in the B3ca or C1ca horizon. In places the gravel and sand in the IIC horizon contain angular fragments of sandstone or siltstone.

Canning soils are deeper over gravel and sand than the nearby Schamber soils.

CdA—Canning loam, 0 to 2 percent slopes. Areas of this nearly level soil are irregular in shape and range from 10 to 400 acres in size. Slopes are smooth and level. In places the subsoil is less clayey than is typical, and the underlying material contains more sand.

Included with this soil in mapping were small areas of Absher and Daglum soils in low areas or in slightly depressed swales. Also included was a soil that has a more clayey subsoil and is more than 40 inches deep over sand and gravel.

This Canning soil is medium in fertility and is easy to work. It is somewhat droughty because it is underlain by sand and gravel. Runoff is slow. Conserving moisture and controlling soil blowing are the main concerns in farming.

About half the acreage is cultivated. Small grain, alfalfa, and corn are the main crops. Small grain is better suited than corn. Other areas are in native grass and are used for range and hay. Silty range site; capability unit IIIs–2; windbreak group 6.

Chantier Series

The Chantier series consists of shallow, well-drained, gently sloping to strongly sloping, calcareous clayey soils on uplands. These soils formed in material weathered from the underlying shale. The native vegetation was mainly a sparse stand of mid grasses.

In a representative profile the surface layer is dark grayish brown (2.5Y 4/2) moist; weak, fine and very fine, granular structure; very hard, firm, sticky and plastic; few roots; strong effervescence; mildly alkaline; clear, wavy boundary.

B2—2 to 6 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, medium, blocky structure; extremely hard, extremely firm, very sticky and plastic; few roots; strong effervescence; mildly alkaline; clear, irregular boundary.

B3cssa—6 to 11 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, blocky structure; extremely hard, extremely firm, very sticky and plastic; few roots; many fine segregations of gypsum and other salts; strong effervescence; moderately alkaline, clear, wavy boundary.

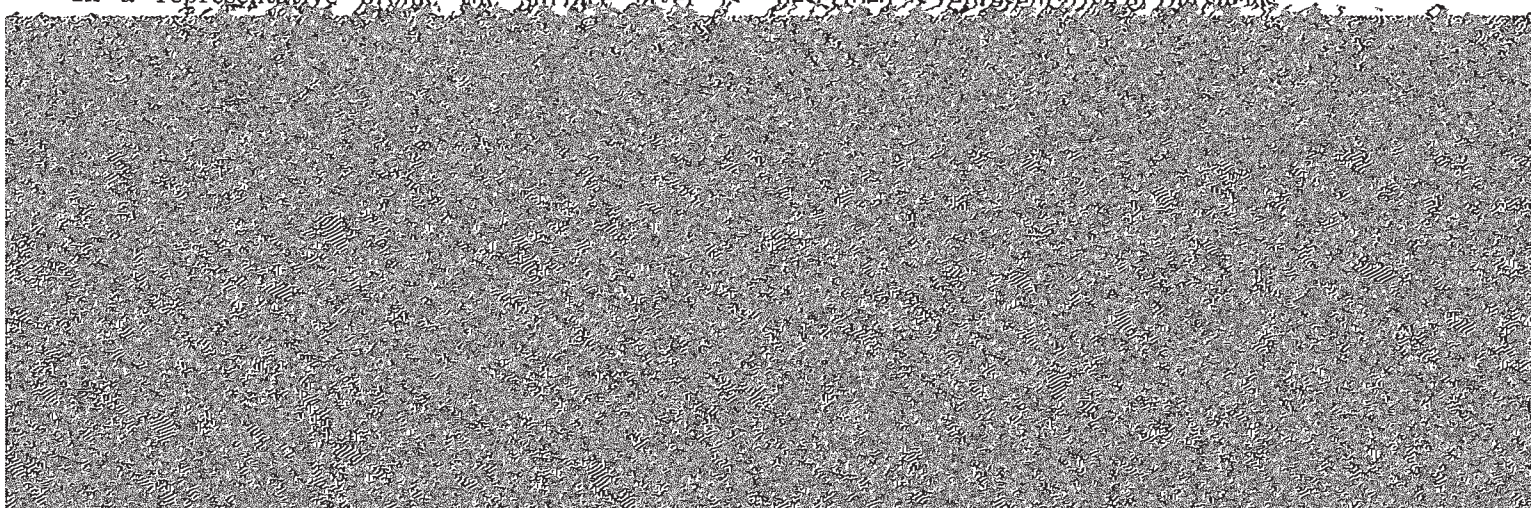
C1—11 to 16 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; few roots; few fine segregations of gypsum and other salts; violent effervescence; mildly alkaline; abrupt, irregular boundary.

C2—16 to 60 inches, multicolored platy shale; strong effervescence along seams and fractures; mildly alkaline.

Depth to shale ranges from 10 to 20 inches. In some places the B and C horizons are as much as 25 percent fine fragments of shale. The A1 horizon is grayish brown or light brownish gray in hue of 2.5Y or 10YR. It is 1 to 3 inches thick. The B2 horizon ranges from grayish brown to light olive gray in hue of 2.5Y or 5Y. It ranges from mildly alkaline to strongly alkaline in reaction and from 4 to 8 inches in thickness. The C horizon ranges from neutral to strongly alkaline.

Chantier soils are near Dupree, Sansarc, and Swanboy soils. They contain more salts nearer the surface than Dupree and Sansarc soils. They are shallower over shale than Swanboy soils.

ChB—Chantier clay, 2 to 9 percent slopes. This gently sloping to sloping soil is irregular in shape and ranges from 30 to 300 acres in size. Slopes commonly are long and concave, but are short and convex between gullies that dissect the areas. This soil has the profile described as representative of the series.

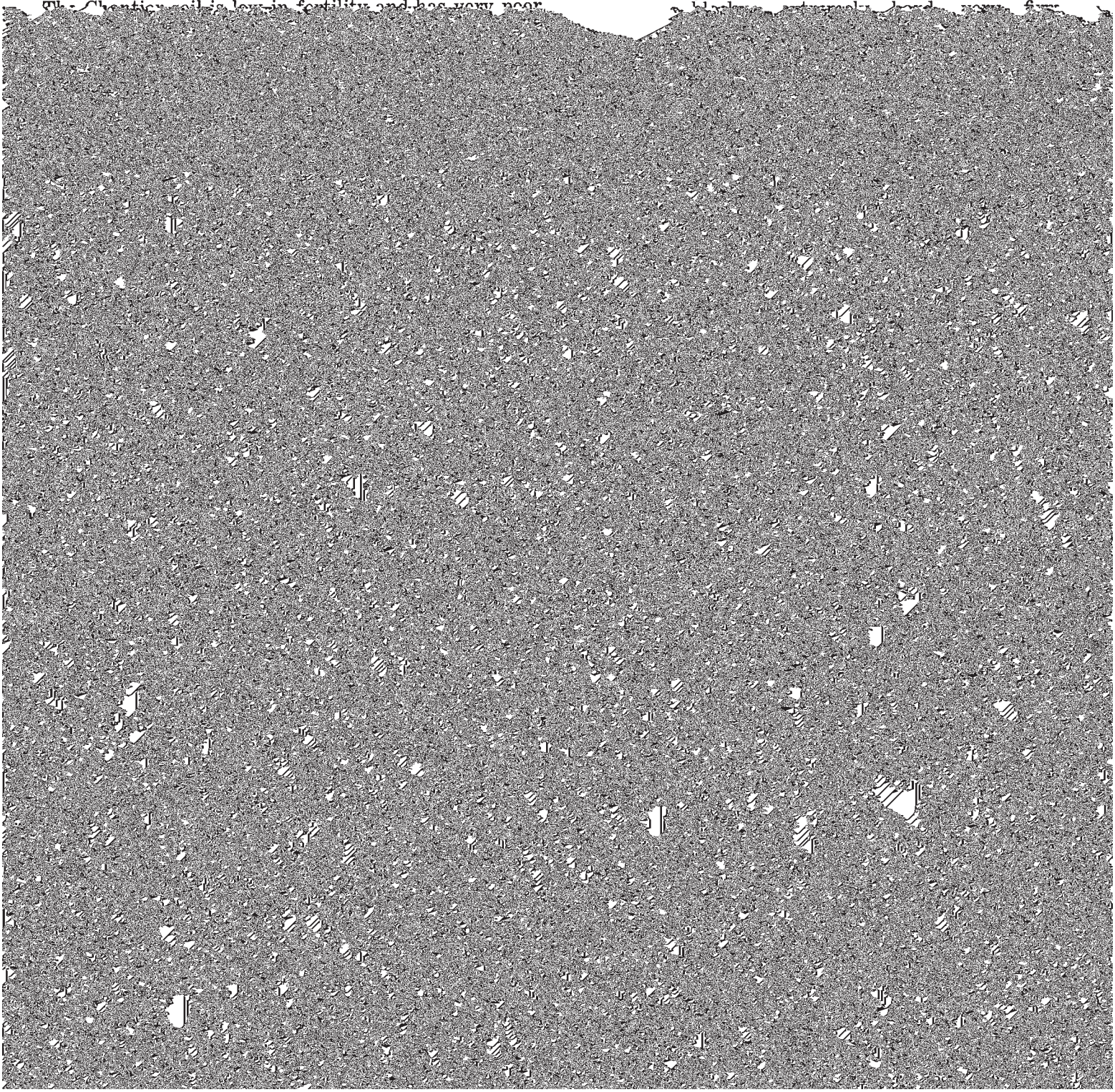


shape and 40 to 400 acres in size. Many gullies up to 10 feet wide and about 3 feet deep have formed. The profile of this Chantier soil commonly is shallower over shale than the one described as representative of the series. Shale land is on the higher parts of the landscape around the heads and on the shoulders of drainageways and gullies. In these areas shale is at or near the surface.

This mapping unit is not suitable for cultivation. The Chantier soil is low in fertility and has very poor

columnar structure parting to moderate, medium, blocky; extremely hard, very firm, sticky; common roots; thin patchy clay films; neutral; clear, wavy boundary.

B22t—16 to 21 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to moderate, coarse and medium,



and water intake and conserving moisture are the main concerns in management.

Many areas are in native grass and are used for range. Some areas are cultivated. Small grain and alfalfa are the main crops. Claypan range site; capability unit IVs–2; windbreak group 9.

Dupree Series

The Dupree series consists of shallow, well-drained

Depth to bedded shale ranges from 10 to 20 inches. The horizons above the shale range from medium acid to mildly alkaline. The A horizon ranges from dark gray to light olive gray in hue of 10YR, 2.5Y, or 5Y. It is clay or silty clay 2 to 4 inches thick. The B2 horizon ranges from dark gray to light olive gray or light brownish gray in hue of 5Y or 2.5Y. It is 5 to 25 percent fine fragments of shale. The B3 horizon is clay or shaly clay.

Dupree soils are near Chantier soils and are mapped

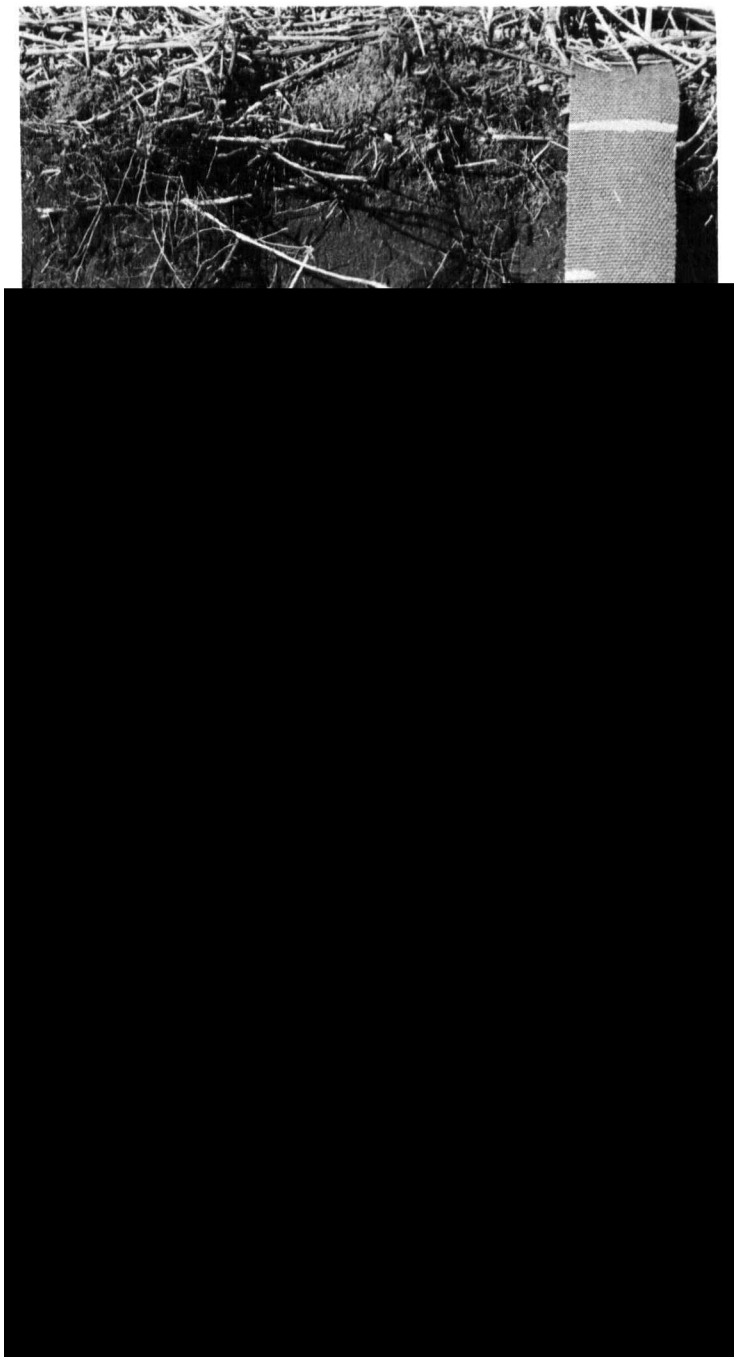


Figure 9.—**An extremely hard claypan is at a depth of about 18 inches in Ekalaka fine sandy loam, 0 to 6 percent slopes. Numbers on the tape are in feet.**

is grayish-brown fine sandy loam about 14 inches thick. The subsurface layer is light-gray loamy fine sand about 4 inches thick. The subsoil, about 20 inches

underlying material is calcareous, light brownish-gray fine sandy loam.

Ekalaka soils are medium in fertility and moderate in content of organic matter. Runoff is slow to medium, and permeability is slow. Available water capacity is low or moderate.

Some areas are cultivated. Other areas are in native grass and are used for range.

Representative profile of Ekalaka fine sandy loam, 0 to 6 percent slopes, in native grass, 2,620 feet west and 100 feet north of the southeast corner of sec. 8, T. 17 N., R. 22 E.

A11—0 to 7 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak subangular blocky structure; slightly hard, very friable, slightly sticky; common roots; medium acid; gradual, smooth boundary.

A12—7 to 14 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, very coarse, prismatic structure parting to weak subangular blocky; soft, very friable; common roots; slightly acid; gradual, smooth boundary.

A2—14 to 18 inches, light-gray (2.5Y 7/2) loamy fine sand, grayish brown (10YR 5/2) moist; weak subangular blocky structure; soft, loose; few roots; mildly alkaline; abrupt, wavy boundary.

B21t—18 to 21 inches, light brownish-gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; strong, very coarse, columnar structure; extremely hard, friable; uncoated sand grains coat upper part of peds, clay bridging between sand grains; few roots; moderately alkaline; abrupt, wavy boundary.

B22tca—21 to 26 inches, light brownish-gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; moderate, very coarse, prismatic structure; very hard, friable; few roots; clay bridging between sand grains; common fine segregations of lime and other salts; strong effervescence; moderately alkaline; clear, wavy boundary.

B3ca—26 to 38 inches, light brownish-gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; weak, very coarse, prismatic structure; hard, very friable; many fine segregations of lime and other salts; strong effervescence; strongly alkaline; gradual boundary.

C—38 to 60 inches, light brownish-gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; weak platy structure; slightly hard, very friable; few fine segregations of lime and other salts;

2.5Y and is loamy fine sand or fine sandy loam. The A horizon ranges from 10 to 20 inches in thickness. The B2t horizon is grayish brown to pale olive in hue of 10YR, 2.5Y, or 5Y. It ranges from 7 to 15 inches in thickness. The B21t horizon has coarse or very coarse columnar structure. If dry, this horizon is extremely hard or very hard. In places the C horizon is loamy fine sand.

Ekalaka soils are mapped with Parshall soils and are near Archin, Rhoades, Vebar, and Tally soils. They have a thicker A horizon and a more sandy B2t horizon than Archin and Rhoades soils. In contrast with Parshall, Tally, and Vebar soils, they have a distinct A2 horizon and a columnar structured B2t horizon.

EkA—Ekalaka fine sandy loam, 0 to 6 percent slopes. This soil is in irregularly shaped areas that range from 20 to 600 acres in size. Slopes are plane to slightly convex. Low hummocks caused by soil blowing have formed in some cultivated areas. This Ekalaka soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Archin and Tally soils. Archin soils are in low spots up to 10 acres in size. Tally soils are on some of the rises that face southeast. These included soils make up less than 20 percent of any given area.

This Ekalaka soil is easy to work, but is subject to soil blowing. The claypan subsoil takes in water slowly and restricts roots. Runoff is slow. Controlling soil blowing is the main concern in farming.

Some areas are cultivated. Spring wheat, oats, and alfalfa are the main crops. Other areas are in native grass and are used for range. Sandy range site; capability unit IVe–13; windbreak group 5.

EkC—Ekalaka fine sandy loam, 6 to 9 percent slopes. This sloping soil is on upland ridges. Areas are oval in shape and range from 15 to 100 acres in size. Slopes are convex. The surface layer is thinner than in the profile described as representative of the series.

Included with this soil in mapping were small areas of Archin, Tally, and Vebar soils. Archin soils are intermingled with Ekalaka soils. Tally and Vebar soils commonly are on the southeast side of some of the ridges. These included soils make up less than 15 percent of any given area.

This Ekalaka soil is easy to work, but is highly susceptible to soil blowing and erosion. It is not suitable for cultivation. Runoff is medium.

Most areas are in native grass and are used for range. Sandy range site; capability unit VIe–6; windbreak group 10.

Farland Series

The Farland series consists of deep, well-drained, nearly level to gently sloping silty soils on high terraces and uplands. These soils formed in alluvium. The native vegetation was mainly mid and short grasses.

In a representative profile the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsoil, about 17 inches thick, is grayish-brown clay loam in the upper 3 inches, light brownish-gray clay loam in the next 8 inches, and light brownish-gray loam in the lower 6 inches. The upper part is very hard when dry and firm when moist. The underlying material is light-gray, calcareous loam to a depth of 44 inches. Below this is light brownish-gray, calcareous very fine sandy loam.

Farland soils are medium in fertility and moderate in content of organic matter. Runoff is slow or medium, and permeability is moderate. Available water capacity is high.

Most areas are cultivated. A few areas are in native grass and are used for range.

Representative profile of Farland silt loam, 0 to 2 percent slopes, in cropland, 1,300 feet south and 150 feet west of the northeast corner of sec. 18, T. 12 N., R. 22 E.

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; slightly hard, very friable, sticky; slightly acid; abrupt, smooth boundary.

A12—5 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to weak, fine and medium, subangular blocky; hard, friable, sticky; slightly acid; clear, wavy boundary.

B21t—8 to 11 inches, grayish-brown (10YR 5/2) light clay loam, dark grayish brown (10YR 4/2) moist; moderate, fine and medium, prismatic structure parting to weak, fine and medium, subangular blocky; very hard, firm, very sticky and plastic; thin patchy clay films; neutral; gradual, wavy boundary.

B22t—11 to 19 inches, light brownish-gray (2.5Y 6/2) light clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure parting to weak, medium and coarse, subangular blocky; very hard, friable, sticky and plastic; mildly alkaline; gradual, wavy boundary.

B3—19 to 25 inches, light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak, coarse, prismatic structure; slightly hard, friable, sticky; slight effervescence; neutral; clear boundary.

C1ca—25 to 44 inches, light-gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, sticky; few fine segregations of lime; strong effervescence; mildly alkaline; diffuse boundary.

C2—44 to 60 inches, light brownish-gray (2.5Y 6/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, sticky; few fine segregations of lime; strong effervescence; mildly alkaline.

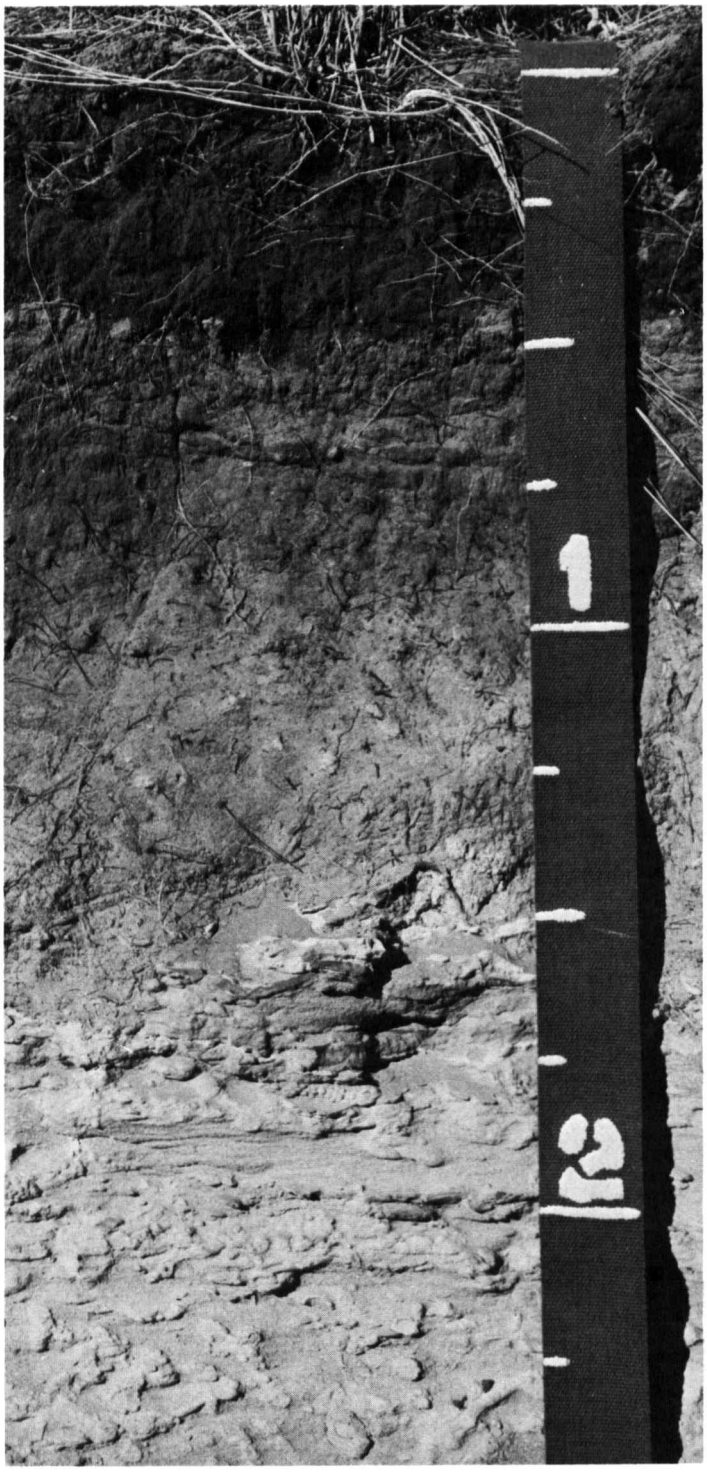
Depth to bedrock commonly is more than 60 inches, but in some places ranges from 40 to 60 inches. Depth to free carbonates ranges from 16 to 30 inches. In places the A horizon is grayish brown. The B2t horizon ranges from grayish brown to light yellowish brown. It is loam, clay loam, or silty clay loam 8 to 16 inches thick. The C horizon ranges from loam to sandy loam.

Farland soils are mapped with Morton soils and are

near Agar, Reeder, and Shambo soils. They have a less silty C horizon than Agar soils and are deeper over bedrock than Morton and Reeder soils. Their B horizon

Nearly all areas are in native grass and are used for range.

Representative profile of Flasher loamy fine sand in



as representative of the series, but in places along the crests of ridges it is underlain by cemented sandstone. The surface layer is loamy fine sand. The Vebar soil is on the lower parts of the landscape. It commonly has slopes of less than 10 percent. The surface layer is fine sandy loam.

Included with these soils in mapping were small areas of Parshall and Tally soils. Parshall soils are in swales. Tally soils are intermingled with Vebar soils.

Runoff is slow on the Flasher soil and medium on the Vebar soil. The Flasher soil is not suitable for cultivation. It is low in fertility and is droughty. The Vebar soil is medium in fertility and has low available water capacity. Controlling soil blowing and erosion is the main concern in management.

Most areas are in native grass and are used for range. A few areas are cultivated. Capability unit VIe–10; Flasher soil in Shallow range site, windbreak group 10; Vebar soil in Sandy range site, windbreak group 5.

FvE—Flasher-Vebar complex, 15 to 25 percent slopes. This mapping unit is about 70 percent Flasher soil, 25 percent Vebar soil, and 5 percent less extensive soils. Areas are irregular in shape and range from 20 to 900 acres in size. They occur as upland ridges and the valley sides of entrenched drainageways. The Flasher soil is on the higher parts of the landscape. It has a surface layer of loamy fine sand. Fragments of sandstone are scattered on the surface, and in places the underlying sandstone is cemented. The Vebar soil is on the lower parts of the landscape. It has a surface layer of fine sandy loam, and sandstone commonly is

organic matter. Runoff is very slow, and permeability is slow. Available water capacity is moderate. Depth to the water table ranges from 12 to 36 inches, and the soils have a high content of salts.

Most areas are in native vegetation and are used for range.

Representative profile of Glenross fine sandy loam, in native grass, 1,160 feet north and 630 feet east of the southwest corner of sec. 31, T. 17 N., R. 24 E.

A2—0 to 1 inch, light-gray (2.5Y 7/2) fine sandy loam, dark gray (10YR 4/1) moist; massive; soft, very friable; common roots; slight effervescence; moderately alkaline; abrupt, wavy boundary.

B2t—1 to 6 inches, light brownish-gray (2.5Y 6/2) sandy clay loam, grayish brown (2.5Y 5/2) moist; many, medium, faint mottles of light olive brown (2.5Y 5/6) moist; moderate, coarse and very coarse, columnar structure; very hard, firm, sticky; common roots; strong effervescence; strongly alkaline; gradual, wavy boundary.

B3sa—6 to 16 inches, light yellowish-brown (2.5Y 6/3) sandy clay loam, light olive brown (2.5Y 5/3) moist; weak, very coarse, prismatic structure parting to weak, coarse, subangular blocky; hard, firm, very sticky; few roots; common fine segregations of salt; violent effervescence; very strongly alkaline; gradual, wavy boundary.

C1sa—16 to 42 inches, light olive-gray (5Y 6/2) sandy clay loam, olive gray (5Y 5/2) moist; many, coarse, prominent mottles of strong brown (7.5YR 5/6) dry and moist; massive; very hard, firm, sticky; few roots to depth of 21 inches; common medium nests and striations of salt; violent effervescence; very strongly alkaline; clear, wavy boundary.

IIC2—42 to 60 inches, olive-yellow (2.5Y 6/6) and light olive-gray (5Y 6/2) loamy fine sand, light olive brown (2.5Y 5/6) and olive gray (5Y 5/2) moist; massive; hard, very friable; strong effervescence; very strongly alkaline.

Fragments of sandstone up to 2 inches in diameter commonly are scattered throughout the profile. The A horizon ranges from gray to light gray in hue of 10YR or 2.5Y. It is fine sandy loam or loamy fine sand 2 inches or less thick. The B2t horizon ranges from gray to light brownish gray in hue of 10YR or 2.5Y. It ranges from 3 to 10 inches in thickness. Mottles are faint or distinct. Texture commonly is sandy clay loam, but ranges from fine sandy loam to clay loam. The B3 and C horizons range from grayish brown to yellow. The B3 and C1 horizons are fine sandy loam, loam, or sandy clay loam. The C2 horizon is fine sandy loam or loamy fine sand. In some places it contains sandstone boulders ranging up to 3 feet in diameter.

Glenross soils are mapped with Regan soils and are near Ekalaka, Heil, Parshall, and Vebar soils. They are more poorly drained and more salty than Ekalaka, Parshall, and Vebar soils. They are less clayey and more salty in the B horizon than Heil soils. In contrast with Regan soils, they have a columnar structured B2t horizon.

Gb—Glenross fine sandy loam (0 to 2 percent slopes). This nearly level soil is in basins and swales on uplands. It occurs as long, irregular areas 10 to 300 acres in size. Slopes are plane to slightly concave. The surface is uneven because of scattered low spots. Drainageways are ill defined. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Heil, Parshall, Regan, and Vebar soils and Slickspots. Heil soils are in closed depressions less than 3 acres in size. Parshall and Vebar soils are at the edge of the areas. Regan soils and Slickspots are in the small low spots. These included soils make up less than 20 percent of any given area.

This Glenross soil is not suitable for cultivation. It is high in salts and is low in fertility. Runoff is very slow, and the water table fluctuates between depths of 12 and 36 inches.

Most areas are in native vegetation and are used for range. Saline Lowland range site; capability unit VIw–4; windbreak group 10.

Gr—Glenross-Regan fine sandy loams (0 to 2 percent slopes). This mapping unit is about 60 percent Glenross soil, 35 percent Regan soil, and 5 percent other soils. Areas are irregular in shape and range from 15 to 200 acres in size. They are along ill-defined drainageways and around Intermittent lakes. Slopes are plane to slightly concave. The surface is uneven because low mounds rise a few inches above the intervening low areas. The two soils are closely intermingled, but the Regan soil commonly is in the low areas. This Regan soil has the profile described as representative of the series.

Included with these soils in mapping were small areas of Heil and Parshall soils and Slickspots. Heil soils are in closed depressions. Parshall soils are at the edge of the areas. Slickspots are in small low spots where salt is at or near the surface.

These soils are not suitable for cultivation. They contain salts and have low fertility. Runoff is very slow, and the water table fluctuates between depths of 12 and 36 inches.

Most areas are in native vegetation and are used for range. Capability unit VIw–4; windbreak group 10; Glenross soil in Saline Lowland range site, Regan soil in Subirrigated range site.

Havrelon Series

The Havrelon series consists of deep, moderately well drained and well drained, nearly level, calcareous loamy soils on bottom land and low terraces. These soils formed in stratified alluvium. The native vegetation is mainly tall and mid grasses.

In a representative profile the surface layer is grayish-brown loam about 9 inches thick. The underlying material is grayish-brown calcareous loam and clay loam thinly stratified with very fine sand.

Havrelon soils are low in fertility and moderately low in content of organic matter. Runoff is slow, and permeability is moderate. Available water capacity is high. These soils receive additional moisture in the

form of runoff from nearby sloping soils. They also are subject to flooding from stream overflow in some years.

Most areas are in native grass and are used for range. Stringers of native trees and shrubs along stream channels provide wildlife habitat. A few small areas are cultivated.

The Havrelon soils in Dewey County are mapped only with Lohler and Trembles soils.

Representative profile of Havrelon loam in an area of Trembles-Havrelon complex, in native grass, 180 feet south and 2,510 feet west of the northeast corner of sec. 29, T. 15 N., R. 26 E.

A1—0 to 9 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak subangular blocky structure; slightly hard, very friable, slightly sticky; common roots; slight effervescence; neutral; clear, smooth boundary.

C1—9 to 38 inches, grayish-brown (2.5Y 5/2) loam stratified with thin lenses of very fine sand, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; hard, friable, sticky; common roots to 15-inch depth, few roots to 38-inch depth; slight effervescence; mildly alkaline; clear, smooth boundary.

C2—38 to 60 inches, grayish-brown (2.5Y 5/2)

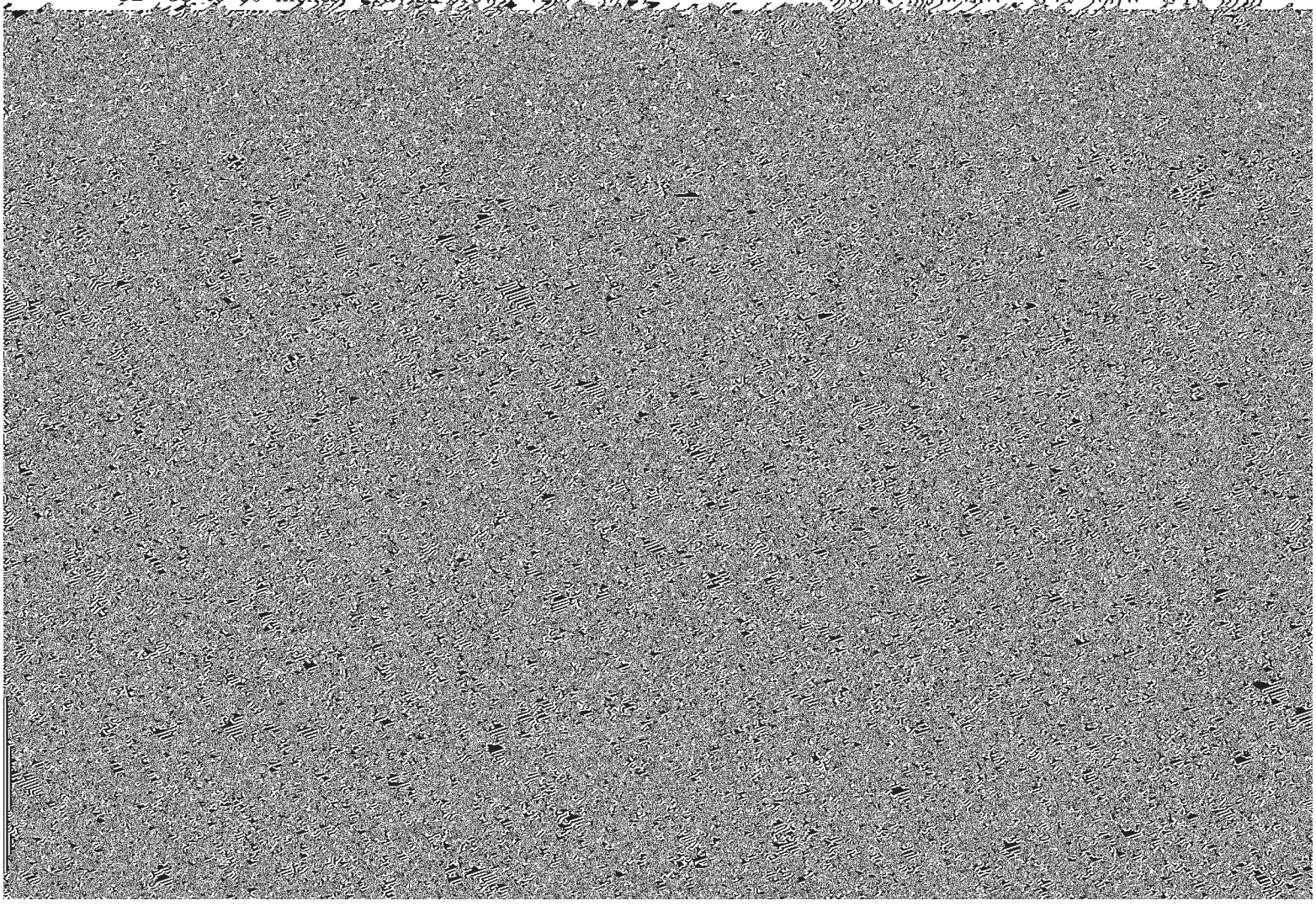
1,650 feet west of the northeast corner of sec. 5, T. 12 N., R. 25 E.

A2—0 to 2 inches, gray (10YR 6/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate, fine, granular structure; hard, friable, very sticky and plastic; many roots; medium acid; abrupt, wavy boundary.

B21t—2 to 8 inches, gray (5Y 5/1) clay, very dark gray (2.5Y 3/1) moist; moderate, coarse, columnar structure parting to strong, medium, blocky; extremely hard, extremely firm, very sticky and plastic; columns coated with bleached very fine sand grains; few roots; slightly acid; gradual, wavy boundary.

B22t—8 to 24 inches, gray (2.5Y 5/1) clay, very dark gray (2.5Y 3/1) moist; moderate, coarse, prismatic structure parting to strong, coarse, blocky; extremely hard, extremely firm, very sticky and plastic; patchy coats of bleached silt and very fine sand grains on prisms; few roots; neutral; gradual, wavy boundary.

B3—24 to 31 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; weak, coarse, blocky structure; very hard, very firm



slowly. Tilth is very poor. These soils are not suitable for cultivation.

All areas are in native grass and are used for range and hay. Closed Depression range site; capability unit VIs–1; windbreak group 10.

Hurley Series

The Hurley series consists of moderately deep, moderately well drained and well drained, nearly level to sloping silty soils that have a claypan subsoil. These soils are on uplands. They formed in material weathered from the underlying clay shale. The native vegetation is mainly mid and short grasses.

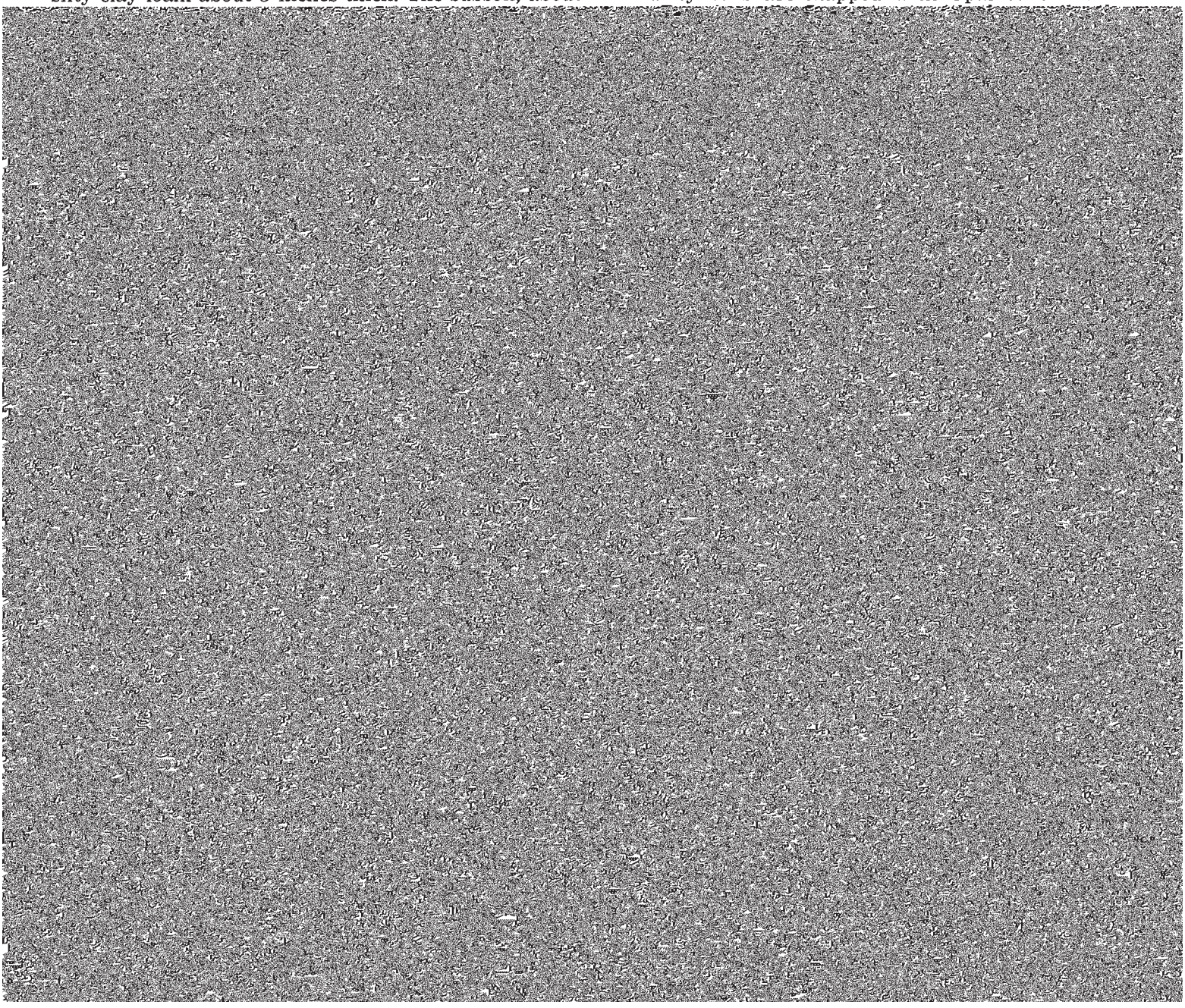
In a representative profile the surface layer is gray silty clay loam about 3 inches thick. The subsoil, about

and plastic; many fragments of shale; strong effervescence; mildly alkaline; gradual, smooth boundary.

C3—34 to 60 inches, light brownish-gray and dark-gray bedded shale; slight effervescence on faces of shale plates in upper part; mildly alkaline.

Depth to bedded shale commonly ranges from 30 to 40 inches, but in some places is more than 40 inches. The B and C horizons range from mildly alkaline to strongly alkaline. The A horizon ranges from gray to light brownish gray in hue of 10YR or 2.5Y. It is silty clay loam or silt loam and 1 to 4 inches thick. The B2t horizon ranges from dark gray to grayish brown in hue of 10YR or 2.5Y. Structure in the B2t horizon is moderate or strong.

Hurley soils are mapped with Opal soils and are



Lantry Series

The Lantry series consists of moderately deep, well-drained, gently undulating to steep silty soils on uplands. These soils formed in material weathered from sandstone, siltstone, or loamy shale. The native vegeta-

(2.5Y 5/2) moist; few roots in upper part; strong effervescence; mildly alkaline; gradual, smooth boundary.

C3—40 to 60 inches, light brownish-gray (2.5Y 6/2) soft sandstone, grayish brown (2.5Y 5/2)

and silty clay loam stratified with shaly clay and loamy sand. The entire profile is calcareous.

Lohler soils are low in fertility and are moderately low in content of organic matter. Runoff is slow, and permeability is moderately slow or slow. Available water capacity is moderate or high. Many areas receive additional moisture as runoff from nearby soils or from stream flooding.

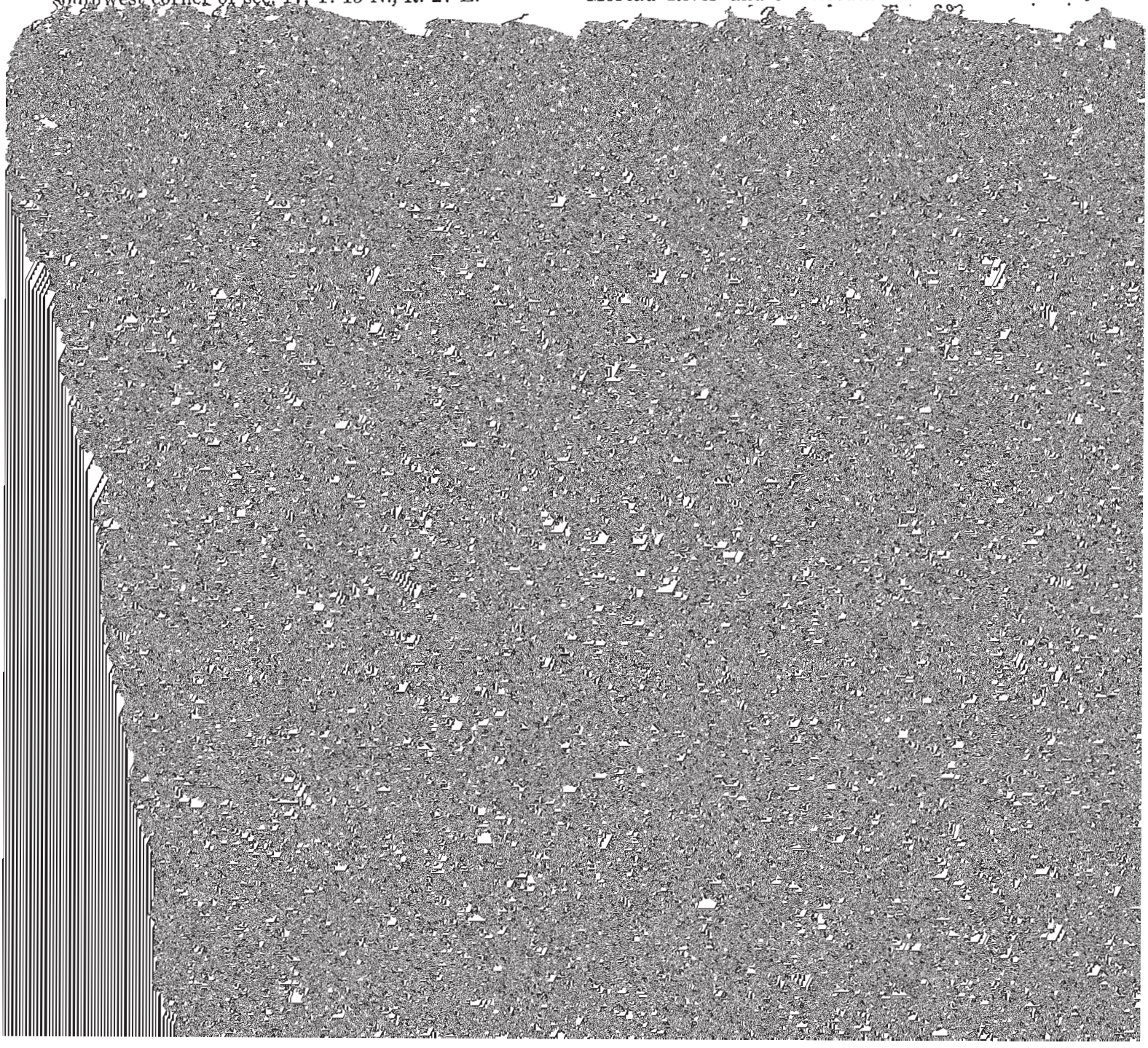
Many areas are in native vegetation and are used for range, hay, and wildlife. A few areas are cultivated.

Representative profile of Lohler silty clay, in native grass, 1,300 feet east and 1,800 feet north of the southwest corner of sec. 17, T. 15 N., R. 27 E.

have a buried A horizon. The A1 horizon ranges from dark grayish brown to light brownish gray. It commonly is silty clay, but ranges from loam to clay and from 4 to 10 inches in thickness. The C horizon ranges from grayish brown to pale yellow. It commonly is stratified with loamy sand to clay.

Lohler soils are mapped with Havrelon soils and are near Trembles soils. They contain more clay throughout the profile than Havrelon and Trembles soils.

Lo—Lohler silty clay (0 to 2 percent slopes). This nearly level soil is on bottom land (fig. 11) along the Moreau River and its tributaries. Areas are mostly



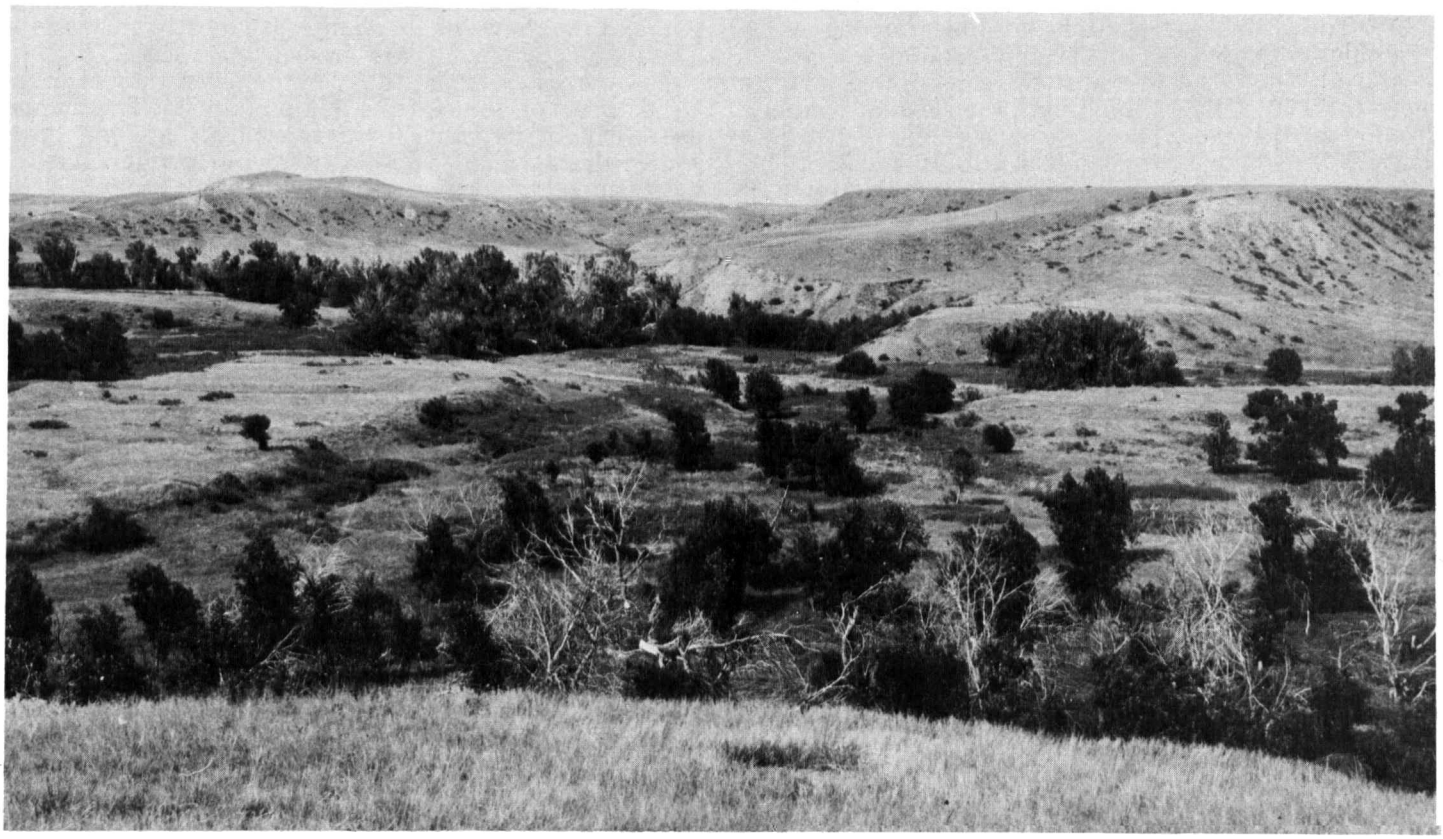


Figure 11.—**Area of Lohler silty clay.**

nearly level to gently sloping silty soils on terraces. These soils formed in wind-deposited material. The native vegetation was mainly mid and short grasses.

In a representative profile the surface layer is dark grayish-brown silt loam about 10 inches thick. The subsoil, about 20 inches thick, is grayish-brown, calcareous silt loam. It is slightly hard when dry and very friable when moist. The lower part has spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 55 inches is light brownish-gray, calcareous silt loam. Below this is light brownish-gray, calcareous gravelly loam.

Lowry soils are medium in fertility and are moderate in content of organic matter. Runoff is slow or medium, and permeability is moderate. Available water capacity is high.

Most areas are cultivated. Some areas are in native grass and are used for range.

Representative profile of Lowry silt loam, 0 to 2 percent slopes, in a cropped area, 130 feet north and 2,400 feet east of the southwest corner of sec. 2, T. 16 N., R. 31 E.

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; soft, very friable, slightly sticky; common roots; neutral; gradual, wavy boundary.

B2—10 to 18 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure; slightly hard, very friable, slightly sticky; common roots; slight effervescence; mildly alkaline; diffuse, smooth boundary.

B3—18 to 30 inches, grayish-brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; slightly hard, very friable, slightly sticky; few roots; few fine segregations of lime; strong effervescence; mildly alkaline; diffuse, smooth boundary.

C1ca—30 to 40 inches, light brownish-gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; hard, very friable, slightly sticky; common fine segregations of lime; violent effervescence; moderately alkaline; diffuse, smooth boundary.

C2—40 to 55 inches, light brownish-gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, slightly sticky; few fine segregations of lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

IIC3—55 to 60 inches, light brownish-gray (2.5Y 6/2) gravelly loam, grayish brown

(2.5Y 5/2) moist; loose, very friable; few fine segregations of lime; strong effervescence; moderately alkaline.

The silty material in which the soil formed is 40 to more than 60 inches thick. Depth to carbonates ranges from 8 to 16 inches. The A horizon ranges from dark grayish brown to brown and is 4 to 10 inches thick. The B2 horizon ranges from dark grayish brown to brown in hue of 10YR or 2.5Y. The thickness of the B2 and B3 horizons combined ranges from 10 to 20 inches. The content of fine sand in the C horizon gradually increases with increasing depth.

Lowry soils contain less clay in the B horizon than the nearby Agar, Promise, and Reliance soils.

LwA—Lowry silt loam, 0 to 2 percent slopes. This nearly level soil is on terraces near Lake Oahe. Areas are irregular in shape and range from 60 to 500 acres in size. This soil has the profile described as representative of the series, but in a few places sand and gravel are at a depth of 50 to 60 inches.

Included with this soil in mapping were small areas of Agar and Reliance soils in the lower, more nearly level areas. Also included were areas of a soil that has a lighter colored surface layer than the Lowry soil. Included soils make up 5 percent or less of any given

bottomed and commonly contain water. The sides of the pits and the slopes of the dumps are mostly very steep. The dumps commonly are eroded and rough.

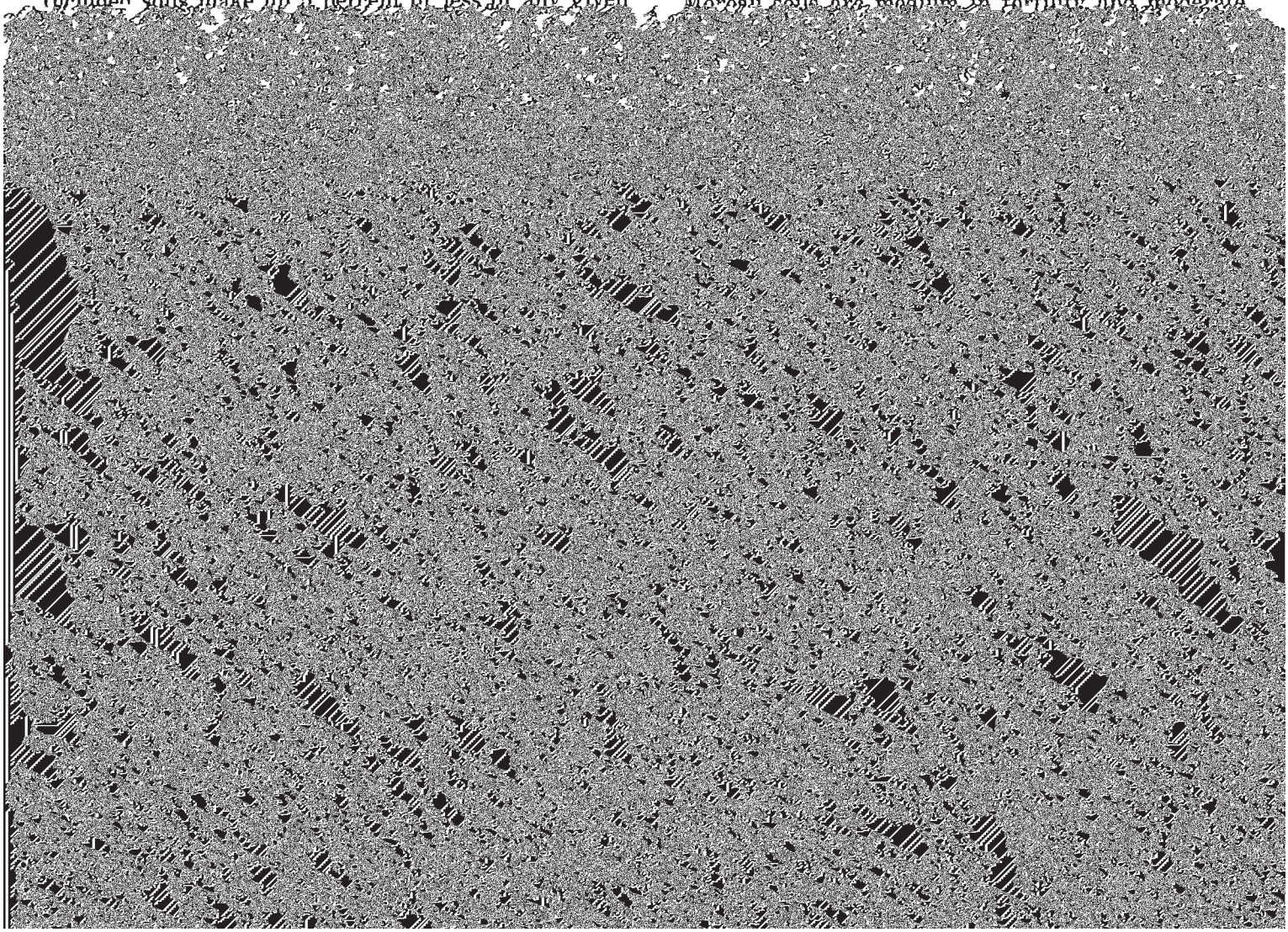
Many areas support little or no vegetation. Annual weeds grow on some of the dump material. The dumps have little or no value for grazing livestock, but have some value as wildlife habitat. Capability unit VIIIs–2; not assigned to a range site or windbreak group.

Moreau Series

The Moreau series consists of moderately deep, well-drained, gently undulating to steep clayey soils on uplands. These soils formed in clayey material weathered from the underlying shale. The native vegetation is mainly mid and short grasses.

In a representative profile the surface layer is grayish-brown silty clay about 5 inches thick. The subsoil, about 16 inches thick, is grayish-brown, calcareous silty clay and clay. It is very hard when dry, firm to very firm when moist, and sticky and plastic when wet. The underlying material to a depth of 29 inches is light brownish-gray, calcareous shaly clay. Below this is soft platy shale.

Moreau soils are medium in fertility and moderate



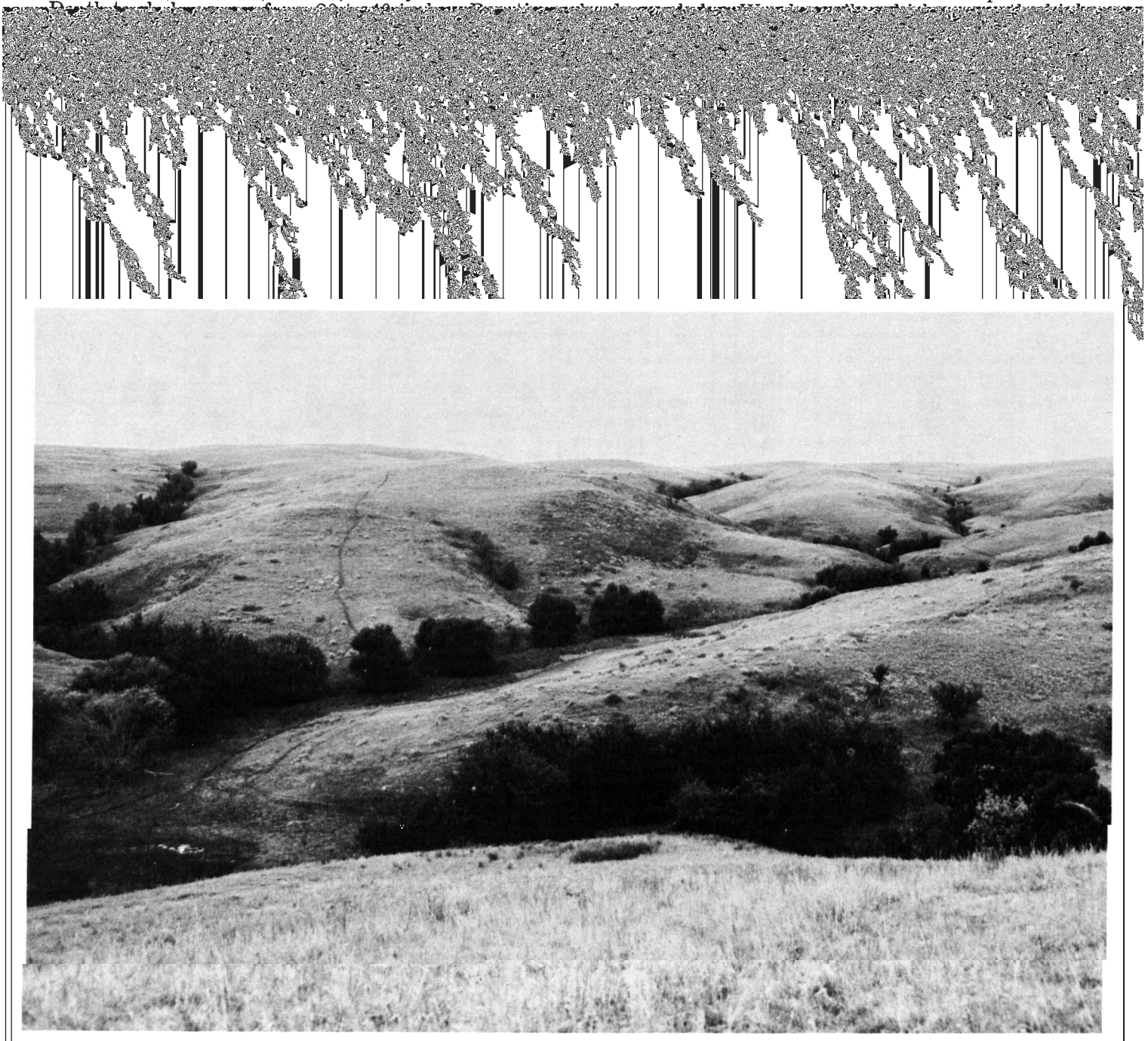
lime; slight effervescence; mildly alkaline; clear, smooth boundary.

C1ca—21 to 29 inches, light brownish-gray (2.5Y 6/2) shaly clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, sticky; few roots; many fine fragments of shale; common fine segregations of lime; slight effervescence; mildly alkaline; clear, smooth boundary.

C2—29 to 60 inches, light brownish-gray (2.5Y 6/2) soft platy shale, grayish brown (2.5Y 5/2) moist; mildly alkaline.

Moreau soils are mapped with Regent and Wayden soils and are near Cabba and Morton soils. They are deeper over shale than Cabba and Wayden soils. They are more clayey than Morton soils and have thinner A and B2 horizons than Regent soils.

MbD—Moreau-Wayden silty clays, 9 to 25 percent slopes. This mapping unit is on upland ridges and the sides of entrenched drainageways (fig. 12). It is about 45 percent Moreau soil, 35 percent Wayden soil, and 20 percent other soils. Areas are irregular in shape and range from 20 to several hundred acres in size. Moreau soils are on the mid and lower parts of the



Almost all areas are in native grass and are used for range. Capability unit VIe–4; windbreak group 10; Moreau soil in Clayey range site, Wayden soil in Shallow range site.

Morton Series

The Morton series consists of moderately deep, well-drained, nearly level to sloping silty soils on uplands. These soils formed in material weathered from the underlying sandstone, siltstone, or loamy shale. The native vegetation was mainly mid and short grasses.

In a representative profile (fig. 13) the surface layer is dark grayish-brown silt loam about 5 inches thick. The subsoil is about 19 inches thick. The upper 12 inches is grayish-brown loam, and the lower 7 inches is light brownish gray loam. The upper part is very hard when dry and friable when moist; the lower part is calcareous and has spots of lime extending into the underlying material. The underlying material to a depth of 37 inches is pale-yellow, calcareous loam. Below this is light brownish-gray, soft sandstone.

Morton soils are medium in fertility and are moderate in content of organic matter. Runoff is slow or medium, and permeability is moderate. Available water capacity is moderate.

Many areas are cultivated. Some are in native grass and are used for range.

Representative profile of Morton silt loam, 2 to 6 percent slopes, in native grass, 200 feet south of the northwest corner of sec. 22, T. 13 N., R. 23 E.

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; soft, very friable, slightly sticky; many roots; slightly acid; clear, wavy boundary.

B21t—5 to 11 inches, grayish-brown (10YR 5/2) heavy loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; very hard, friable, sticky and plastic; common roots; neutral; clear, wavy boundary.

B22t—11 to 17 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate, coarse, prismatic structure parting to weak, coarse, subangular blocky; hard, friable, sticky; few patchy clay films on vertical faces of peds; common roots; neutral; clear, wavy boundary.

B3ca—17 to 24 inches, light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak, coarse, prismatic structure; hard, friable, sticky; few roots; common, medium and fine segregations of lime; violent effervescence; mildly alkaline; gradual, wavy boundary.

C1ca—24 to 37 inches, pale-yellow (2.5Y 7/4) loam, light olive brown (2.5Y 5/4) moist; massive, some vertical cleavage; hard, very friable, slightly sticky; few roots; common medium and fine segregations of lime; violent effervescence; mildly alkaline; clear boundary.

C2—37 to 60 inches, light brownish-gray (2.5Y 6/2) soft sandstone; weakly bedded; slight effervescence; moderately alkaline.

Figure 13.—**Favorable structure allows grass roots to penetrate to a depth of 3 feet in Morton silt loam, 2 to 6 percent slopes. Numbers on tape are in feet.**

Depth to soft sandstone, siltstone, or shale ranges from 20 to 40 inches. The A horizon is grayish brown in places. It commonly is silt loam, but in places is loam or very fine sandy loam. The A horizon ranges from

4 to 8 inches in thickness. The B2t horizon ranges from grayish brown to light yellowish brown in hue of 10YR or 2.5Y. It is loam, clay loam, or silty clay loam 8 to 16 inches thick. The B3ca and C1ca horizons combined are 15 to 20 inches thick and have common to many segregations of lime.

Morton soils are mapped with Belfield, Farland, and Lantry soils. They are near Reeder and Regent soils. They contain less clay in the B horizon than Belfield and Regent soils and more silt and less sand than Reeder soils. They are shallower over bedrock than Farland soils. They have thicker A and B horizons than Lantry soils.

McB—Morton silt loam, 2 to 6 percent slopes. This soil is on uplands in irregularly shaped areas that range from 10 to several hundred acres in size. The smooth, convex slopes are mostly 2 to 6 percent, but in small included areas they are less than 2 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Belfield, Farland, Heil, Lantry, and Reeder soils. Belfield and Farland soils are in swales. Heil soils are in closed depressions, less than 3 acres in size, which are designated on the soil map by a wet spot symbol. Lantry soils are on or near the crests of ridges. The included soils commonly make up about 25 percent of any mapped area.

This Morton soil is easy to work and has moderate available water capacity. Runoff is medium. Controlling erosion is the main concern in management.

Many areas are cultivated. Small grain, alfalfa, and corn are the main crops. Other areas are in native grass and are used for range and hay. Silty range site; capability unit IIe–1; windbreak group 3.

MdA—Morton-Belfield complex, 0 to 2 percent slopes. This mapping unit is about 45 percent Morton soil, 35 percent Belfield soil, and 20 percent included soils. It is in irregularly shaped areas that range from 10 to 150 acres in size. The Morton soil is on very slight rises. The Belfield soil is in the lower, more nearly level parts of the landscape. The Morton soil has a subsoil of clay loam, but otherwise has a profile similar to the one described as representative of the series. The Belfield soil has a surface layer of loam.

Included with these soils in mapping were areas of Absher, Daglum, Farland, Heil, and Rhoades soils. Of these, Daglum and Farland soils are the most common included soils. Absher, Daglum, and Rhoades soils are along ill-defined drainageways and in low areas near

MdB—Morton-Belfield complex, 2 to 6 percent slopes. This mapping unit is about 60 percent Morton soil, 25 percent Belfield soil, and 15 percent other soils. It is in irregularly shaped areas that range from 10 to 200 acres in size. Slopes are long and smooth. The Morton soil is on the mid and upper parts of the landscape, and the Belfield soil is on the lower parts and in swales. The Morton soil has a subsoil of clay loam, but otherwise has a profile similar to the one described as representative of the series. The Belfield soil has a loam surface layer.

Included with these soils in mapping were small areas of Absher, Farland, Heil, Reeder, and Rhoades soils. Absher and Rhoades soils are in small scattered spots throughout the areas. Farland soils generally are between areas of Morton and Belfield soils. Heil soils are in closed depressions, some of which are identified on the soil map by a wet spot symbol. Lantry soils are on some of the ridgetops.

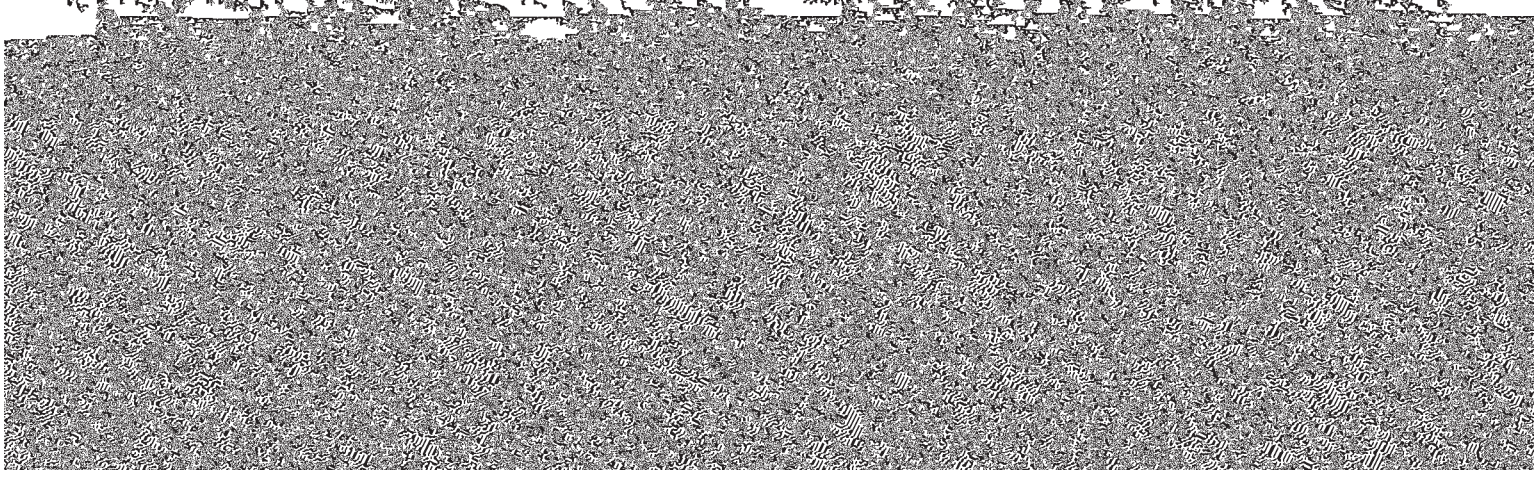
These soils have moderate available water capacity. The clayey subsoil of the Belfield soil takes in water slowly and releases it slowly to plants. Runoff is medium. Controlling erosion is the main concern in management, but improving water intake in the Belfield soil is also important.

Some areas are cultivated. Small grain and alfalfa are the main crops. Other areas are in native grass and are used for range and hay. Capability unit IIe–1; Morton soil in Silty range site, windbreak group 3; Belfield soil in Clayey range site, windbreak group 4.

MfA—Morton-Farland silt loams, 0 to 2 percent slopes. This mapping unit is 65 percent Morton soil, 30 percent Farland soil, and 5 percent other soils. It is on uplands in irregularly shaped areas 10 to 200 acres in size. The Morton soil is on very slight rises. It has a thicker surface layer, but otherwise has a profile similar to the one described as representative of the series. Slopes are slightly convex. The Farland soil is on the more nearly level parts of the landscape. Slopes are smooth to slightly concave.

Included with these soils in mapping were small areas of Belfield, Heil, and Reeder soils. Belfield soils are in some of the low areas. Heil soils are in closed depressions, some of which are identified on the soil map by a wet spot symbol. Reeder soils are on slight rises near Morton soils.

These soils are easy to work and have moderate or high available water capacity. Runoff is slow. Conserving moisture is the main concern in farming



than is typical. Some cultivated areas are moderately eroded.

Included with these soils in mapping were small areas of Belfield, Cabba, and Reeder soils. Belfield soils are in swales, and Cabba soils are on some of the ridgetops. Reeder soils are intermingled with Morton soils and make up as much as 25 percent of some areas in the northern part of the county.

The soils in this unit are easy to work. Runoff is medium. The Lantry soil is low in fertility and erodes easily. Controlling erosion is the main concern in farming.

Some areas are cultivated. Small grain and alfalfa are the main crops. Many areas are in native grass and are used for range and hay. Capability unit IIIe–1; Morton soil in Silty range site, windbreak group 3; Lantry soil in Thin Upland range site, windbreak group 8.

Natriborolls

Na—Natriborolls, channeled (0 to 2 percent slopes) are mainly mixed claypan soils along drainageways and in upland swales. Areas range from 20 to 300 acres in size. Many are long and narrow and are dissected by channels. Some areas are mainly Daglum soils, and some are mainly Belfield and Farland soils. Spots of Absher soils and Slickspots commonly occur with the Daglum soils. Narrow strips of Havrelon soils are along the channels in some areas.

This unit receives runoff from nearby soils and in some years is flooded by overflow from the channels. Flood damage generally is minor and is mainly damaged fences and deposits of debris.

A few areas are cultivated. Alfalfa and small grain are the main crops. Most areas are in native grass and are used for range. Overflow range site; capability unit VIw–1; windbreak group 10.

Opal Series

The Opal series consists of moderately deep, well-drained, nearly level to moderately steep clayey soils on uplands. These soils formed in material weathered from the underlying shale. The native vegetation is mainly mid and short grasses.

In a representative profile the surface layer is grayish-brown clay about 5 inches thick. The subsoil, about 15 inches thick, is grayish-brown clay. It is extremely hard when dry, extremely firm when moist, and very sticky and plastic when wet. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material to a depth of 33 inches is light yellowish-brown clay and pale-olive shaly clay. Below this is light olive-gray and very dark gray shale.

Opal soils are medium in fertility and are moderate in content of organic matter. Runoff is medium or rapid, and permeability is very slow. Available water capacity is low or very low.

Most areas are in native grass and are used for range. Some areas are cultivated.

Representative profile of Opal clay, 2 to 9 percent slopes, in native grass, 510 feet east and 780 feet south of the northwest corner of sec. 4, T. 11 N., R. 27 E.

A1—0 to 5 inches, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak, fine, subangular blocky structure parting to weak, fine, granular; hard, very firm, very sticky and plastic; common roots; neutral; clear, wavy boundary.

B2—5 to 14 inches, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak, coarse, prismatic structure parting to moderate, medium, blocky and subangular blocky; extremely hard, extremely firm, very sticky and plastic; common roots; mildly alkaline; clear, gradual boundary.

B3ca—14 to 20 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, blocky structure; extremely hard, extremely firm, very sticky and plastic; few roots; few medium segregations of lime; slight effervescence; mildly alkaline; clear, gradual boundary.

C1cacs—20 to 28 inches, light yellowish-brown (2.5Y 6/3) clay, olive brown (2.5Y 4/3) moist; weak, coarse, blocky structure; very hard, very firm, very sticky and plastic; few roots; many fine segregations of lime and gypsum; strong effervescence; mildly alkaline; clear, gradual boundary.

C2—28 to 33 inches, pale-olive (5Y 6/3) shaly clay, olive (5Y 4/3) moist; massive; hard, firm, sticky; few roots; common fine segregations of lime and gypsum; slight effervescence; mildly alkaline; clear, gradual boundary.

C3—33 to 60 inches, light olive-gray and very dark gray shale; mildly alkaline.

Depth to bedded shale ranges from 20 to 40 inches. Free carbonates commonly are throughout the profile above the shale, and reaction in the B and C horizons is mildly alkaline or moderately alkaline. In places, however, the soil is noncalcareous and reaction is neutral in the B horizon. The A horizon ranges from dark gray to grayish brown in hue of 10YR or 2.5Y. It is clay or silty clay and 4 to 7 inches thick. The B horizon ranges from dark gray to light olive gray in hue of 2.5Y or 5Y. In places the B2 horizon does not have prismatic structure. Total thickness of the B2 and B3 horizons ranges from 12 to 18 inches.

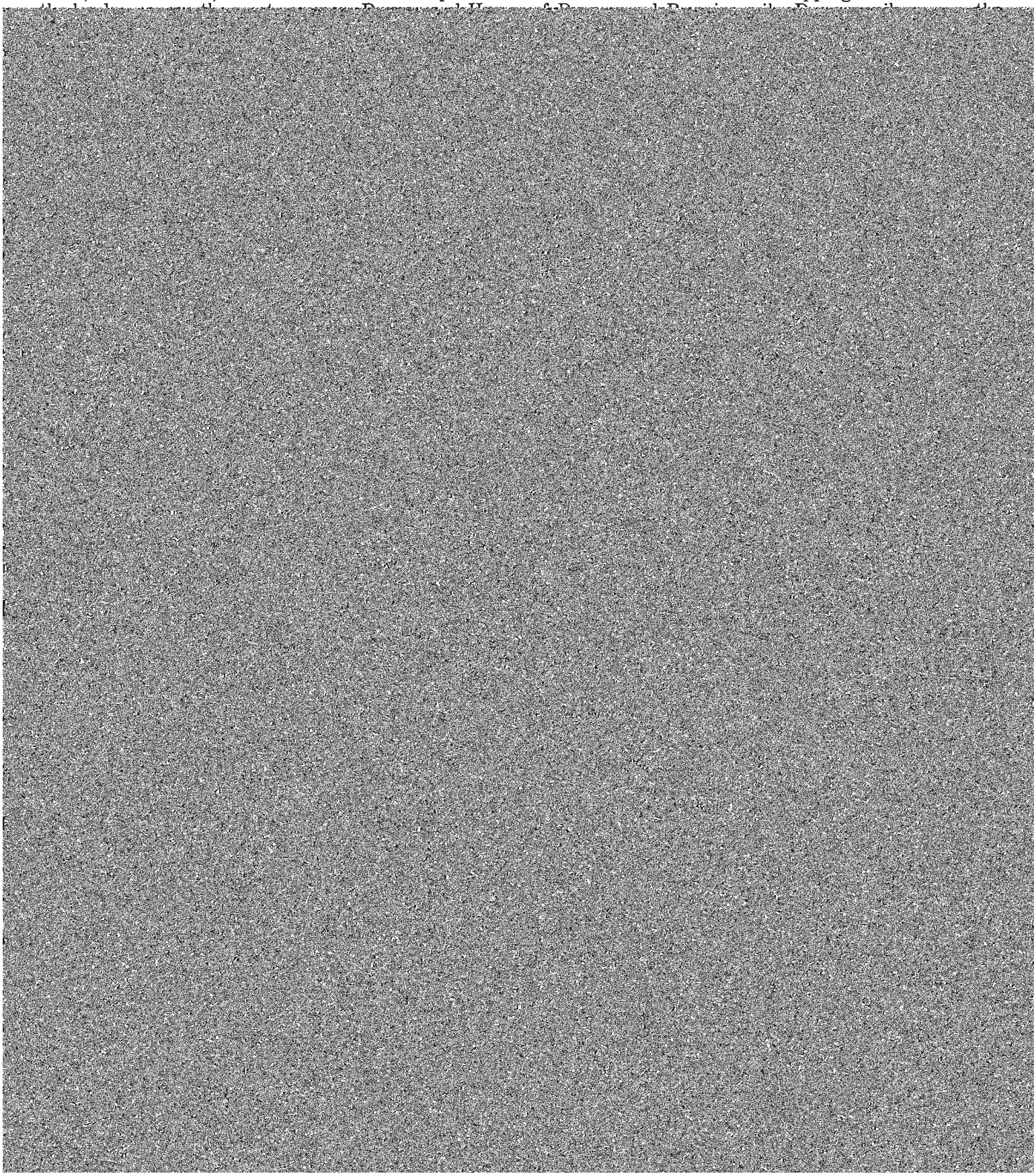
Opal soils are mapped with Dupree, Promise, and Sansarc soils. They are near Chantier and Swanboy soils. They are deeper over shale than Chantier, Dupree, and Sansarc soils. They are shallower over shale than Promise and Swanboy soils.

OaB—Opal clay, 2 to 9 percent slopes. This soil is on uplands in irregular shaped areas that range from 20 to 2,000 acres in size. It is mostly gently sloping. Slopes are long and convex. Scattered stones of glacial origin are on the surface in the eastern part of the county. This soil has the profile described as representative of the series.

Included with this soil in mapping were small areas of Dupree, Hurley, Promise, and Sansarc soils. Of

these, Promise soils, which are on the lower parts of

Included with this unit in mapping were small areas



4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak, medium, granular structure; soft, very friable; neutral; abrupt, smooth boundary.

A12—5 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, thick, platy structure parting to weak, fine and medium, subangular blocky; slightly hard, very friable; slightly acid; gradual, smooth boundary.

B21—8 to 19 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; slightly hard, very friable; slightly acid; gradual, smooth boundary.

B22—19 to 31 inches, olive-brown (2.5Y 4/3) fine sandy loam, olive brown (2.5Y 3/3) moist; weak, fine and medium, subangular blocky structure; hard, friable; slightly acid; gradual, smooth boundary.

B3—31 to 36 inches, olive-brown (2.5Y 4/4) fine sandy loam, olive brown (2.5Y 3/3) moist; weak, medium, subangular blocky structure; slightly hard, very friable; slight effervescence; neutral; gradual, smooth boundary.

C—36 to 60 inches, light olive-brown (2.5Y 5/4) loamy fine sand and fine sand, olive brown (2.5Y 4/4) moist; single grained; loose; slight effervescence; neutral.

Depth to soft sandstone ranges from 50 to more than 60 inches. The A horizon ranges from dark grayish brown to brown and is 8 to 17 inches thick. The B2 horizon ranges from dark grayish brown to light olive brown and is 14 to 25 inches thick. The B3 horizon is fine sandy loam or loamy fine sand and in places has a few segregations of lime. In places the C horizon is fine sandy loam.

Parshall soils are mapped with Ekalaka soils and are near Vebar soils. They do not have the distinct A2 horizon and the columnar-structured B horizon that are typical of Ekalaka soils. They have a thicker A horizon and are deeper over sandstone than Vebar soils.

Pa—Parshall fine sandy loam (0 to 2 percent slopes). This soil is in swales in the uplands. Areas are long and narrow and range from 10 to 150 acres in size. This soil has the profile described as representative of the series, but in places the subsoil contains slightly more clay.

Included with this soil in mapping were areas of Ekalaka and Vebar soils. Ekalaka soils are in low areas, and Vebar soils are at the edge of some areas.

This Parshall soil is easy to work and has moderate available water capacity. Runoff is slow. Controlling soil blowing is the main concern in farming.

Many areas are cultivated. Small grain, corn, and alfalfa are the main crops. Other areas are in native grass and are used for range and hay. Sandy range site; capability unit IIIe–7; windbreak group 1.

Pe—Parshall-Ekalaka fine sandy loams (0 to 2 percent slopes). This mapping unit is in swales in the uplands. It is about 65 percent Parshall soil, and 35 percent Ekalaka soil. Areas range from 10 to 200 acres in size. Some are very slightly undulating. In places these soils contain slightly more clay in the subsoil than is typical.

These soils are easy to work and take in water readily. Runoff is slow. Most areas receive runoff from adjacent soils. Controlling soil blowing is the main concern in farming.

Many areas are cultivated. Alfalfa, corn, and small grain are the main crops. Other areas are in native grass and are used for range and hay. Sandy range site; capability unit IIIe–7; Parshall soil in windbreak group 1, Ekalaka soil in windbreak group 5.

Promise Series

The Promise series consists of deep, well-drained, nearly level to gently sloping clayey soils on uplands and terraces. These soils formed in material weathered in place from clay shale or washed in from adjacent soils. The native vegetation is mainly mid and short grasses.

In a representative profile the surface layer is dark grayish-brown clay about 4 inches thick. The subsoil, about 27 inches thick, is clay that is dark grayish brown in the upper part and grayish brown in the lower part. The upper part is extremely hard when dry, extremely firm when moist, and very sticky and plastic when wet. The lower part is calcareous. The underlying material is light brownish-gray, calcareous silty clay.

Promise soils are medium in fertility and moderate in content of organic matter. Runoff is slow or medium, and permeability is slow or very slow. Available water capacity is low or moderate.

Many areas are in native grass and are used for range. Other areas are cultivated.

Representative profile of Promise clay, 2 to 6 percent slopes, in a cultivated area, 100 feet south and 1,150 feet west of the northeast corner of sec. 17, T. 17 N., R. 30 E.

Ap—0 to 4 inches, dark grayish-brown (10YR 4/2) clay, very dark brown (10YR 2/2) moist; weak, medium and coarse, subangular blocky structure parting to moderate, fine, granular; very hard, firm, very sticky and plastic; common roots; medium acid; clear, wavy boundary.

B21—4 to 10 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak, very coarse, prismatic structure parting to moderate, medium, subangular blocky; extremely hard, extremely firm, very sticky and plastic; common roots; neutral; clear, wavy boundary.

B22—10 to 20 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to moderate, coarse, subangular blocky; extremely hard, extremely firm, very sticky and plastic; few roots; slight effervescence; mildly alkaline; gradual, smooth boundary.

B3—20 to 31 inches, grayish-brown (2.5Y 5/2)

clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, subangular blocky structure; extremely hard, very firm, sticky and plastic; few roots; strong effervescence; mildly alkaline; gradual, smooth boundary.

C1ca—31 to 45 inches, light brownish-gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; weak, coarse, subangular blocky structure; very hard, very firm, sticky; many very fine segregations of lime and gypsum; strong effervescence; mildly alkaline; gradual, smooth boundary.

C2cs—45 to 60 inches, light brownish-gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky; few fine fragments of shale; common fine segregations of gypsum; few fine segregations of lime; strong effervescence; mildly alkaline.

Depth to shale ranges from 40 to more than 60 inches. In places free carbonates are at or near the surface. The A horizon ranges from dark gray to grayish brown in hue of 10YR or 2.5Y. It is clay or silty clay 4 to 8 inches thick. The B2 horizon ranges from dark grayish brown to pale olive in hue of 2.5Y or 5Y. The prisms in the B2 horizon range from medium to very coarse. In places segregations of lime are in the B3 horizon.

Promise soils are mapped with Opal and Swanboy soils and are near Lohler soils. They are more clayey than Lohler soils and also differ from Lohler soils in having a B horizon. They are deeper over shale than Opal soils. They contain less salt in the upper part of the profile than Swanboy soils.

PrA—Promise clay, 0 to 2 percent slopes. This soil is in irregularly shaped areas that range from 15 to 400 acres in size. It is mostly nearly level. Slopes are plane to concave and in places are as much as 4 percent. A few scattered, large glacial stones are on the surface in some areas in the eastern part of the county.

Included with this soil in mapping were small areas of Opal and Swanboy soils. Opal soils are on slight rises. Swanboy soils are in low areas. Included soils make up less than 10 percent of any given area.

This Promise soil has poor tilth and takes in water slowly. Available water capacity is moderate or low. Runoff is slow to medium. Improving tilth and such

This Promise soil is difficult to work and takes in water slowly. Runoff is medium. Controlling erosion and improving tilth and water intake are the main concerns in farming.

Many areas are in native grass and are used for range and hay. Wheat and alfalfa are the main crops in cultivated areas. Clayey range site; capability unit IIIe–4; windbreak group 4.

PsA—Promise-Slickspots complex, 0 to 2 percent slopes. This mapping unit is on upland flats below strongly sloping ridges. It is about 70 percent Promise soils, 25 percent Slickspots, and 5 percent other soils. Areas are irregular in shape and range from 20 to 250 acres in size. Slopes are plane to slightly concave. The profile of the Promise soil has a thinner surface layer and commonly has salts nearer the surface than the one described as representative of the series. Scattered Slickspots occur throughout the landscape. These spots have a puddled or "slicked-over" surface, and salt is within a few inches of the surface.

Included with this unit in mapping were small areas of Swanboy soils adjacent to Slickspots. In a few areas, Swanboy soils make up as much as 25 percent of the mapped area.

The Promise soil has poor tilth and takes in water very slowly. Improving tilth and water intake is the main concern in managing this soil. Slickspots are not suitable for cultivation. Runoff is slow and ponded.

Slickspots are bare or nearly bare of vegetation. The rest of the acreage is in native grass and is used for range. The pattern of Slickspots in many areas is such that cropping the Promise soil is impractical. Promise soil in Clayey range site, capability unit IIIs–3, windbreak group 4; Slickspots in VIIIs–3, not assigned to a range site or windbreak group.

Pw—Promise-Swanboy clays, channeled (0 to 4 percent slopes). This mapping unit is on low terraces and bottom land along creeks (fig. 14). It is about 65 percent Promise soil, 25 percent Swanboy soil, and 10 percent other soils. Areas are long and narrow and range from 20 to 400 acres in size. Meandering channels ranging up to 20 feet deep and 50 feet wide dissect areas into small parcels. Swanboy soils are on fans at the edge of the mapped areas. In places the material underlying these soils is more stratified than is typical.

Included with this unit in mapping were small areas of Lohler soils in low areas immediately adjacent to the channels.

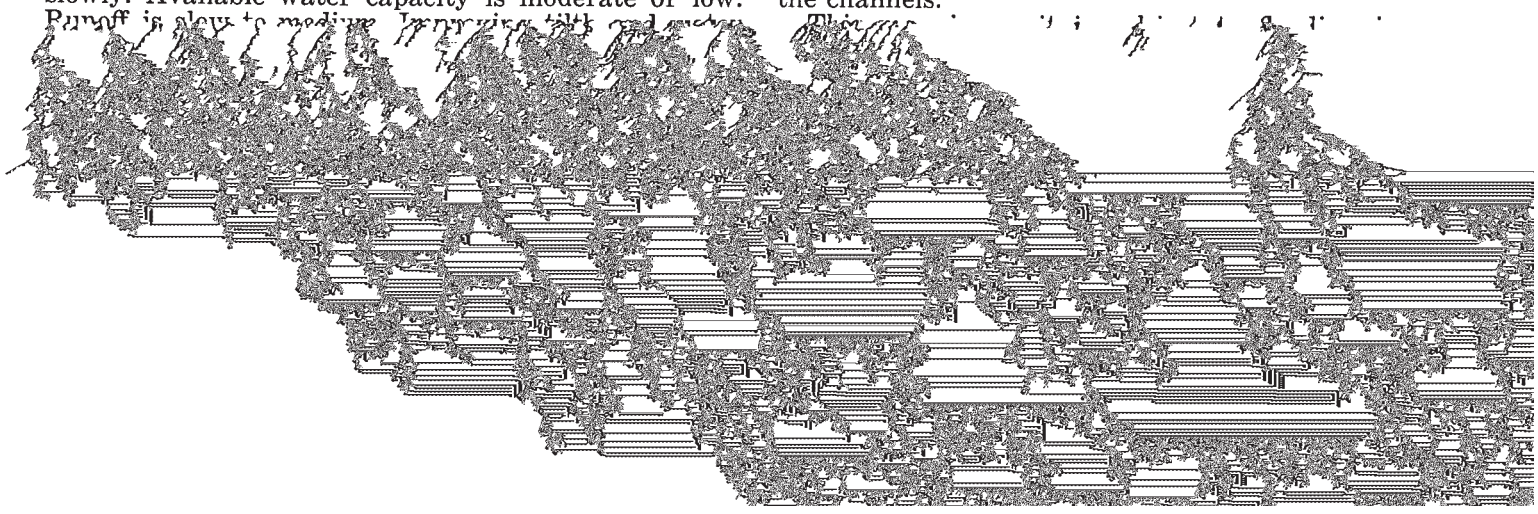


Figure 14.—**Promise-Swanboy clays, channeled.**

the underlying soft sandstone. The native vegetation was mainly mid and short grasses.

In a representative profile the surface layer is dark grayish-brown loam about 7 inches thick. The subsoil, about 19 inches thick, is loam that is dark brown in the upper part and brown in the lower part. The upper part is very hard when dry and friable when moist. The underlying material to a depth of 36 inches is light olive-brown, calcareous fine sandy loam. Below this is light olive-brown soft sandstone.

Reeder soils are medium in fertility and moderate in content of organic matter. Runoff is slow or medium, and permeability is moderate. Available water capacity is low or moderate.

Many areas are cultivated. Others are in native grass and are used for range.

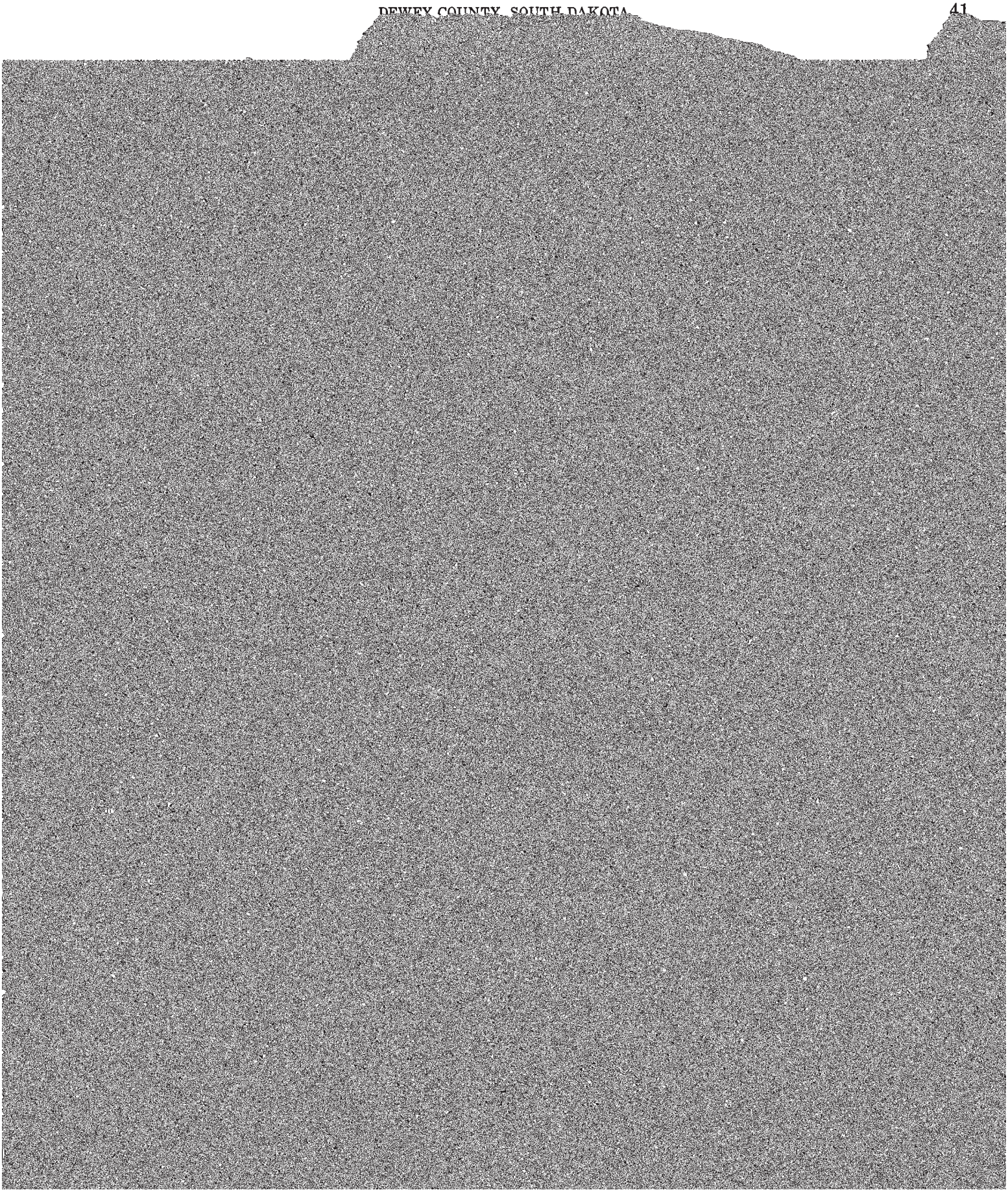
Representative profile of Reeder loam, 2 to 6 percent slopes, in a cropped area, 75 feet west and 1,150 feet south of the northeast corner of sec. 6, T. 17 N., R. 28 E.

Ap—0 to 7 inches, dark grayish-brown (10YR friable, slightly sticky; slightly acid; abrupt, smooth boundary.

B21t—7 to 12 inches, dark-brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, friable, sticky; thin patchy clay films; slightly acid; clear, wavy boundary.

B22t—12 to 18 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm, sticky; thin patchy clay films; neutral; gradual, smooth boundary.

B3—18 to 26 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky;



nests of salt crystals; common segregations of lime; strong effervescence; mildly alkaline; gradual, wavy boundary.

C2ca—11 to 17 inches, 80 percent light brownish-gray (2.5Y 6/2) and 20 percent white (2.5Y 8/1) loam, gray (5Y 6/1) moist; weak, fine, granular structure; slightly

Regent soils are medium in fertility and are moderate in content of organic matter. Runoff is slow or medium, and permeability is slow. Available water capacity is low or moderate.

Many areas are cultivated. Other areas are in native grass and are used for range.

Representative profile of Regent silty clay loam in

parts. Depth to the underlying shale commonly is less than in the profile described as representative of the series.

Included with this soil in mapping were small areas of Moreau and Ridgeview soils. Moreau soils are on the tops and upper sides of some ridges. Ridgeview soils are on the lower parts of the landscape. Included soils make up 15 percent or less of any given area.

This Regent soil has low or moderate available water capacity. Runoff is medium. Controlling erosion is the main concern in farming.

Small grain and alfalfa are the main crops. Many areas are in native grass and are used for range. Clayey range site; capability unit IIIe–1; windbreak group 3.

RmB—Regent-Moreau complex, 2 to 9 percent slopes. This mapping unit is about 55 percent Regent soil, 40 percent Moreau soil, and 5 percent other soils. Areas are long and range from 10 to 200 acres in size. Slopes are short and convex on the higher parts of the landscape, but are longer and plane to concave on the

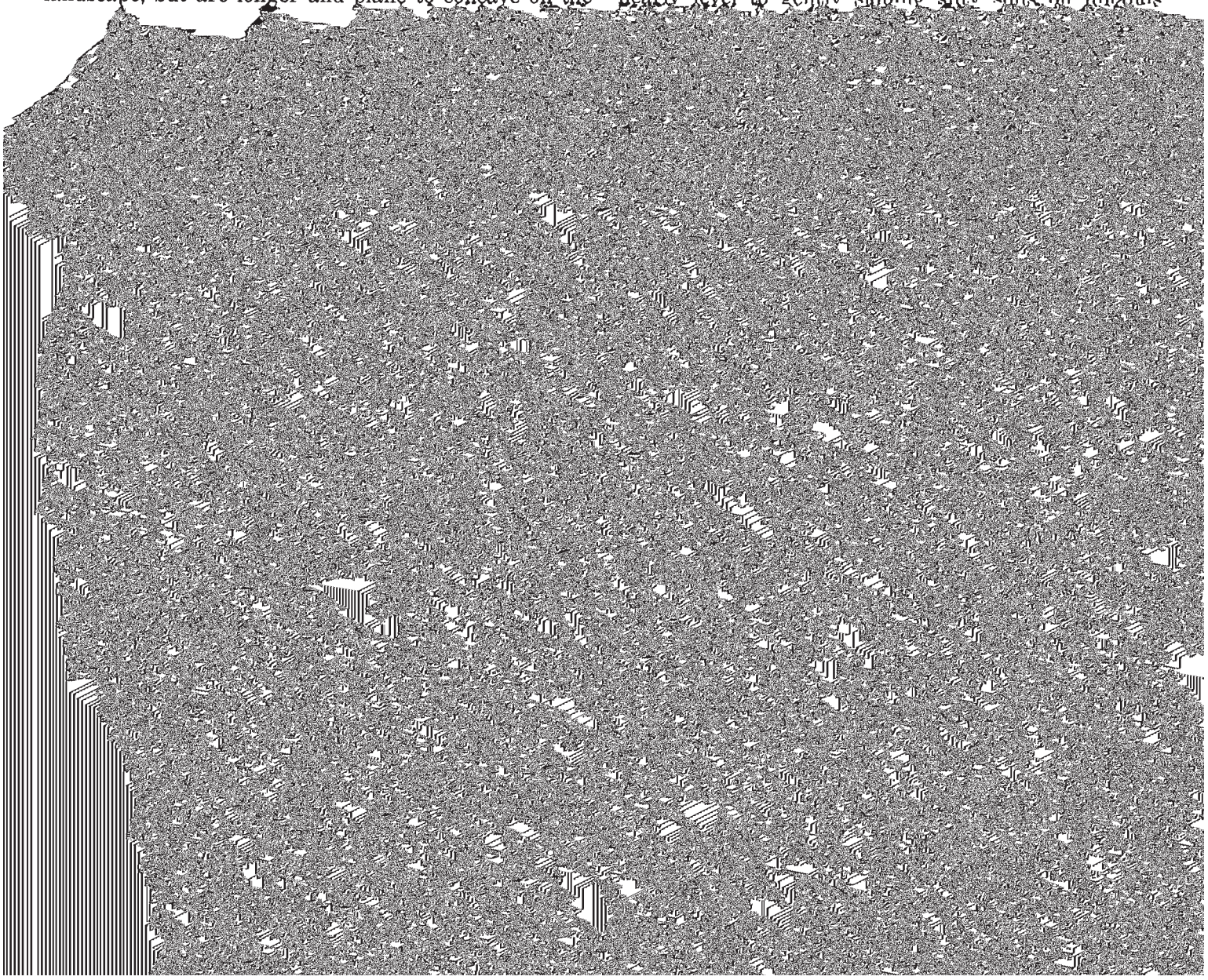
Included with this unit in mapping were small areas of Belfield, Daglum, Heil, and Rhoades soils. Belfield and Daglum soils are in swales. Heil soils are in closed depressions of less than 5 acres and are identified on the soil map by wet spot symbols. Rhoades soils are in depressed spots near Regent soils.

This mapping unit takes in water slowly and releases it slowly to plants. Runoff is medium. Controlling erosion is the main concern in farming.

Many areas are cultivated. Wheat, other small grain, and alfalfa are the main crops. Winter wheat grows well on these soils. Some areas are in native grass and are used for range and hay. Clayey range site; capability unit IIe–1; Regent soil in windbreak group 3, Ridgeview soil in windbreak group 4.

Reliance Series

The Reliance series consists of deep, well-drained, nearly level to gently sloping silty soils on uplands



silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, very fine and fine, subangular blocky structure; hard, firm, sticky; thin patchy clay films; few roots; common fine and medium segregations of lime; strong effervescence; mildly alkaline; gradual, smooth boundary.

C1ca—28 to 41 inches, light brownish-gray (2.5Y

Rhoades Series

The Rhoades series consists of deep, moderately well drained, gently sloping loamy soils that have a claypan subsoil. These soils are on uplands. They formed in material weathered from soft shale. The native vegetation is mainly short and mid grasses.

In a representative profile the surface layer is grayish-brown loam about 4 inches thick. The subsoil

very sticky; many fine segregations of lime and salt; slight effervescence; mildly alkaline; gradual boundary.

C2—37 to 60 inches, light brownish-gray (2.5Y 6/2) silty clay, olive gray (5Y 4/2) moist; massive; very hard, very firm, very sticky; common fine segregations of lime and salt; slight effervescence; mildly alkaline.

In places the soil has a thin A1 horizon. The A horizon ranges from grayish brown to light brownish gray. It is loam, silt loam, or very fine sandy loam 1 to 5 inches thick. In places the upper part of the B2t horizon is dark grayish brown. It has columnar structure that ranges from moderate to strong in grade and from medium to coarse in size. The B2t horizon is 6 to 15 inches thick. Segregations of lime, gypsum, and other salts in the B3 and C horizons range from few to many.

Rhoades soils are mapped with Daglum soils and are near Absher, Belfield, and Ekalaka soils. They have a thicker, darker colored A horizon than Absher soils. They have a thinner A horizon than Daglum, Belfield, and Ekalaka soils.

RtB—Rhoades-Daglum complex, 2 to 6 percent slopes. This mapping unit is about 45 percent Rhoades soil, 30 percent Daglum soil, and 25 percent other soils. Areas are irregular in shape and range from 10 to several hundred acres in size. Slopes commonly are long. Some short slopes range up to 10 percent. The surface is uneven because of many small mounds that rise a few inches above the intervening low spots. The surface layer is loam and silt loam. The Rhoades soil is commonly on the higher parts of the landscape. It has the profile described as representative of the series. In places it is only 30 to 40 inches deep over shale. The Daglum soil is on the lower parts of the landscape.

Included with this unit in mapping were small areas of Absher and Belfield soils and Slickspots. Absher soils and Slickspots are in low spots between the mounds. Belfield soils are in swales.

Tilth is poor. Available water capacity is low or moderate. Runoff is medium. The claypan subsoil takes in water very slowly and restricts roots. Improving tilth and water intake are the main concerns in cultivated areas. The Rhoades soil is not suitable for cultivation.

Most areas are in native grass and are used for range. Small grain and alfalfa are the main crops in cultivated areas. Capability unit VIs–1; Rhoades soil in Thin Claypan range site, windbreak group 10; Daglum soil in Claypan range site, windbreak group 9.

Ridgeview Series

The Ridgeview series consists of deep, well-drained, nearly level to gently sloping silty soils on uplands. These soils formed in clayey alluvium washed in from adjacent soils. The native vegetation is mainly mid and short grasses.

In a representative profile the surface layer is dark-gray silty clay loam about 5 inches thick. The subsoil, about 29 inches thick, is grayish-brown silty clay and clay in the upper part and light brownish-gray clay in the lower part. The upper part is hard when dry and firm when moist. The lower part is calcareous and has spots and streaks of lime that extend into the underlying material. The underlying material is grayish-brown, calcareous clay.

Ridgeview soils are medium in fertility and moderate in content of organic matter. Runoff is slow or medium, and permeability is slow. Available water capacity is moderate or high.

Many areas are cultivated. Some areas are in native grass and are used for range.

Representative profile of Ridgeview silty clay loam in an area of Regent-Ridgeview silty clay loams, 2 to 6 percent slopes, in native grass, 315 feet east and 115 feet south of the northwest corner of sec. 6, T. 13 N., R. 22 E.

A1—0 to 5 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak, fine, granular and subangular blocky structure; slightly hard, friable, sticky and plastic; common roots; slightly acid; clear, smooth boundary.

B1—5 to 10 inches, grayish-brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate, very fine and fine, subangular blocky structure; hard, firm, very sticky and plastic; continuous shiny surfaces on peds; common roots; slightly acid; clear, wavy boundary.

B21t—10 to 17 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure parting to strong, coarse and medium, blocky; extremely hard, extremely firm, very sticky and plastic; continuous shiny surfaces on peds; few roots; slight effervescence; neutral; clear, irregular boundary.

B22t—17 to 25 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, very coarse, prismatic structure parting to strong, coarse, blocky; extremely hard, extremely firm, very sticky and plastic; continuous shiny surfaces on peds; few roots; strong effervescence; mildly alkaline; gradual boundary.

B3ca—25 to 34 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, subangular blocky structure; very hard, very firm, very sticky and plastic; few, fine and medium segregations of lime; strong effervescence; mildly alkaline; gradual boundary.

C1cacs—34 to 44 inches, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; massive; very hard, very firm, sticky and plastic; few striations and nests of gypsum; few medium segregations of lime; strong effervescence; mildly alkaline; gradual boundary.

C2—44 to 60 inches, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y

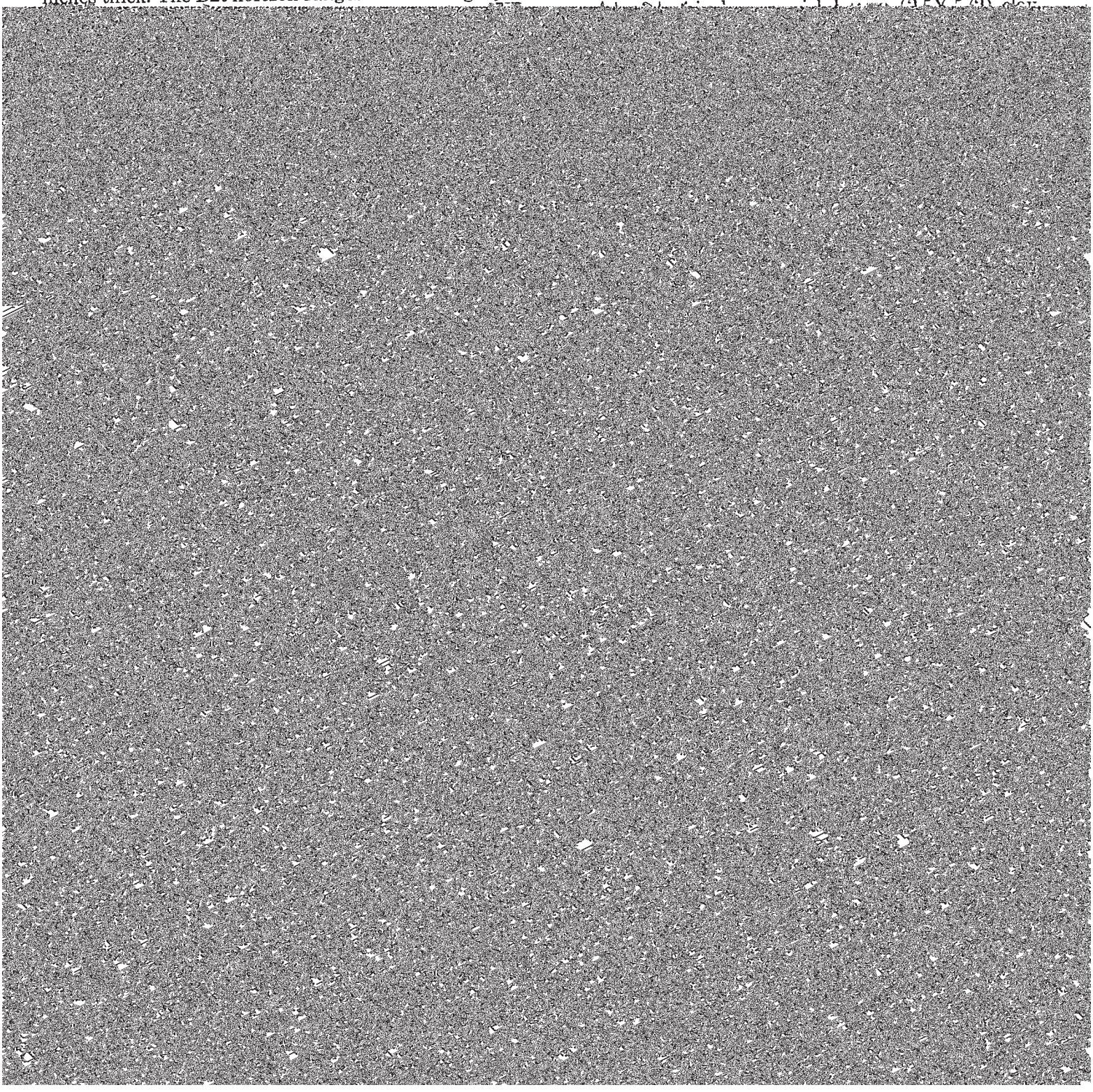
3/2) moist; massive; hard, firm, sticky and plastic; strong effervescence; mildly alkaline.

Depth to bedded shale ranges from 40 to more than 60 inches. Depth to free carbonates ranges from 8 to 12 inches. The A horizon ranges from dark gray to grayish brown in hue of 10YR or 2.5Y. It is 4 to 7 inches thick. The B2t horizon ranges from dark grayish

very rapid, and permeability is slow. Available water capacity is very low.

Almost all areas are in native grass and are used for range.

Representative profile of Sansarc clay in an area of Sansarc-Opal clays, 15 to 25 percent slopes, in native grass, 10 feet south and 10 feet east of the northwest corner of sec. 5, T. 11 N., R. 28 E.



These soils take in water slowly and have very low available water capacity and rapid runoff. They are generally is not conveniently located for that use. Controlling erosion is the main concern of management.

All areas are in native grass and are used for range. Capability unit VIIs–2; windbreak group 10; Sansarc soil in Shallow range site, Opal soil in Clayey range site.

ScF—Sansarc-Shale land complex, 15 to 45 percent slopes. This mapping unit is about 55 percent Sansarc soil and 45 percent Shale land. Areas range from 20 to 400 acres in size. Slopes are hilly to steep and short and convex and in some areas range up to 60 percent. Many gullied drainageways lace the landscape, and slump areas are common on the bluffs above deeply entrenched drainageways. This Sansarc soil is shallower over bedded shale than is typical. Shale land is mainly outcrops of shale intermingled with soils that are less than 6 inches of shaly clay over bedded shale. Areas of Shale land range up to 25 acres in size.

Included in some mapped areas were small areas of Dupree soils. These soils commonly are on the lower parts of the landscape.

This mapping unit is not suitable for cultivation. The soils are low in fertility and have very low available water capacity. Runoff is rapid or very rapid. Geologic erosion is active on Shale land.

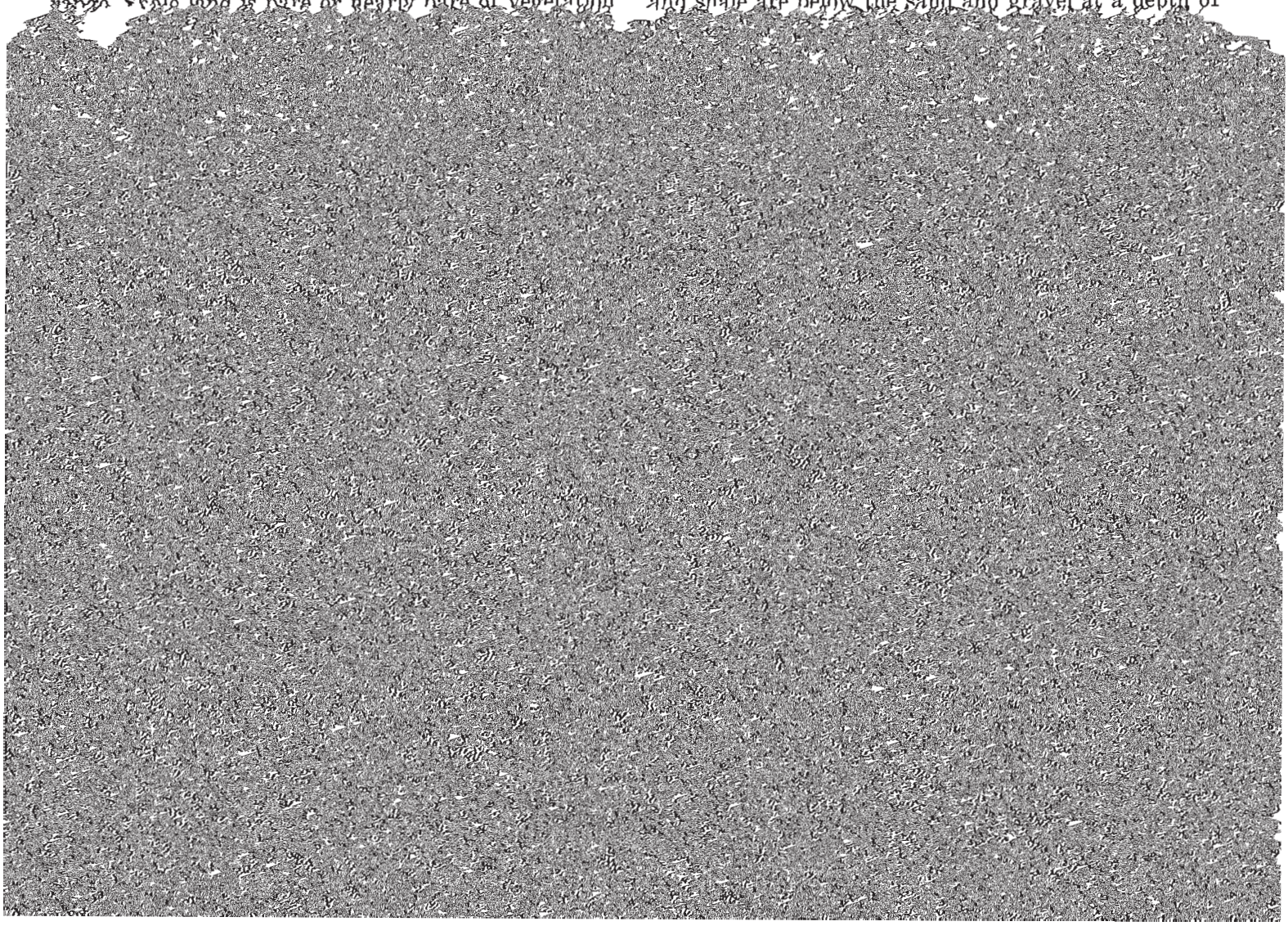
All areas are in native vegetation and are used for range. Shale land is bare or nearly bare of vegetation

C1ca—5 to 17 inches, light brownish-gray (10YR 6/2) sand and gravel, grayish brown (10YR 5/2) moist; single grained; loose; few roots; undersides of pebbles are coated with lime; slight effervescence; mildly alkaline; abrupt, wavy boundary.

C2ca—17 to 28 inches, light brownish-gray (10YR 6/2) coarse sand and gravel, grayish brown (10YR 5/2) moist; single grained; loose; undersides of pebbles are coated with lime; strong effervescence; mildly alkaline; abrupt boundary.

C3—28 to 60 inches, light brownish-gray (10YR 6/2) coarse sand and gravel, grayish brown (10YR 5/2) moist; single grained; loose; undersides of pebbles are coated with lime; slight effervescence; mildly alkaline; clear boundary.

Depth to sand and gravel is less than 10 inches. The A horizon ranges from grayish brown to light yellowish brown in hue of 10YR or 2.5Y. It ranges from gravelly loamy sand to loam in texture and from 4 to 9 inches in thickness. The C horizon ranges from grayish brown to pale yellow in hue of 10YR or 2.5Y. In places clay and shale are below the sand and gravel at a depth of



Included with this unit in mapping were small areas of Dupree, Farland, and Opal soils. Dupree and Opal soils are on the lower parts of the landscape. Farland soils are on small isolated flats above the Schamber soils.

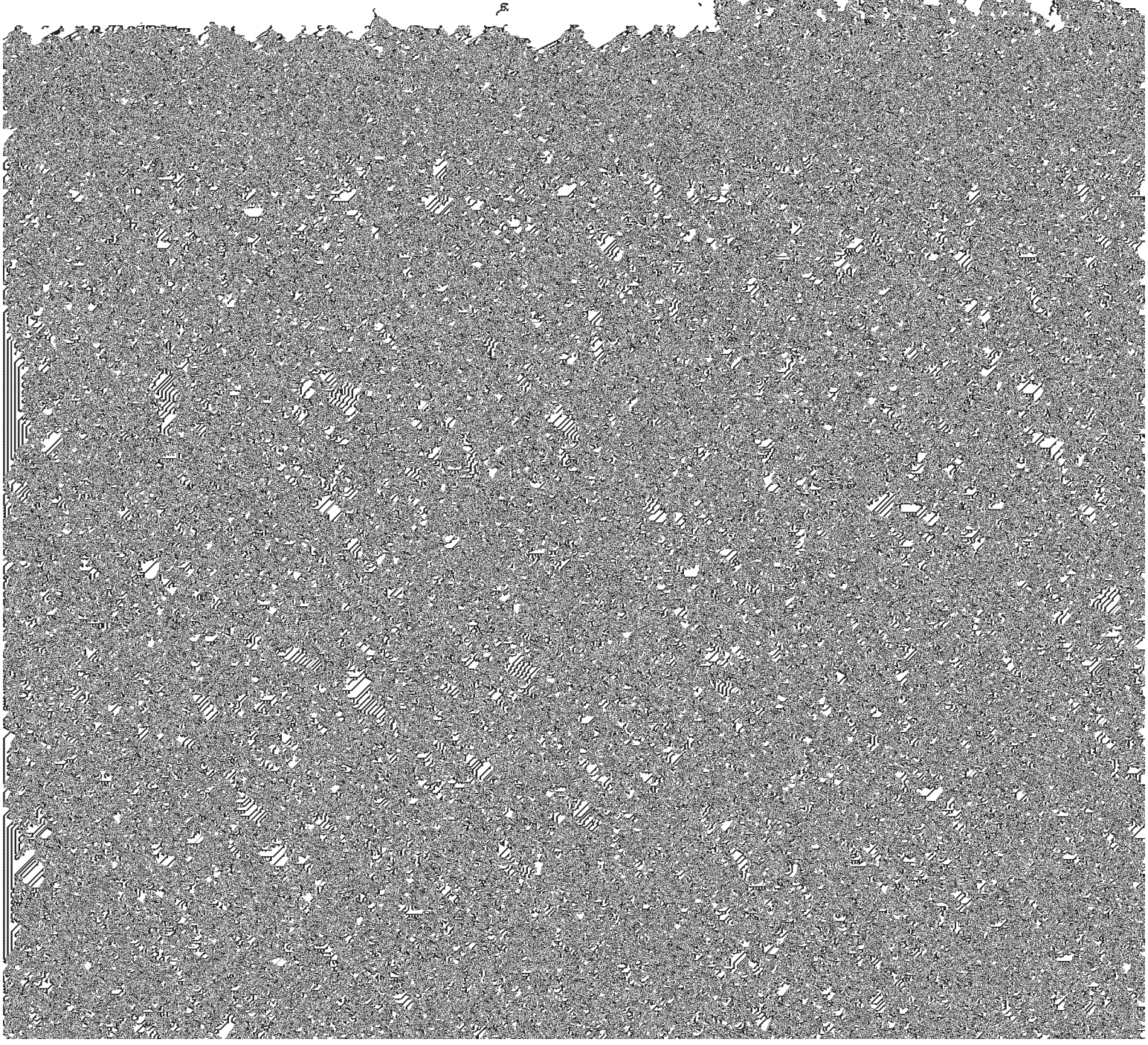
This mapping unit has very low or low available water capacity. Runoff is medium to rapid. The soils are too droughty and too steep for cultivation.

All areas are in native grass and are used for range. Capability unit VIIs–4; windbreak group 10; Schamber soil in Very Shallow range site, Sansarc soil in Shallow range site.

grass, 1,330 feet east and 1,850 feet south of the northwest corner of sec. 29, T. 15 N., R. 26 E.

A1—0 to 6 inches, grayish-brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak, fine, subangular blocky structure parting to weak, fine, granular; hard, friable, slightly sticky; many roots; slightly acid; clear, smooth boundary.

B21—6 to 10 inches, grayish-brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; very hard, friable,



range. This soil is well suited to all crops grown in the county and to irrigation, but areas commonly are small and isolated. Silty range site; capability unit IIc–2; windbreak group 3.

Swanboy Series

The Swanboy series consists of deep, well drained or moderately well drained, nearly level, calcareous clayey soils on terraces and uplands. These soils formed in alluvium. The native vegetation is mainly mid grasses.

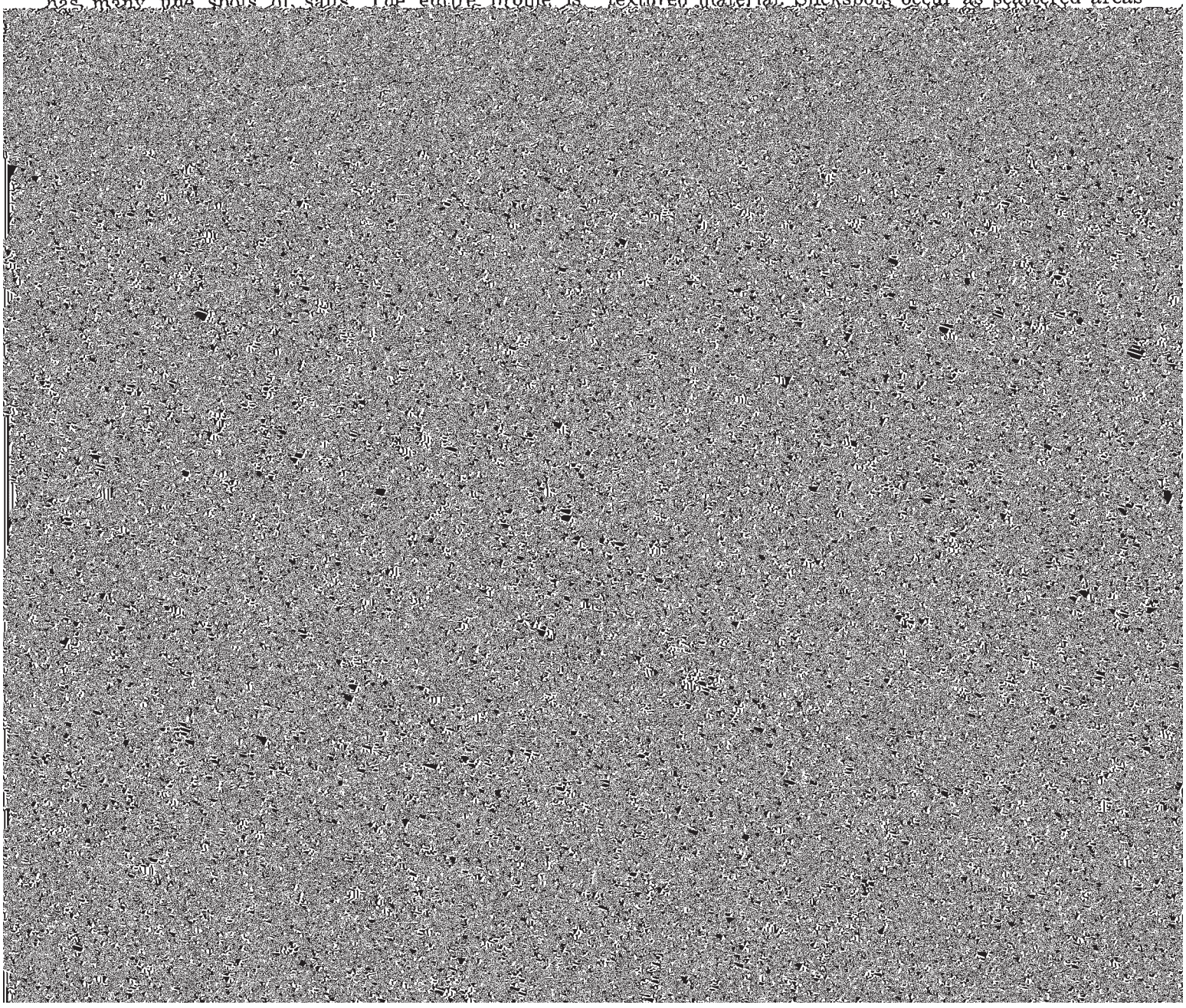
In a representative profile the surface layer is gray clay about 1 inch thick. The subsoil is gray clay about 8 inches thick. It is extremely hard when dry, extremely firm when moist, and very sticky and plastic when wet. The underlying material is gray clay that has many fine spots of salts. The entire profile is

Slickspots. These spots have a puddled or "slicked-over" surface and commonly are bare of vegetation.

This Swanboy soil has very poor tilth, takes in water very slowly, and has medium to rapid runoff. It is not suitable for cultivation.

All areas are in native grass and are used for range. Dense Clay range site; capability unit VIs–5; windbreak group 10.

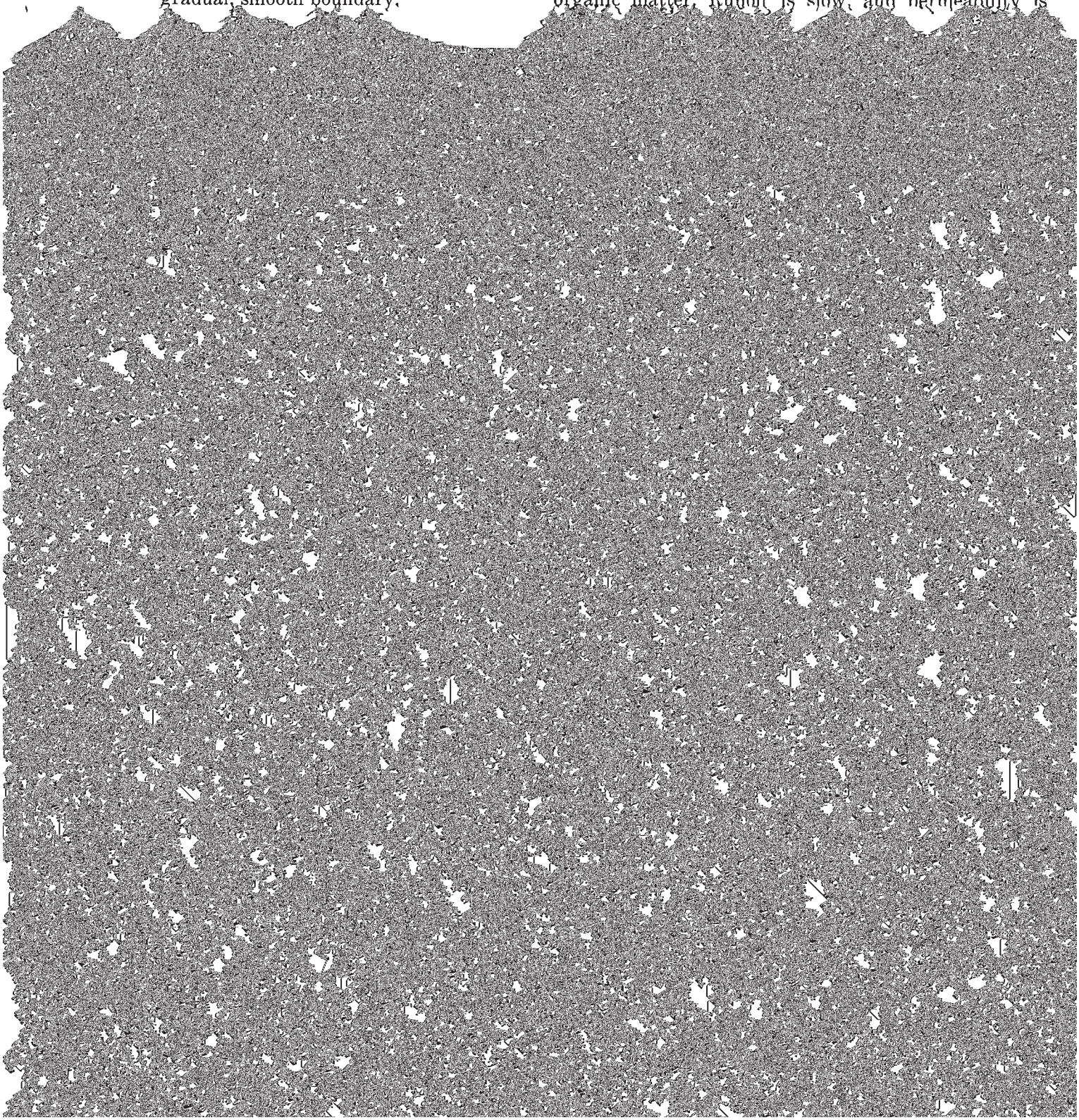
Sy—Swanboy-Slickspots complex (0 to 2 percent slopes). This mapping unit is on bottom land, terraces, and fans along creeks and drainageways. It is about 50 percent Swanboy soil, 30 percent Slickspots, and 20 percent other soils. Areas are long and narrow and range from 20 to 300 acres in size. Commonly they are dissected by gullied channels 15 to 30 feet deep and 20 to 50 feet wide. In places this Swanboy soil below a depth of 20 inches is stratified with coarser textured material. Slickspots occur as scattered areas



B21—7 to 13 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, very coarse, prismatic structure parting to weak, coarse, subangular blocky; hard, very friable; common roots; neutral; gradual, smooth boundary.

grayish-brown fine sandy loam about 4 inches thick. Next is a layer of light brownish-gray fine sandy loam about 4 inches thick. It is slightly hard when dry and very friable when moist. The underlying material is light brownish-gray, calcareous fine sandy loam.

Trembles soils are low in fertility and in content of organic matter. Runoff is slow, and permeability is



near the stream channel. Lohler soils are in the low areas and in old channel scars.

The soils in this unit are easy to work and take in water readily. Available water capacity is moderate or high. Runoff is slow. Most areas receive additional moisture in the form of runoff from adjacent uplands, and in some years the lower levels are subject to flooding. Flood damage usually is minor, and the additional moisture is beneficial. Controlling soil blowing and conserving moisture are the main concerns in farming.

Most areas are in native grass and are used for range and hay. The scattered native trees and shrubs along the channel in many areas provide protection for livestock and wildlife. Alfalfa, oats, and wheat are the main crops in cultivated areas. These soils have a potential for irrigation. Overflow range site; capability unit IIIe–7; windbreak group 1.

Tr—Trembles and Banks soils (0 to 2 percent slopes). Some areas of this mapping unit are mainly Trembles soil, some are mainly Banks soil, and some contain both soils. The irregularly shaped areas are on bottom land (fig. 16) and range from 20 to several hundred acres in size. Some areas are very slightly undulating or hummocky. The surface layer is fine sandy loam and loamy fine sand. The Banks soil has the profile described as representative of the series.

Included with this unit in mapping were small areas of Havrelon and Lohler soils. Havrelon soils are in the less sandy parts. Lohler soils are in low areas and flood channels. Included soils make up as much as 20 percent of some areas.

The soils in this unit take in water readily, but are low in fertility and blow easily. The Banks soil has low available water capacity and is droughty. Many areas receive additional moisture in the form of runoff from adjacent uplands, and the lower levels are subject to flooding from stream overflow. Flood damage usually is minor. Controlling soil blowing is the main concern of management.

Almost all areas are in native grass and are used for range. Scattered native trees and shrubs, growing singly or in clumps, provide protection for livestock and wildlife. Trembles soil in Overflow range site, capability unit IIIe–7, windbreak group 1; Banks soil in Sands range site, capability unit VIe–8, windbreak group 7.

Vebar Series

The Vebar series consists of moderately deep, well-drained, nearly level to hilly loamy soils on uplands. These soils formed in material weathered from the underlying soft sandstone. The native vegetation is mainly tall and mid grasses.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 7 inches thick. The subsoil, about 17 inches thick, is fine sandy loam that is grayish brown in the upper part and brown in the lower part. The upper part is slightly hard when dry and friable when moist. The underlying material to a depth of 32 inches is light-gray and light-brown loamy fine sand. Below this is light-gray soft sandstone.

Vebar soils are medium in fertility and are moderate in content of organic matter. Runoff is slow or medium,

Figure 16.—**An area of Trembles and Banks soils.**

and permeability is moderately rapid. Available water capacity is low.

Many areas are cultivated. Other areas are in native grass and are used for range.

Representative profile of Vebar fine sandy loam, 0 to 6 percent slopes, in cropland, 900 feet east and 1,050 feet south of the northwest corner of sec. 9, T. 17 N., R. 25 E.

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure parting to weak, fine and medium, granular; slightly hard, friable; many roots; slightly acid; abrupt, smooth boundary.

B2—7 to 18 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; upper 4 inches is very dark grayish brown (10YR 3/2) moist; weak, medium and coarse, prismatic structure parting to weak, fine and medium, subangular blocky; slightly hard, friable; common roots; slightly acid; clear, wavy boundary.

B3—18 to 24 inches, brown (10YR 5/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; slightly hard, very friable; common roots; slightly acid; gradual, wavy boundary.

C1—24 to 32 inches, about 60 percent light-gray (10YR 7/2) and 40 percent light-brown (7.5YR 6/3) loamy fine sand, light yellowish brown (2.5Y 6/3) and brown (7.5YR 5/3) moist; massive; soft, very friable; few roots; slightly acid; gradual, wavy boundary.

C2—32 to 60 inches, light gray (10YR 7/2) soft

VeB—Vebar fine sandy loam, 0 to 6 percent slopes. This soil is on uplands in irregularly shaped areas that range up to several hundred acres in size. It has the profile described as representative of the series.

Included with this soil in mapping were small areas of Flasher, Parshall, Reeder, and Tally soils. Flasher soils are on the tops and upper sides of some of the ridges. Parshall soils are in swales. Reeder and Tally soils are in the lower parts of some areas. These included soils make up 15 percent or less of any given area.

This Vebar soil is easy to work and takes in water readily, but it blows easily and has low available water capacity. Runoff is slow to medium. Controlling soil blowing and erosion is the main concern in farming.

Many areas are cultivated. Alfalfa, small grain, and corn are the main crops. Other areas are in native grass and are used for range. Sandy range site; capability unit IIIe–10; windbreak group 5.

VfB—Vebar-Flasher complex, 2 to 9 percent slopes. Vebar soils make up about 60 percent of this mapping unit and Flasher soils 40 percent. Areas are long and range from 10 to 300 acres in size. Slopes are convex and in small areas are 9 percent or more. Vebar soils are on the mid and lower parts of the landscape. Their surface layer is fine sandy loam. Flasher soils, on the higher parts of the landscape, have short convex slopes and have a surface layer of loamy fine sand.

Included with this unit in mapping were small areas of Parshall, Reeder, and Tally soils. Parshall soils are in swales. Reeder and Tally soils are on the lower parts of the landscape. Included soils commonly make up less than 5 percent of any given area.

The soils in this unit are easy to work and take in water readily, but they blow easily and are droughty. Runoff is medium. Controlling soil blowing and erosion is the main concern in farming. The Flasher soil is not suitable for cultivation.

Many areas are cultivated. Small grain and alfalfa

Representative profile of Wayden silty clay in an area of Wayden-Moreau silty clays, 25 to 40 percent slopes, in native grass, 3,170 feet east and 2,090 feet north of the southwest corner of sec. 25, T. 13 N., R. 23 E.

A1—0 to 5 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak, very fine, granular structure; slightly hard, friable, sticky; many roots; slight effervescence; neutral; clear, smooth boundary.

C1—5 to 11 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure parting to weak, medium and fine, subangular blocky; very hard, friable,

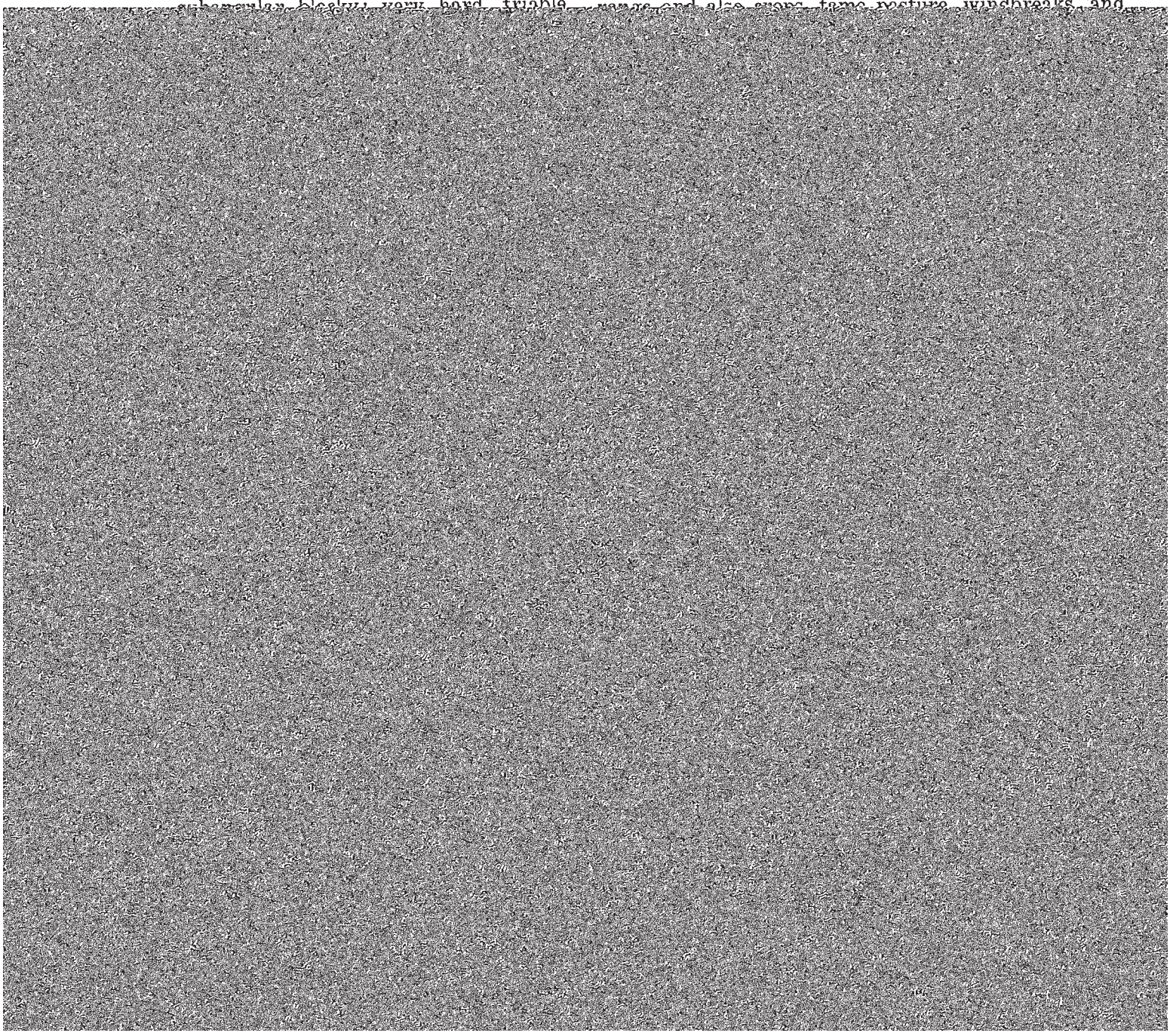
drainageways. Regent soils are on the lower parts of some areas or are on wide ridgetops.

The soils in this unit take in water slowly and have very low or low available water capacity and rapid runoff. They erode easily and are too steep for cultivation.

All areas are in native grass and are used for range. Capability unit VIIs–2, windbreak group 10; Wayden soil in Shallow range site, Moreau soil in Clayey range site.

Use and Management of the Soils

The soils of Dewey County are used extensively for



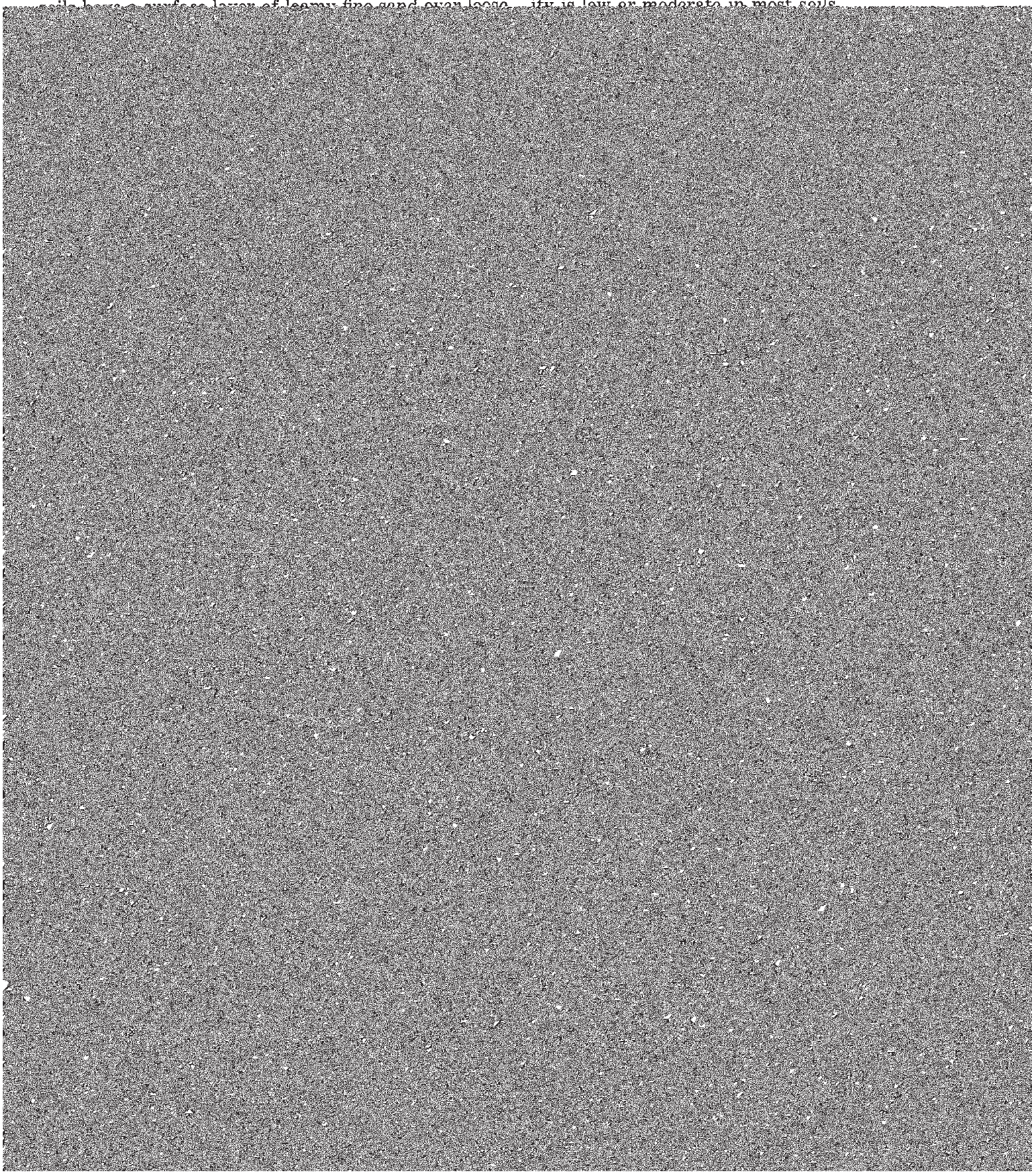
composition on a range site has departed from that of the climax cover.

Four range condition classes are recognized: ex-

Mechanical measures, such as furrowing and pitting, are not feasible on this site.

On a site in excellent condition, the total annual air-

sandy soils on low terraces and bottom land. These soils have a surface layer of loamy fine sand over loose and releases it slowly to plants. Available water capacity is low or moderate in most soils.



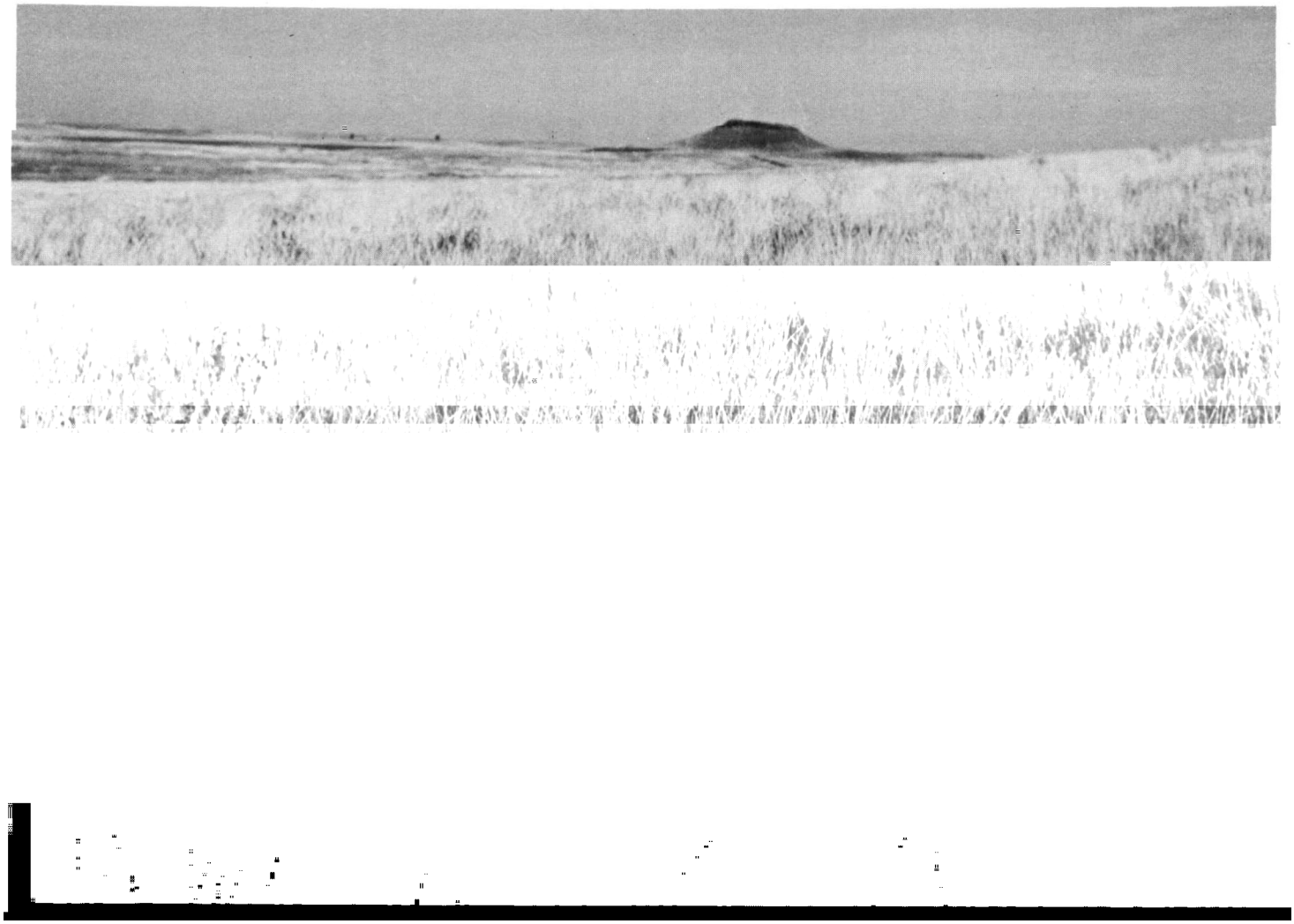


Figure 17.—**Silty range site in excellent condition.**

air dry yield per acre ranges from 1,200 pounds in an [illegible] drained and moderately well drained silty and loamy

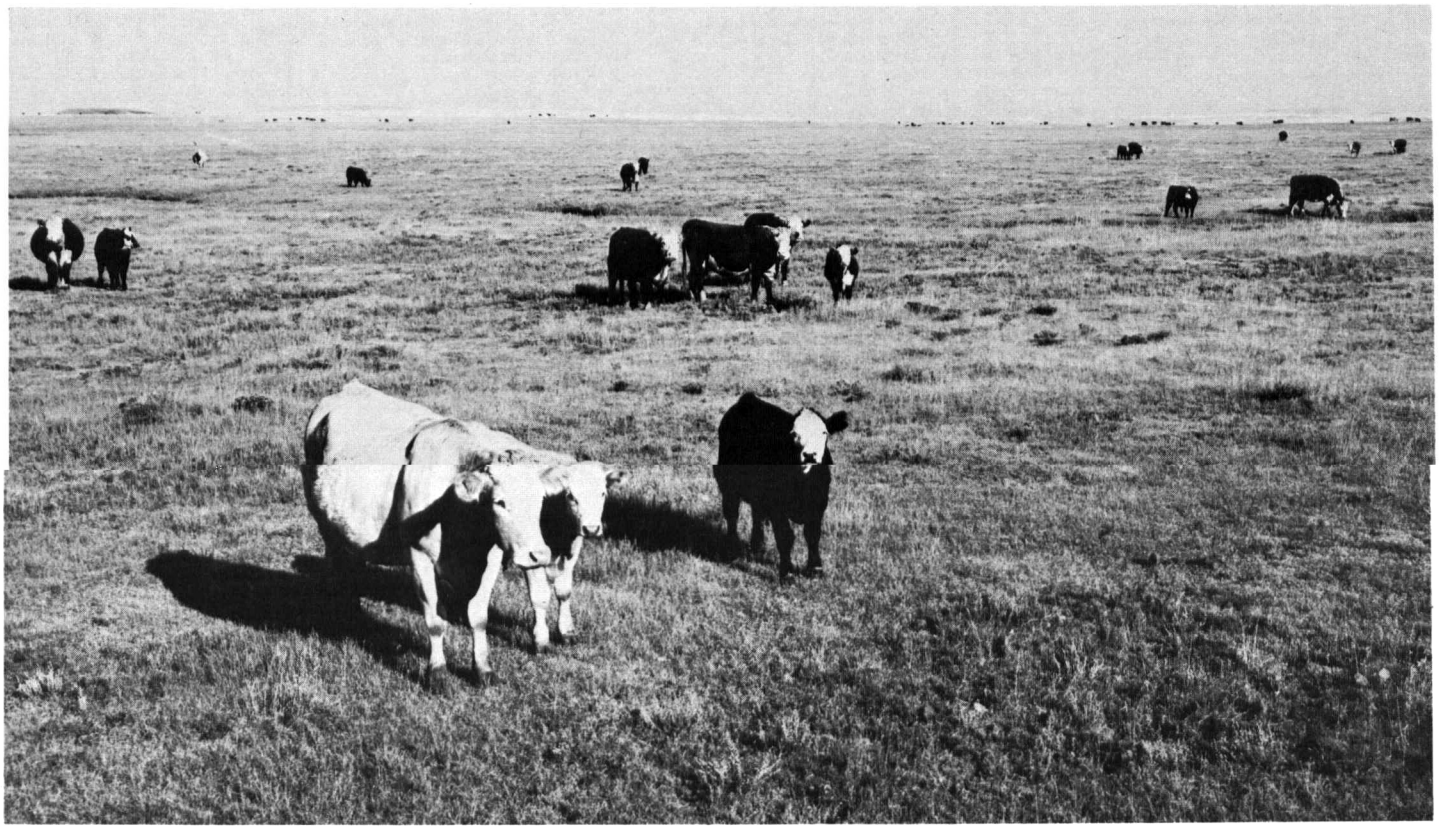


Figure 18.—Thin Claypan range site.

der continued close grazing, these grasses are replaced by annuals.

Mechanical measures are not feasible on this site, and the chance for success of range seeding is very poor.

If this site is in excellent condition, the total annual air-dry yield per acre ranges from 600 pounds in an unfavorable year to 1,200 pounds in a favorable year.

Crops [4]

About 12 percent of Dewey County is cropped. Most of this acreage is in the Belfield-Daglum, Morton-Reeder, Regent-Ridgeview, and Vebar-Flasher associations. Wheat, alfalfa, oats, and corn are the main crops.

The successful, long-term cultivation of any soil depends on managing that soil according to its capabilities for crops. Management needs are chiefly conserving moisture, controlling erosion and soil blowing, helps control erosion and blowing; and usually conserves moisture and maintains fertility.

Conserving moisture generally means evenly distributing snow cover, reducing evaporation, limiting runoff, and controlling weeds. Among the effective measures are minimum tillage, stubble mulching, crop residue management, wind stripcropping, field windbreaks, contour farming, terracing, and timely tillage. These measures also help in controlling erosion and soil blowing. Grassed waterways and diversions are additional erosion control measures, and emergency tillage is effective in controlling soil blowing. A combination of such measures usually is needed.

Effective in maintaining soil tilth are stubble mulching, crop residue management, minimum tillage, timely tillage, green manure crops, and grasses and legumes in the cropping system. These measures and applying animal manures and chemical fertilizers improve fertility. The level of fertility also depends on controlling erosion and soil blowing.

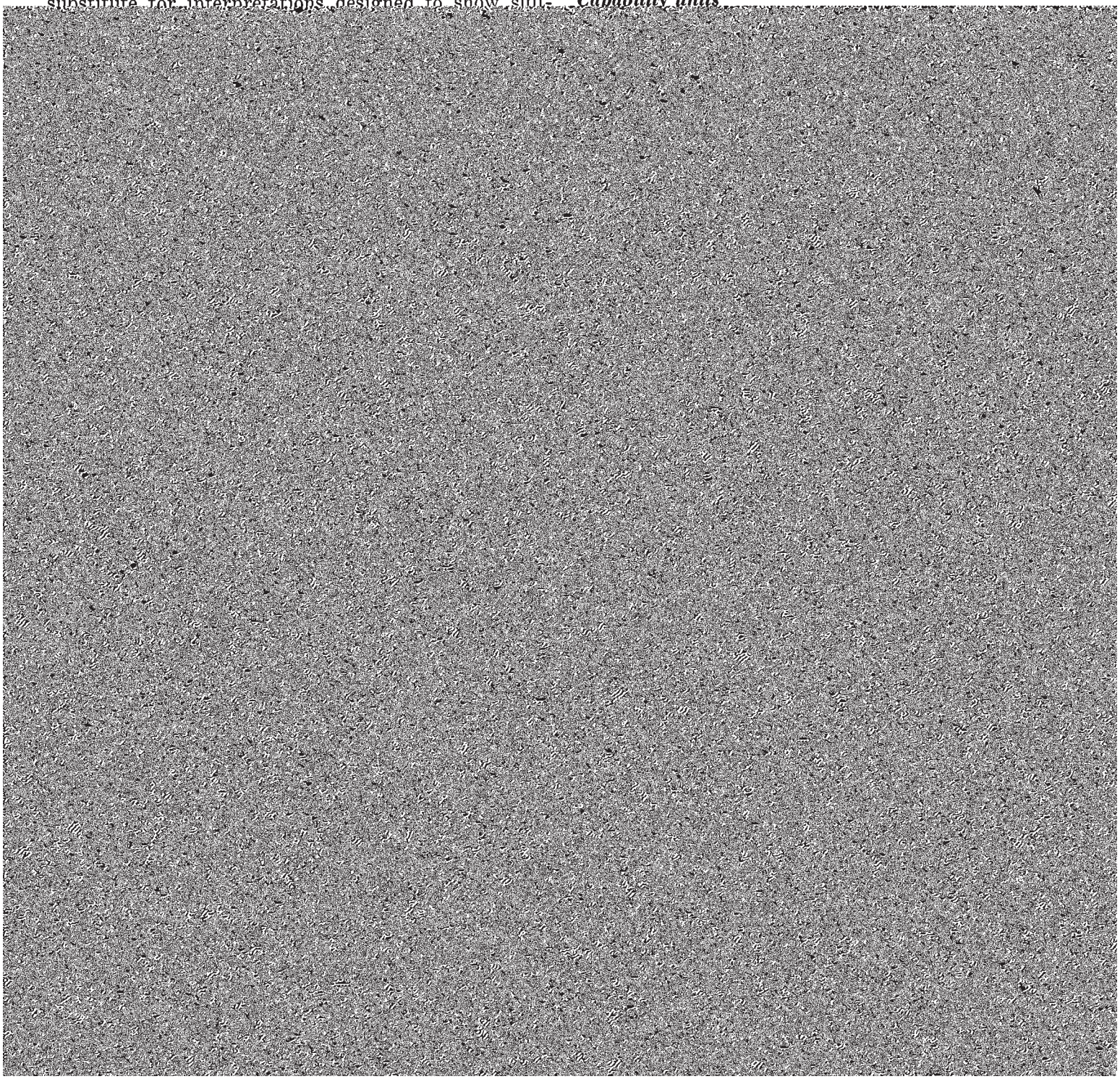
Improved drainage is needed on a few soils in the

and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural or other crops requiring special management.

Those familar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suit-

Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or IIIs–3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass or kind of limitation; and the Arabic numeral specifically identifies the capability unit within each subclass.

Capability units



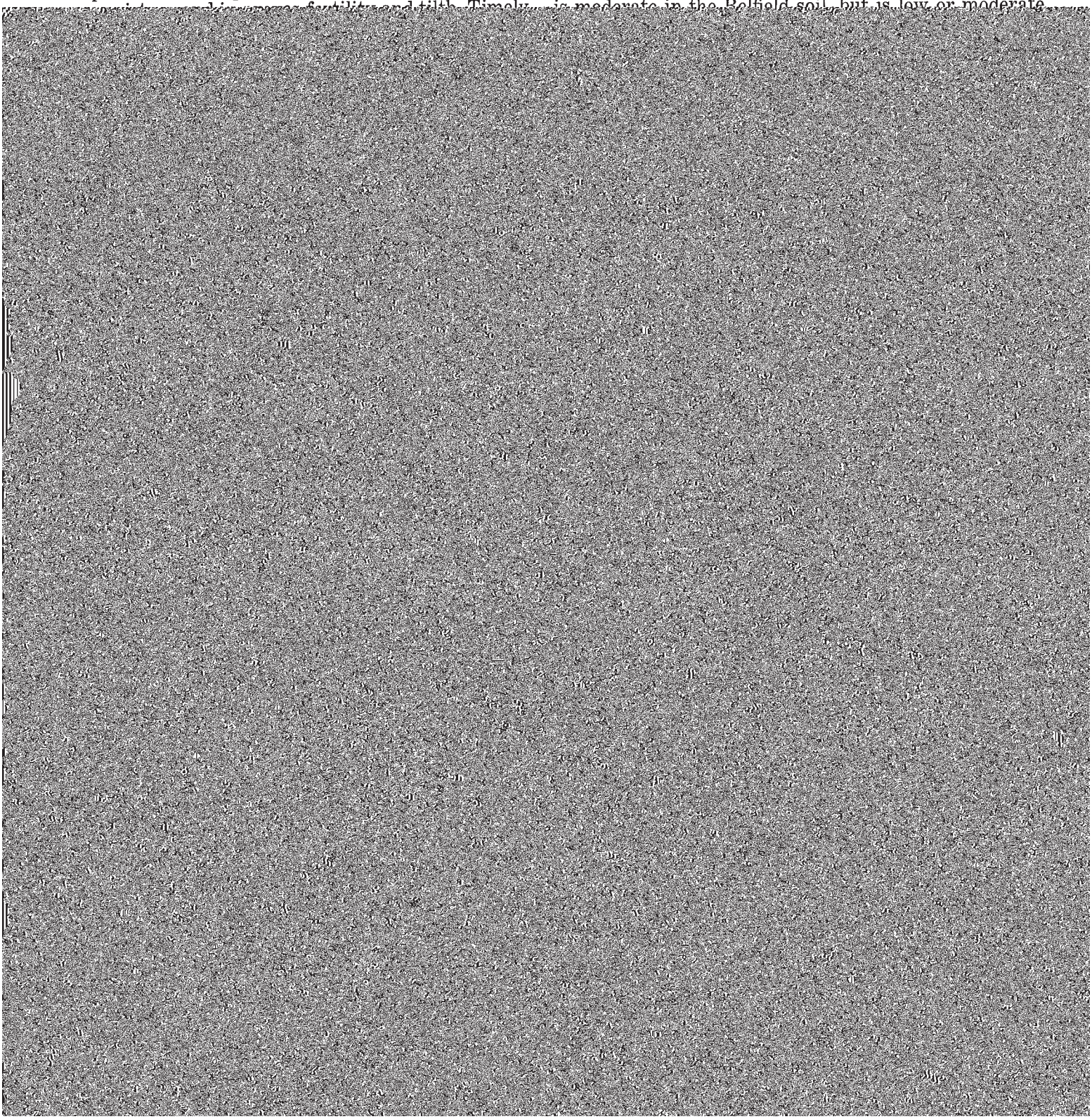
the main concern in management. Maintaining fertility and tilth also are important.

Most of the acreage is in native vegetation and is used for range. The soils are well suited to cultivated crops and tame grasses. Alfalfa and oats are the main crops.

Crop residue management or stubble mulching conserves moisture, maintains fertility and tilth. Timely

only soils in this unit. The dominant Belfield soil has a subsoil of clay loam and silty clay, and the Reeder soil has a subsoil of loam. Part of the cultivated acreage is slightly eroded.

These soils are medium in fertility, but the clayey subsoil of the Belfield soil takes in water slowly and releases it slowly to plants. Available water capacity is moderate in the Belfield soil, but is low or moderate



Stubble mulching, crop residue management, wind stripcropping, field windbreaks, and minimum tillage help control soil blowing and conserve moisture. Green manure crops and grasses and legumes in the cropping system improve fertility and content of organic matter.

CAPABILITY UNIT IIIe–10

Vebar fine sandy loam, 0 to 6 percent slopes, is the only soil in this unit. This moderately deep, well-drained, nearly level to gently undulating soil has a surface layer and subsoil of fine sandy loam. It is underlain by soft sandstone.

This soil is easy to work, but it blows easily and is droughty. Permeability is moderately rapid, and runoff is slow to medium. Controlling soil blowing and erosion is the main concern if this soil is farmed. Conserving moisture and maintaining fertility and the content of organic matter are also important.

Many areas are cultivated. Small grain, alfalfa, and corn are the main crops. Spring-sown small grain is better suited than winter wheat because of the soil blowing hazard. Some areas are in native grass and are used for range.

Stubble mulching, crop residue management, wind stripcropping, field windbreaks, and minimum tillage help control soil blowing and erosion. Contour stri[illegible]

Small grain is better suited than corn. About half the acreage is in native grass and is used for range and hay.

Stubble mulching, crop residue management, minimum tillage, and wind stripcropping are the chief management needs.

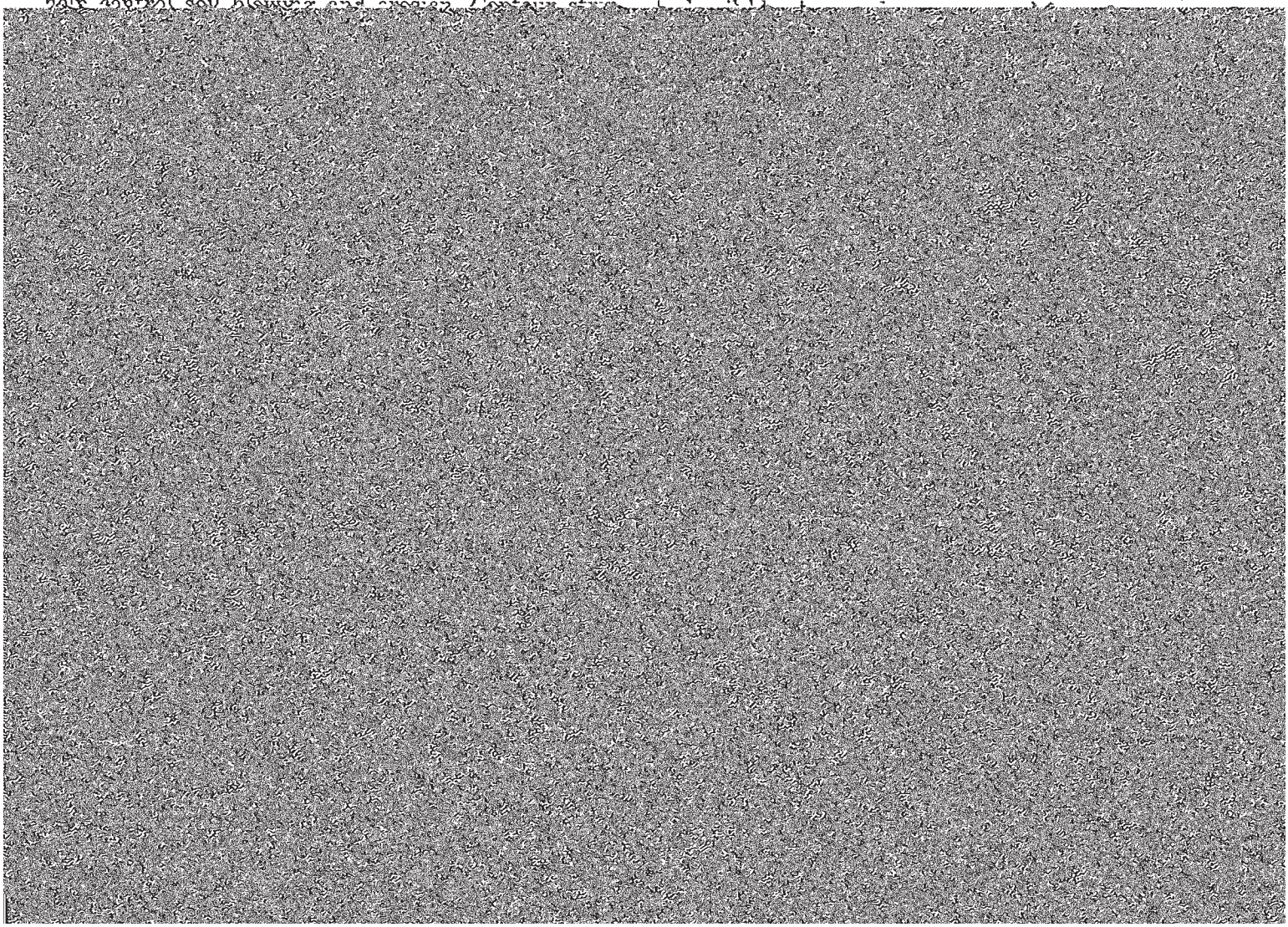
CAPABILITY UNIT IIIs–3

This unit consists of moderately deep and deep, well-drained clayey soils on uplands and terraces. Most of these soils are nearly level. Some are gently sloping.

These soils are medium in fertility, but have poor tilth and are difficult to work. Permeability is very slow, and the clayey subsoil releases moisture slowly to plants. Available water capacity is moderate to very low. Runoff is slow or medium. The soils dry slowly in spring. Improving tilth and water intake, controlling soil blowing, and conserving moisture are the major concerns in management.

Some areas are in native grass and are used for range and hay. Others are cultivated. Wheat, other small grain, and alfalfa are the main crops.

Stubble mulching, crop residue management, wind stripcropping, grasses and legumes in the cropping system, chiseling or subsoiling, timely tillage, and minimum tillage improve tilth and water intake, con-



erosion. Grasses and legumes in the cropping system improve fertility and the content of organic matter.

CAPABILITY UNIT IVe–13

Ekalaka fine sandy loam, 0 to 6 percent slopes, the only soil in this unit, is deep, well drained, and nearly level to gently sloping. This soil is on uplands. It has a thick surface layer of fine sandy loam and a claypan subsoil.

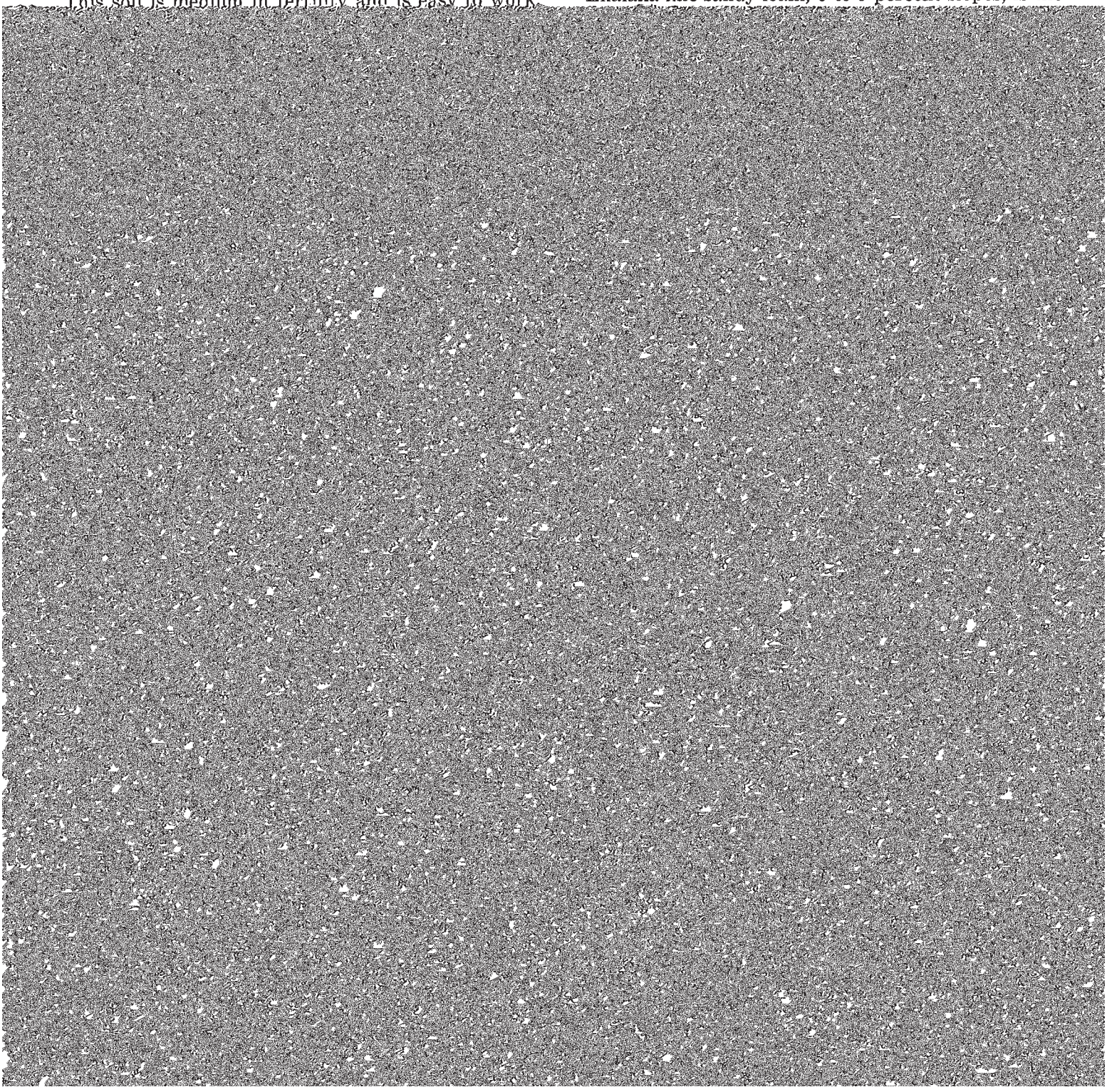
This soil is medium in fertility and is easy to work

These soils are not suitable for cultivation. Available water capacity is low or very low. Permeability is slow or very slow. Runoff is medium to rapid, and the hazard of erosion is severe.

Most areas are in native grass and are used for range. Proper range use is essential in controlling erosion. Cultivated areas should be seeded to native grass.

CAPABILITY UNIT VIe–6

Ekalaka fine sandy loam, 6 to 9 percent slopes, is the



sloping clayey and claypan soils along creeks and drainageways and in upland swales. Areas are long and narrow and are dissected by vertical-walled channels.

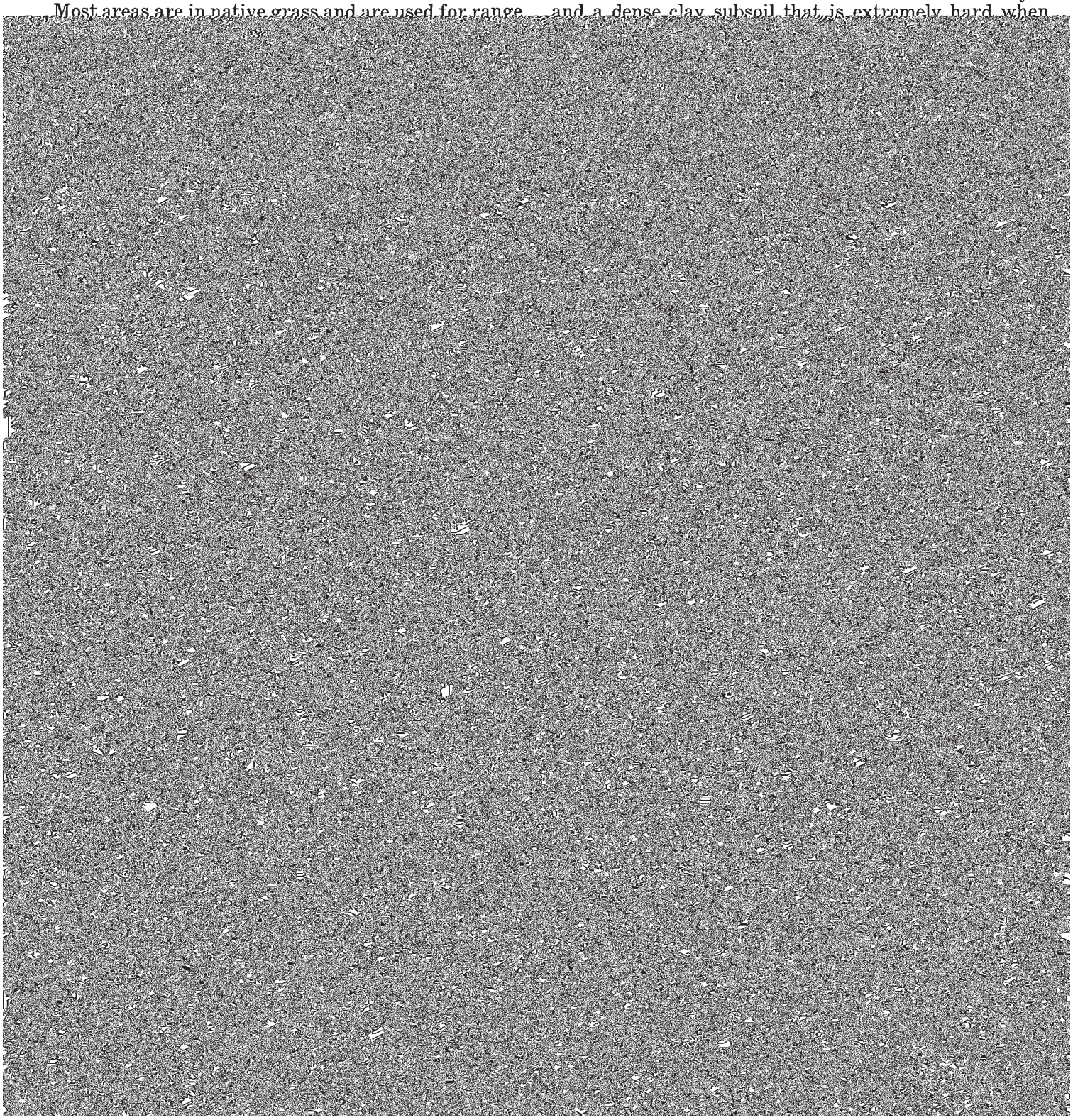
These soils are subject to flooding in some years. Cultivation is not practical because channels have cut most areas into small parcels. Streambank erosion is a hazard in some areas.

Most areas are in native grass and are used for range.

All areas are in native grass and are used for range. Proper range use is essential in conserving moisture and controlling soil blowing.

CAPABILITY UNIT VIs–5

This unit consists of shallow and deep, well drained and moderately well drained clayey soils on uplands and terraces. These soils have a thin surface layer and a dense clay subsoil that is extremely hard when



These soils are not suitable for cultivation. They are low in fertility and have very low or low available water capacity. In disturbed areas they are subject to soil blowing and erosion.

All areas are in native grass and are used for range. Proper range use is essential in conserving moisture and controlling soil blowing and erosion.

Tame Pasture [5]

Tame pasture is only about 1 percent of the land area in the county, but it is important to the livestock industry. It supplements the grazing provided by native range.

Sustained high production from tame pasture de-

TABLE 2.—*Predicted average yields per acre of principal dryfarmed crops*

[Figures in columns A are the yields to be expected under average prevailing management; those in columns B can be expected under improved management. Only soils suitable for crops are listed. Absence of a figure indicates the crop is not commonly grown on the soil or the soil is not suitable for that crop. Yields for soil complexes are based on the weighted average yields of the soil

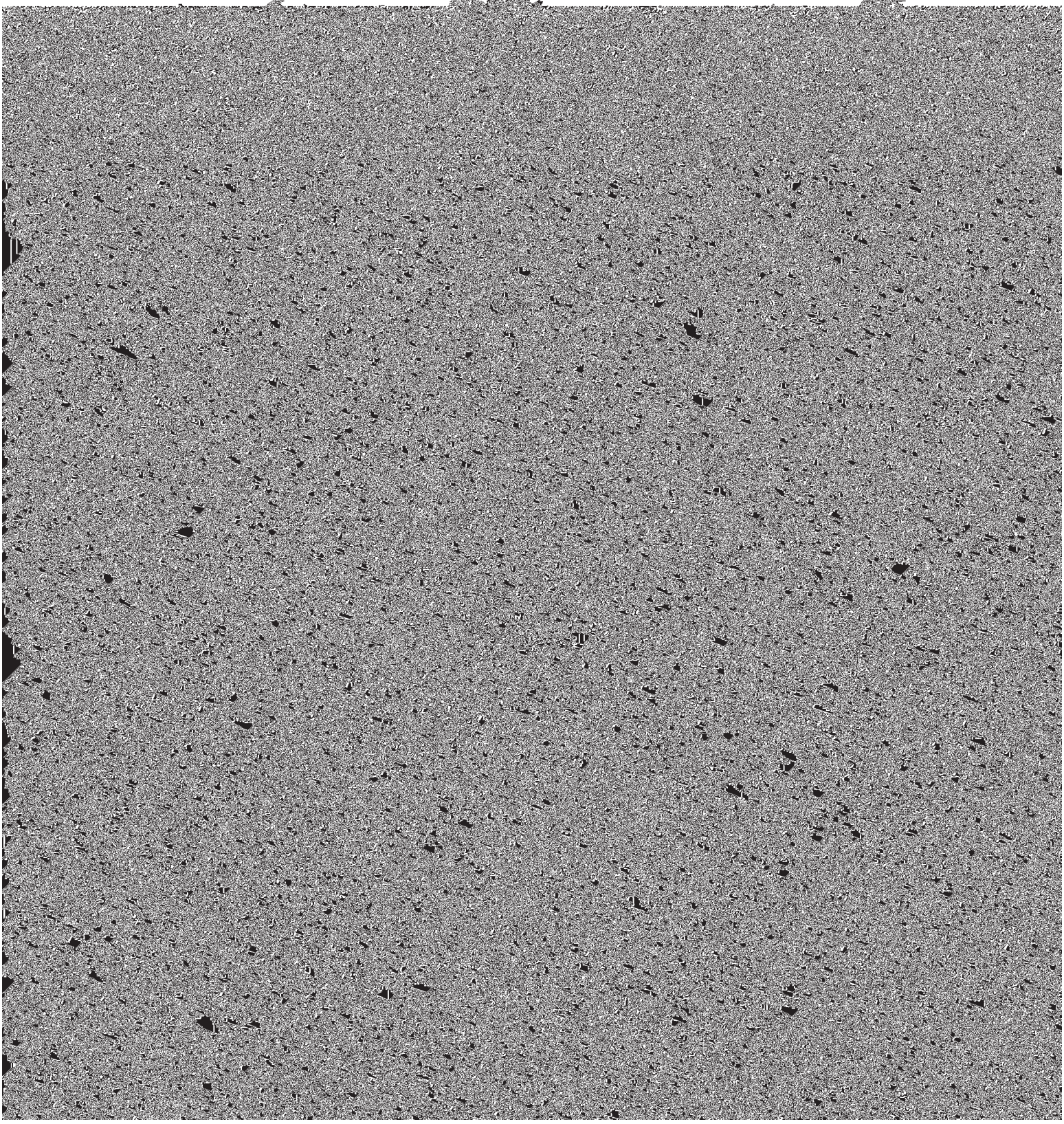


Figure 19.—**Cottonwood trees on Trembles and Banks soils along the Moreau River.**

stream valleys and in swales on uplands. The surface layer and subsoil range from fine sandy loam to clay.

These soils are medium or low in fertility, but have moderate or high available water capacity. Most areas receive additional moisture in the form of runoff from adjacent soils or from stream overflow. The moisture required on these soils is the most favorable in the county for planting trees.

Soils of this group are well suited to plantings for the protection of fields, farmsteads, and feedlots. The soils that have a fine sandy loam surface layer are dominantly moderate, but in places is slow or moderately slow. Most soils have moderate or high available water capacity. In all but the dry years soil moisture is favorable for tree growth. Sloping soils are subject to erosion.

Soils of this group are well suited to windbreak plantings for the protection of fields, farmsteads, and feedlots, and to plantings for beautification, recreation, and wildlife. At least 1 year of fallow before planting is essential in site preparation. Contour plantings help control erosion on the sloping soils.

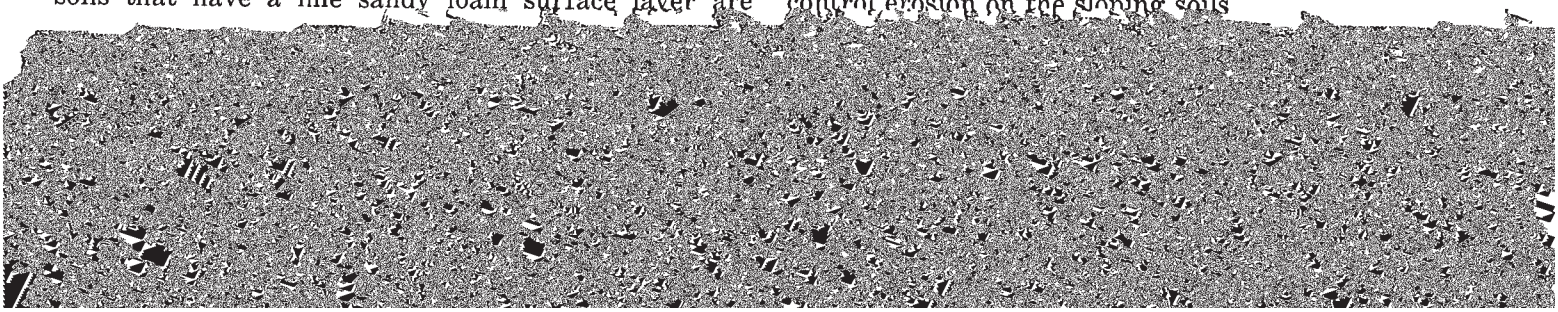


TABLE 3.—*Estimated height of trees and shrubs at 20 years of age by windbreak suitability groups*

[Absence of entry indicates that the species is not suitable for the specified group. Windbreak group 10 is not listed because the soils are not suitable for windbreaks and onsite investigation is needed to determine species for other kinds of plantings]

Trees and shrubs	Group 1	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9
	Ft	*Ft*	*Ft*	*Ft*	*Ft*	*Ft*	*Ft*	*Ft*
American elm	23–25	18–20	18–20	18–20				
Chinkota elm	25–30	24–26	23–25	22–24	11–13		10–12	10–20
Dropmore elm	25–30	24–26	23–25	22–24	11–13		10–12	10–12
Golden willow	28–32							
Plains cottonwood	30–35							
Siberian elm	25–30	24–26	23–25	22–24	11–13		10–12	10–12
White willow	28–32							
Black Hills spruce	20–24	17–19						
Blue spruce	20–24	17–19						
Boxelder	15–17	15–17						
Green ash	18–22	14–16	14–16	14–16	9–11		8–10	9–11
Hackberry	16–18	12–14	12–14	16–18	11–13			
Ponderosa pine	20–24	18–20	15–17	18–20	11–13	10–14	12–14	9–11
Russian-olive	14–16	15–17	12–14	15–17	7–9		8–9	8–9
Common chokecherry	10–12	8–11	8–10	8–11				
Eastern redcedar	13–15	10–12	13–15	11–13	7–9	8–10	6–8	5–7
Harbin pear	12–14	11–13	9–11	11–13			4–5	4–6
Rocky Mountain juniper	13–15	10–12	13–15	11–13	7–9	8–10	6–8	5–7
Siberian crabapple	12–14	11–13	10–12	11–13				
Siberian peashrub	8–10	8–9	6–8	8–10	4–5		4–5	4–5
American plum	7–8	7–8	4–5	5–6				
Lilac	5–6	6–7	4–5	4–5	3–4		3–4	3–4
Nanking cherry	4–5	4–5	4–5					
Peking cotoneaster	4–5	4–5	4–5	4–5				
Silver buffaloberry	6–8	5–7	5–7	5–6			3–4	3–4
Tartarian honeysuckle	6–8	6–8	5–7	4–6				

water slowly or very slowly. The sloping soils are subject to erosion, and the clayey soils are susceptible to soil blowing.

Soils in this group are moderately suited to field, farmstead, and feedlot windbreaks. They also can be used for beautification, recreation, and wildlife plantings, although the height of growth may be less than is desired. At least 1 year of fallow before planting is necessary in site preparation. Contour plantings help control erosion on sloping soils.

WINDBREAK GROUP 5

This group consists of deep and moderately deep, well-drained, nearly level to sloping loamy soils on uplands. These soils have a surface layer and subsoil of fine sandy loam.

These soils are medium in fertility, are easy to work, and take in water readily. They release moisture readily to growing trees, but are subject to soil blowing.

This soil is medium in fertility, but it is droughty. The underlying sand and gravel restricts the development of roots.

This soil is poorly suited to field windbreaks and to all other types of tree plantings, but it can be used if height of growth is not critical or if supplementary water is available at the site. At least 1 year of fallow before planting is necessary in site preparation. The amount of water stored is limited by the underlying sand and gravel.

WINDBREAK GROUP 7

The Banks part of Trembles and Banks soils, the only soil in this group, is a deep, somewhat excessively drained, nearly level sandy soil on low terraces and bottom land. The surface layer is loamy fine sand, and the underlying material is fine sand and sand.

This soil is low in fertility and has low available water capacity. Permeability is rapid. Droughtiness

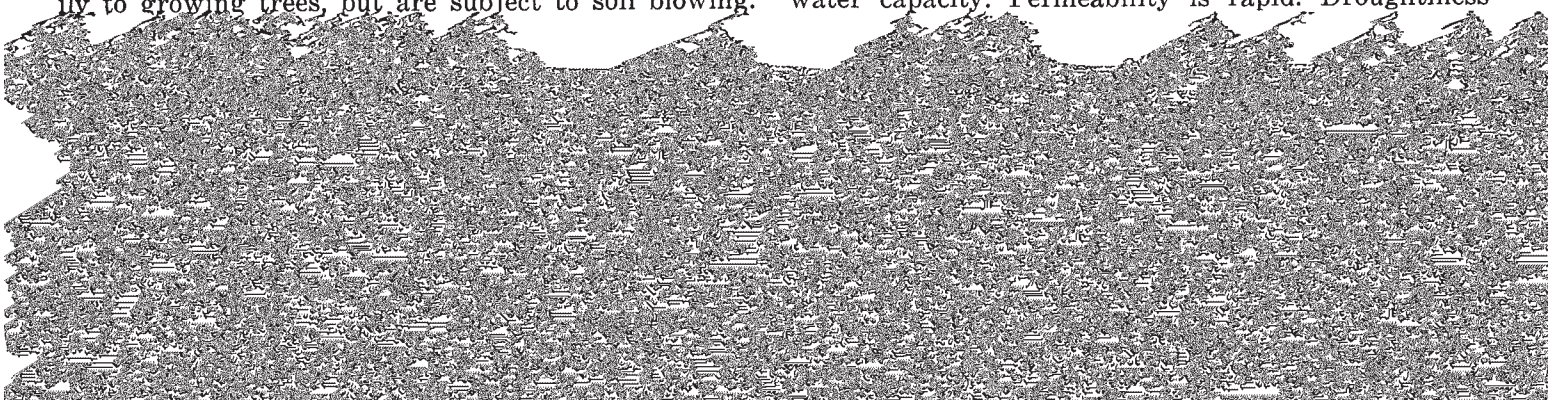


Figure 20.—**A clean, cultivated windbreak on Vebar fine sandy loam, 0 to 6 percent slopes. The evergreens add longevity to this windbreak and enhance the beauty of the farmstead.**

erately deep, well-drained, sloping, calcareous silty soil on uplands. The subsoil and underlying material are mildly alkaline.

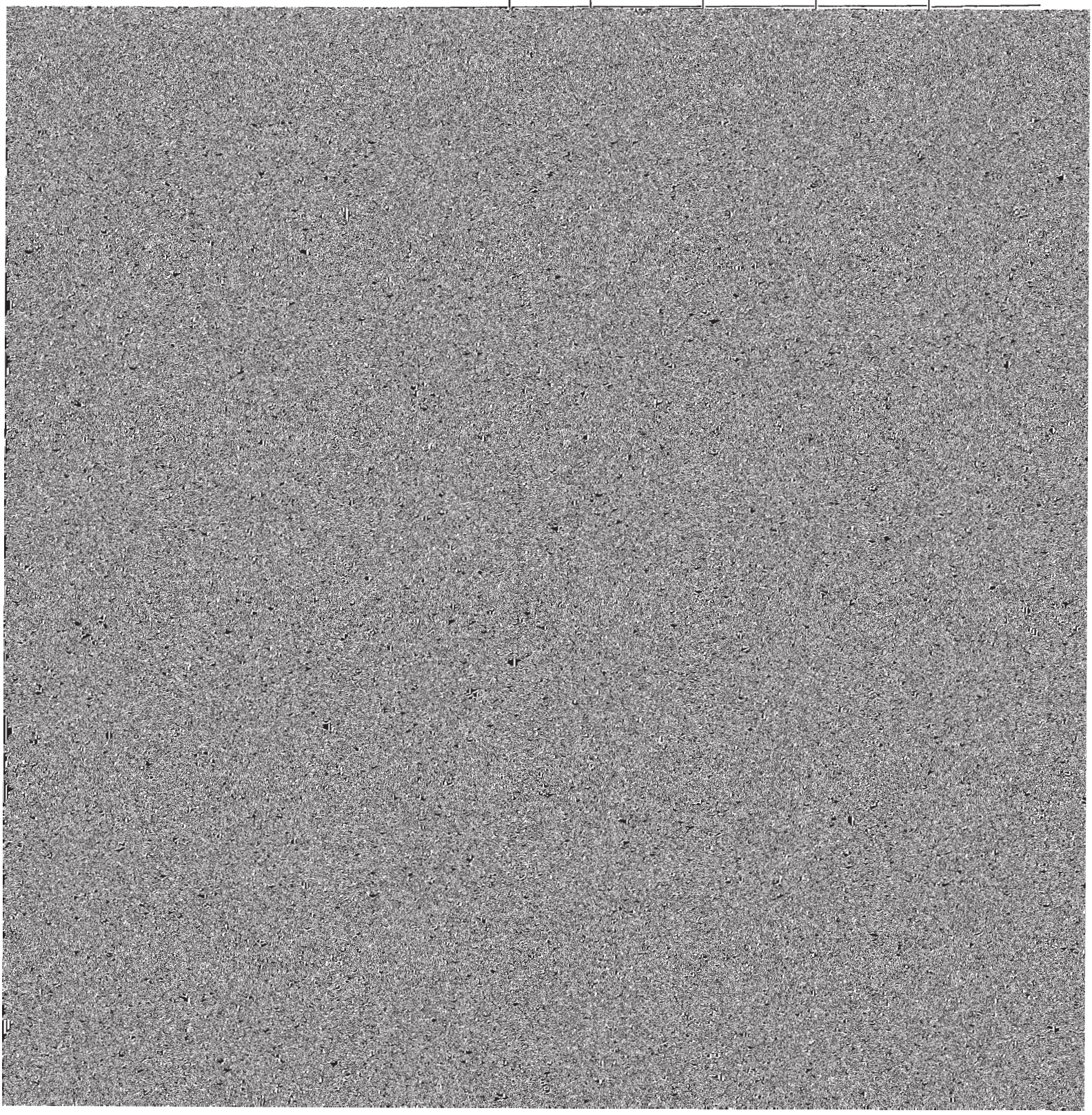
This soil is low in fertility. Permeability is moderate, and available water capacity is low or moderate. The high content of lime and the droughtiness of this soil limit tree growth. This soil is subject to erosion.

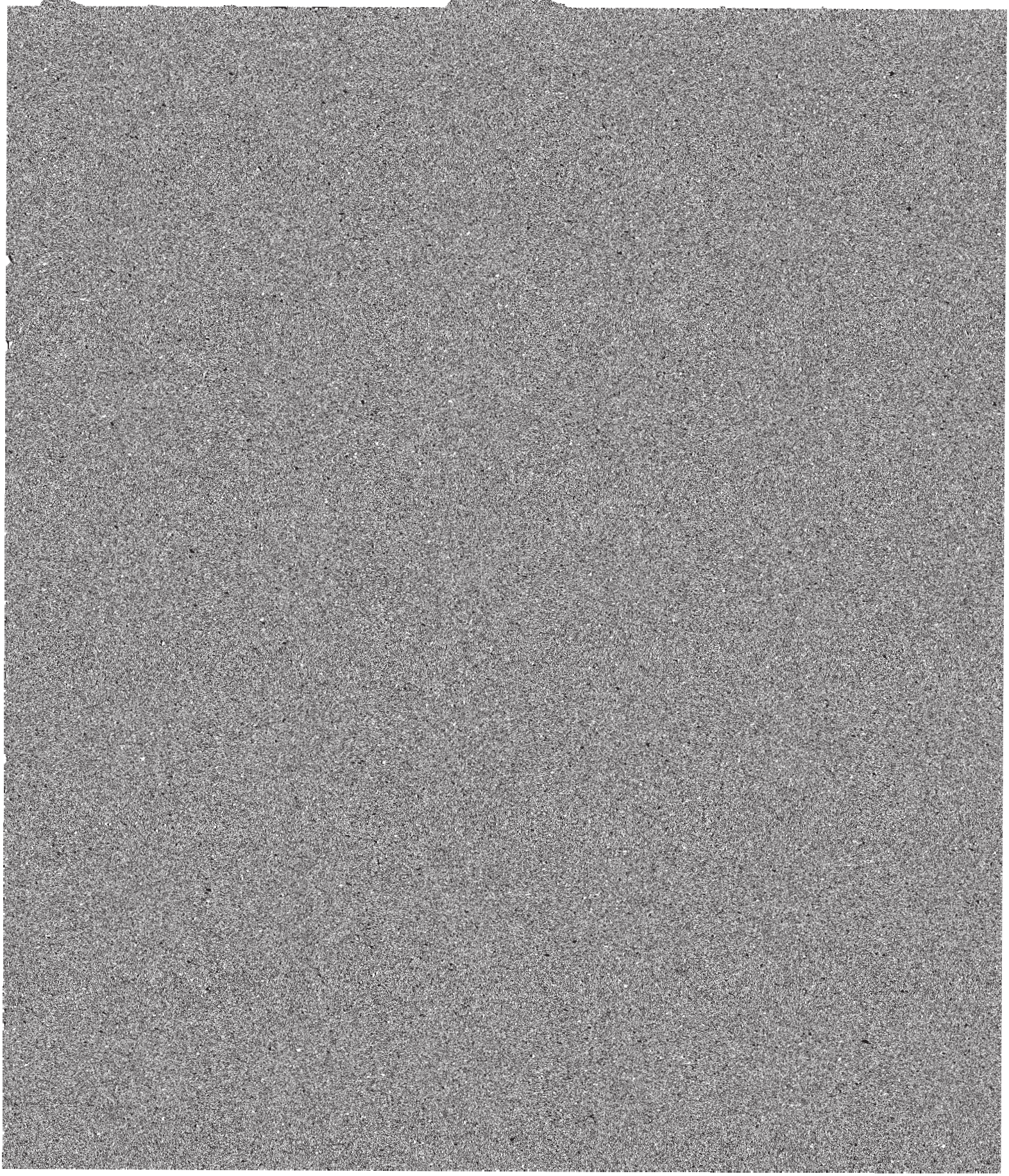
too steep for windbreaks planted with machinery. Other soils are too wet, too high in salts, or are too droughty for good survival and growth of trees.

Some soils in this group are not suitable for plantings of any kind. Others can support recreation and wildlife plantings if the trees are hand planted and special care is given. The trees or shrubs selected must

TABLE 4.—*Wildlife habitat, by soil associations*

Soil associations	Percent	Suitability for wildlife of:			
		Farmland	Woodland	Wetland	Rangeland





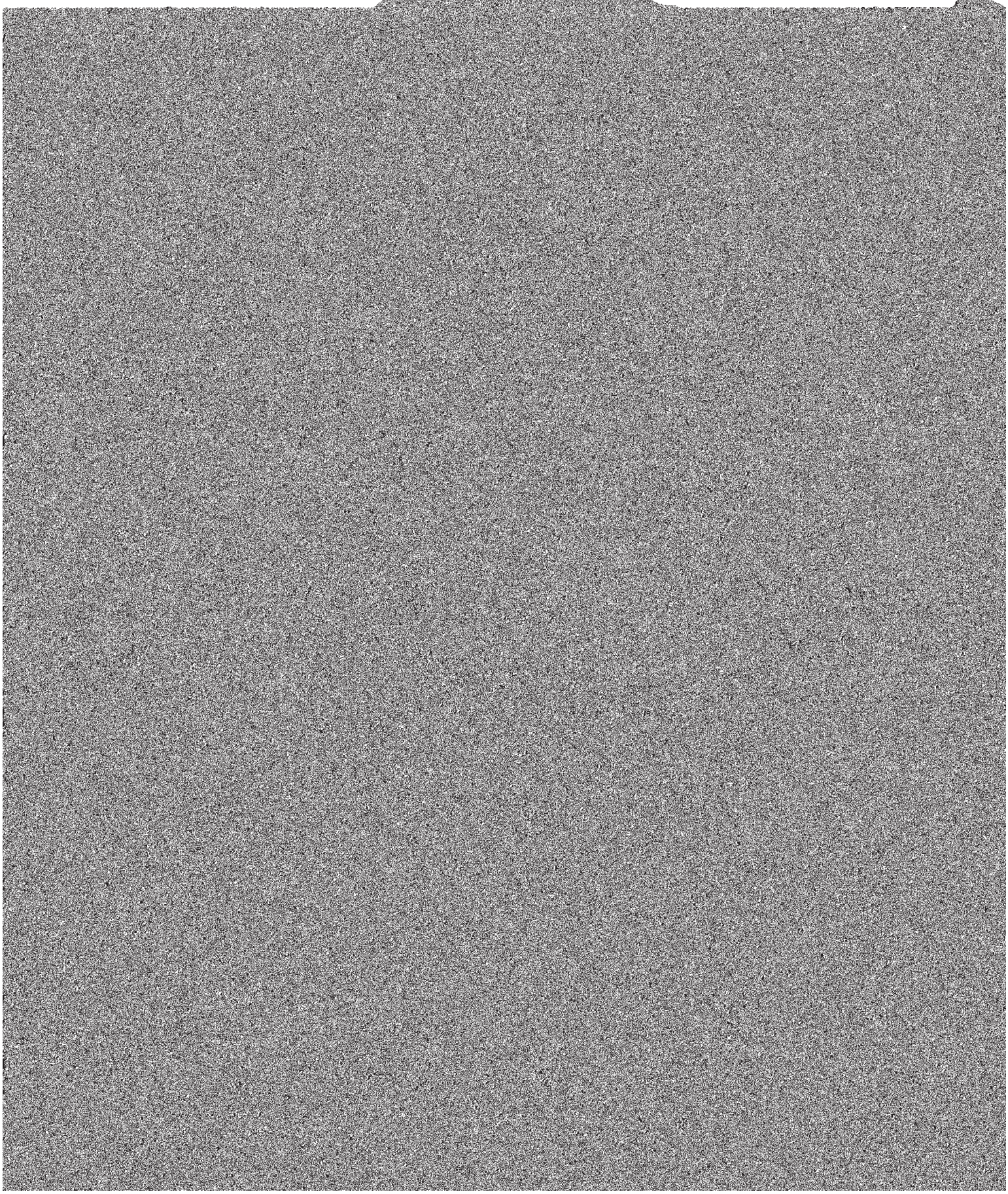
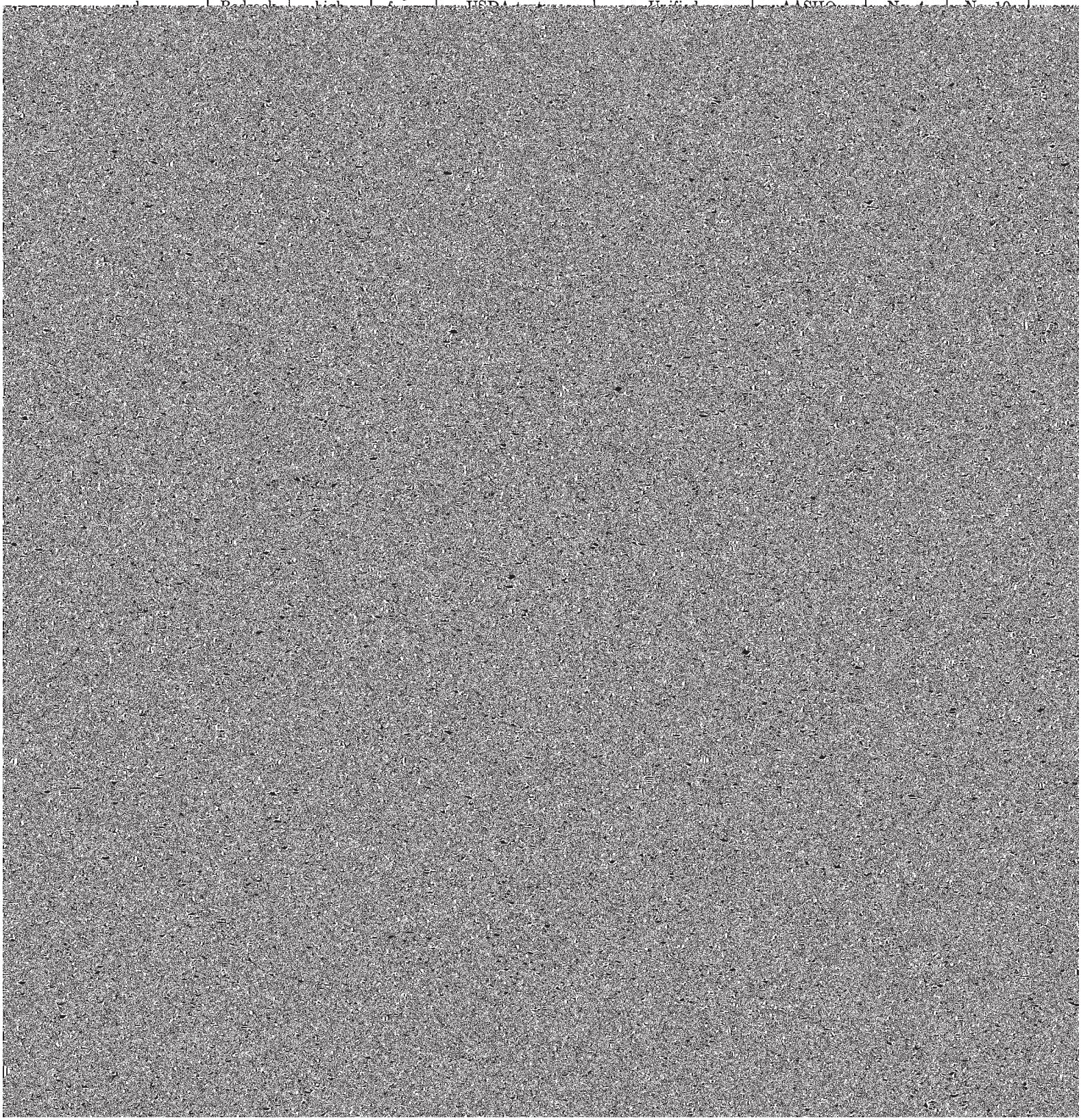


TABLE 5.—*Estimated physical*

Soil series	Depth to—		Depth	Dominant	Classification		Percentage less than 3 inches passing sieve—	
	Bedrock	Seasonal high water table	from surface	USDA texture	Unified	AASHO	No. 4	No. 10



and chemical properties—Continued

Percentage less than 3 inches passing sieve—continued		Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Risk of corrosion	
No. 40 (0.42 mm)	No. 200 (0.074 mm)								Uncoated steel	Concrete
				In/hr	*In/in of soil*	*pH*	*Mmhos/cm*			
95–100	95–100	60–90	31–60	<0.06	0.08–0.12	5.6–7.8	<2	High	High	Moderate.
90–100	90–100	65–110	36–80	<0.02			<2	High	High	Moderate.
70–85	40–55	22–30	4–7	2.0–6.0	0.14–0.17	5.6–6.5	<2	Low	Low	Low.
50–75	15–30	<25	NP–4	2.0–6.0	0.08–0.10	7.4–7.8	<2	Low	Low	Low.
70–85	40–55	22–30	4–7	0.06–0.2	0.09–0.12	7.9–8.4	2–4	Low	High	Moderate.
50–75	15–30	<25	NP–4	2.0–6.0	0.05–0.07	7.9–9.0	2–4	Low	High	Moderate.
70–85	40–55	22–30	4–7	2.0–6.0	0.09–0.12	7.9–9.0	2–4	Low	High	Moderate.
90–100	70–90	26–39	5–15	0.6–2.0	0.19–0.22	6.1–7.3	<2	Low	Low	Low.
90–100	70–80	30–45	11–22	0.6–2.0	0.17–0.20	6.6–7.8	<2	Moderate	Moderate	Low.
85–95	60–75	30–40	11–20	0.6–2.0	0.16–0.18	6.6–7.8	<2	Low	Moderate	Low.
85–95	50–65	20–30	4–10	0.6–2.0	0.15–0.17	7.4–7.8	<2	Low	Moderate	Low.
50–75	15–30	<25	NP–4	6.0–20.0	0.08–0.10	6.6–7.8	<2	Low	Low	Low.
80–100	25–55	27–35	5–15	0.06–0.2	0.13–0.15	8.5–9.5	8–16	Moderate	High	High.
50–75	15–30	<25	NP–4	6.0–20.0	0.05–0.07	9.0–9.5	8–16	Low	High	High.
85–95	60–75	30–40	11–20	0.6–2.0	0.16–0.18	6.6–7.8	<2	Low	Low	Low.
90–100	70–80	30–45	11–22	0.6–2.0	0.17–0.20	7.4–8.4	<2	Moderate	Moderate	Low.
90–100	75–95	45–70	22–40	<0.06	0.07–0.11	5.6–9.0	2–4	High	High	High.
95–100	85–95	45–55	19–33	0.2–0.6	0.19–0.22	6.1–6.5	<2	Moderate	Moderate	Low.
90–100	75–95	60–90	30–63	<0.06	0.07–0.11	7.4–9.0	4–8	High	High	High.
90–100	75–95	50–80	22–50	<0.06	0.05–0.09	7.4–9.0	4–16	High	High	High.
95–100	90–100	60–100	33–65	<0.02		6.6–7.8	<2	High	High	Moderate.
90–100	85–100	25–35	6–12	0.6–2.0	0.17–0.20	6.6–7.8 7.4–8.4	<2	Low or moderate.	Low	Low.
95–100	90–95	45–60	19–40	0.06–0.6	0.11–0.16	6.6–7.8	<2	High	High	Low.
90–100	75–95	41–50	15–30	0.06–0.6	0.14–0.17	7.4–7.8	<2	High	High	Low.
90–100	70–100	25–35	4–11	0.6–2.0	0.19–0.22	6.6–7.8	<2	Low	Low	Low.
90–100	70–100	25–37	4–12	0.6–2.0	0.17–0.20	7.4–8.4	<2	Low	Low	Low.
60–75	35–65	20–30	4–10	2.0–6.0	0.16–0.18	7.9–8.4	<2	Low	Low	Low.

TABLE 5.—*Estimated physical*

Soil series and map symbols	Depth to—		Depth from surface	Dominant USDA texture	Classification		Percentage less than 3 inches passing sieve—	
	Bedrock	Seasonal high water table			Unified	AASHO	No. 4 (4.7 mm)	No. 10 (2.0 mm)
	In	*In*	*In*					
Mine pits and dumps: Ma. No valid estimates can be made.								
*Moreau: MbD----- For Wayden part of MbD, see Wayden series.	20–40	>60	0–7 7–29 29–60	Silty clay---------- Clay---------- Shale.	CH CH	A–7 A–7	100 100	100 100
*Morton: McB, MdA, MdB, MfA, MgB. For Belfield part of MdA and MdB, see Belfield series; for Farland part of MfA, see Farland series; for Lantry part of MgB, see Lantry series.	20–40	>60	0–5 5–11 11–37 37–60	Silt loam---------- Loam---------- Loam---------- Sandstone----------	ML–CL or CL ML–CL or CL ML–CL or CL ----------	A–4 or A–6 A–6 or A–7 A–4 or A–6 ----------	100 100 100 ----------	100 100 95–100 ----------
Natriborolls, channeled: Na. No valid estimates can be made.								
*Opal: OaB, OhB, OpA, OsC, OtB. For Hurley part of OhB, see Hurley series; for Promise part of OpA, see Promise series; for Sansarc part of OsC, see Sansarc series. No valid estimates can be made for Slickspots part of OtB.	20–40	>60	0–14 14–33 33–60	Clay---------- Clay---------- Shale----------	CH CH CH	A–7 A–7 A–7	100 100 100	100 100 100
*Parshall: Pa, Pe----- For Ekalaka part part of Pe, see Ekalaka series.	>60	>60	0–36 36–60	Fine sandy loam---- Loamy fine sand----	SM or ML SM	A–4 A–2 or A–4	100 100	100 100
*Promise: PrA, PrB, PsA, Pw. For Swanboy part of Pw, see Swanboy series. No valid estimates can be made for Slickspots part of PsA.	>60	>60	0–10 10–31 31–60	Clay---------- Clay---------- Silty clay----------	CH CH CH	A–7 A–7 A–7	100 100 100	100 100 100

and chemical properties—Continued

Percentage less than 3 inches passing sieve—continued		Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Risk of corrosion	
No. 40 (0.42 mm)	No. 200 (0.074 mm)								Uncoated steel	Concrete
				In/hr	*In/in of soil*	*pH*	*Mmhos/cm*			
95–100	90–95	50–65	22–45	0.06–0.2	0.13–0.18	7.4–7.8	<2	High	High	Moderate.
90–100	75–95	50–70	22–45	0.06–0.2	0.11–0.16	7.4–9.0	2–4	High	High	Moderate.
90–100	85–100	27–40	6–17	0.6–2.0	0.19–0.22	6.1–7.3	<2	Low	Low	Low.
90–100	85–100	30–42	11–19	0.6–2.0	0.18–0.20	6.6–7.3	<2	Moderate	Moderate	Low.
90–100	85–100	27–35	6–15	0.6–2.0	0.16–0.18	6.6–7.8	<2	Low or moderate.	Moderate	Low.
						7.9–8.4				
90–100	85–100	50–85	22–50	<0.06	0.10–0.14	6.6–7.8	<2	High	High	Low.
90–100	85–100	55–90	26–60	<0.06	0.08–0.12	6.6–8.4	<2	High	High	Moderate.
95–100	90–100	60–90	25–60	<0.02		6.6–7.8	<2	High	High	Moderate.
70–85	40–55	25–30	4–7	2.0–6.0	0.14–0.17	6.1–7.3	<2	Low	Low	Low.
65–80	25–45	<25	NP–4	2.0–6.0	0.08–0.10	6.6–7.3	<2	Low	Low	Low.
90–100	80–100	50–70	22–40	0.02–0.2	0.10–0.14	5.6–7.3	<2	High	High	Low.
90–100	80–100	55–85	26–55	0.02–0.2	0.08–0.12	7.4–7.8	<2	High	High	Low.
90–100	90–100	50–65	22–35	0.06–0.2	0.08–0.12	7.4–7.8	<2	High	High	Low.

TABLE 5.—*Estimated physical*

Soil series and map symbols	Depth to—		Depth from surface	Dominant USDA texture	Classification		Percentage less than 3 inches passing sieve—	
	Bedrock	Seasonal high water			Unified	AASHO	No. 4 (4.7 mm)	No. 10 (2.0 mm)

and chemical properties—Continued

Percentage less than 3 inches passing sieve—continued		Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Risk of corrosion	
No. 40 (0.42 mm)	No. 200 (0.074 mm)								Uncoated steel	Concrete
				In/hr	*In/in of soil*	*pH*	*Mmhos/cm*			
85–95	60–75	27–35	7–13	0.6–2.0	0.18–0.20	5.6–6.5	<2	Low	Moderate	Low.
85–95	50–75	30–40	8–18	0.6–2.0	0.16–0.18	6.1–7.3	<2	Moderate	Moderate	Low.
70–85	50–60	25–30	4–7	2.0–6.0	0.12–0.15	7.4–7.8	<2	Low	Moderate	Low.
						7.4–7.8				
70–85	40–55	25–30	4–7	2.0–6.0	0.14–0.17	7.4–7.8	<2	Low	Low	Low.
85–95	60–75	27–35	6–13	0.6–2.0	0.13–0.15	7.4–8.4	8–16	Moderate	High	Moderate.
70–85	40–55	25–30	4–7	0.6–2.0	0.09–0.12	7.4–8.4	8–16	Low	High	Moderate.
85–95	60–75	27–35	6–13	0.6–2.0	0.13–0.15	7.4–8.4	8–16	Moderate	High	Moderate.
55–80	15–35	<25	NP–4	6.0–20.0	0.08–0.10	6.6–7.8	4–8	Low	High	Moderate.
95–100	85–100	45–60	19–35	0.6–2.0	0.19–0.22	6.1–6.5	<2	Moderate or high.	Low	Low.
95–100	90–100	55–70	26–40	0.06–0.2	0.13–0.18	6.6–7.3	<2	High	High	Low.
95–100	90–100	55–70	26–40	0.06–0.2	0.11–0.16	7.4–8.4	<2	High	High	Moderate.
						7.4–7.8				
95–100	85–95	35–55	11–28	0.6–2.0	0.19–0.22	6.1–7.3	<2	Moderate or high.	Moderate	Low.

TABLE 5.—*Estimated physical*

Soil series and map symbols	Depth to—		Depth from surface	Dominant USDA texture	Classification		Percentage less than 3 inches passing sieve—	
	Bedrock	Seasonal high water table			Unified	AASHO	No. 4 (4.7 mm)	No. 10 (2.0 mm)
	In	*In*	*In*					
Swanboy: Sw, Sy—— No valid estimates can be made for Slickspots part of Sy.	>60	>60	0–60	Clay	CH	A–7	100	100
Tally: Ta——	>60	>60	0–13	Fine sandy loam	SM or ML	A–4	100	100
			13–29	Fine sandy loam	SM or ML	A–4	100	100
			29–60	Loamy fine sand	SM	A–2	100	100
*Trembles: Th, Tr—— For Havrelon part of Th, see Havrelon series; for Banks part of Tr, see Banks series.	>60	>60	0–4	Fine sandy loam	SM or ML	A–4	100	100
			4–60	Fine sandy loam	SM or ML	A–4	100	100
*Vebar: VeB, VfB—— For Flasher part of VfB, see Flasher series.	20–40	>60	0–7	Fine sandy loam	SM	A–4	100	100
			7–24	Fine sandy loam	SM	A–4	100	100
			24–32	Loamy fine sand	SM	A–2 or A–4	95–100	95–100
			32–60	Sandstone.				
*Wayden: WaF—— For Moreau part of WaF, see Moreau series.	10–20	>60	0–16	Clay	CH	A–7	100	100
			16–60	Shale	----	----	----	----

[1] Nonplastic.

2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand.

Permeability is the quality that enables a soil to transmit water or air. It is estimated on the basis of soil characteristics observed, particularly structure and texture. The estimates do not take into account lateral

and chemical properties—Continued

Percentage less than 3 inches passing sieve—continued		Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Risk of corrosion	
No. 40 (0.42 mm)	No. 200 (0.074 mm)								Uncoated steel	Concrete

TABLE 6.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. fully the instructions for referring to other series

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill	Local roads and streets
Absher: AbA, AcA---- No valid interpretations can be made for Slickspots part of AcA.	Severe: very slow permeability.	Slight----	Severe: silty clay and clay textures.	Severe: high shrink swell.	Severe: silty clay and clay textures.	Severe: high shrink swell.
Agar: AgB----	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight----	Moderate: moderate shrink swell.	Slight----	Severe: AASHO group index more than 8.
Archin: ArB---- No valid interpretations can be made for Slickspots part.	Slight if tile is placed in substratum; severe if placed in subsoil.	Severe: moderately rapid permeability in substratum.	Moderate: compact claypan subsoil.	Moderate: moderate shrink swell.	Severe: moderately rapid permeability in substratum.	Moderate: moderate shrink swell in subsoil.
Arvada: AsA---- No valid interpretations can be made for Slickspots part.	Severe: very slow permeability.	Slight----	Severe: clay texture.	Severe: high shrink swell.	Severe: clay texture.	Severe: high shrink swell.
Banks---- Mapped only with Trembles soils.	Severe: subject to flooding.[2]	Severe: subject to flooding; rapid permeability.	Severe: loamy sand and sand textures.	Severe: subject to flooding.	Severe: subject to flooding; rapid permeability.	Moderate: subject to flooding.
*Belfield: BdA, BrA, BrB, BrC. For Daglum part of BdA, see Daglum series; for Reeder part of BrA, BrB, and BrC, see Reeder series.	Severe: slow permeability.	Slight if slope is less than 2 percent, moderate if 2 to 7, severe if 7 to 9.	Moderate: clay loam and silty clay textures.	Severe: high shrink swell.	Moderate: clay loam and silty clay textures.	Severe: CH or CL material; plasticity index more than 15.
*Cabba: CbE, CbF---- For Lantry part of CbE and CbF, see Lantry series.	Severe: less than 20 inches to sandstone; more than 15 percent slopes.	Severe: less than 20 inches to sandstone; more than 15 percent slopes.	Severe: slopes more than 15 percent.	Severe: slopes more than 15 percent; less than 20 inches to sandstone.	Severe: less than 20 inches to sandstone.	Severe: more than 15 percent slopes.
Canning: CdA----	Slight[2]----	Severe: rapid permeability in substratum.	Severe: sand and gravel at 20 to 40 inches.	Slight----	Severe: rapid permeability in substratum.	Moderate: moderate shrink swell; AASHO group index 5 to 8 in soil above sand and gravel.

interpretations

The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow care-
that appear in the first column of this table]

Suitability as source of—			Soil features affecting—				
	Sand		Pond	Embankments			Terraces

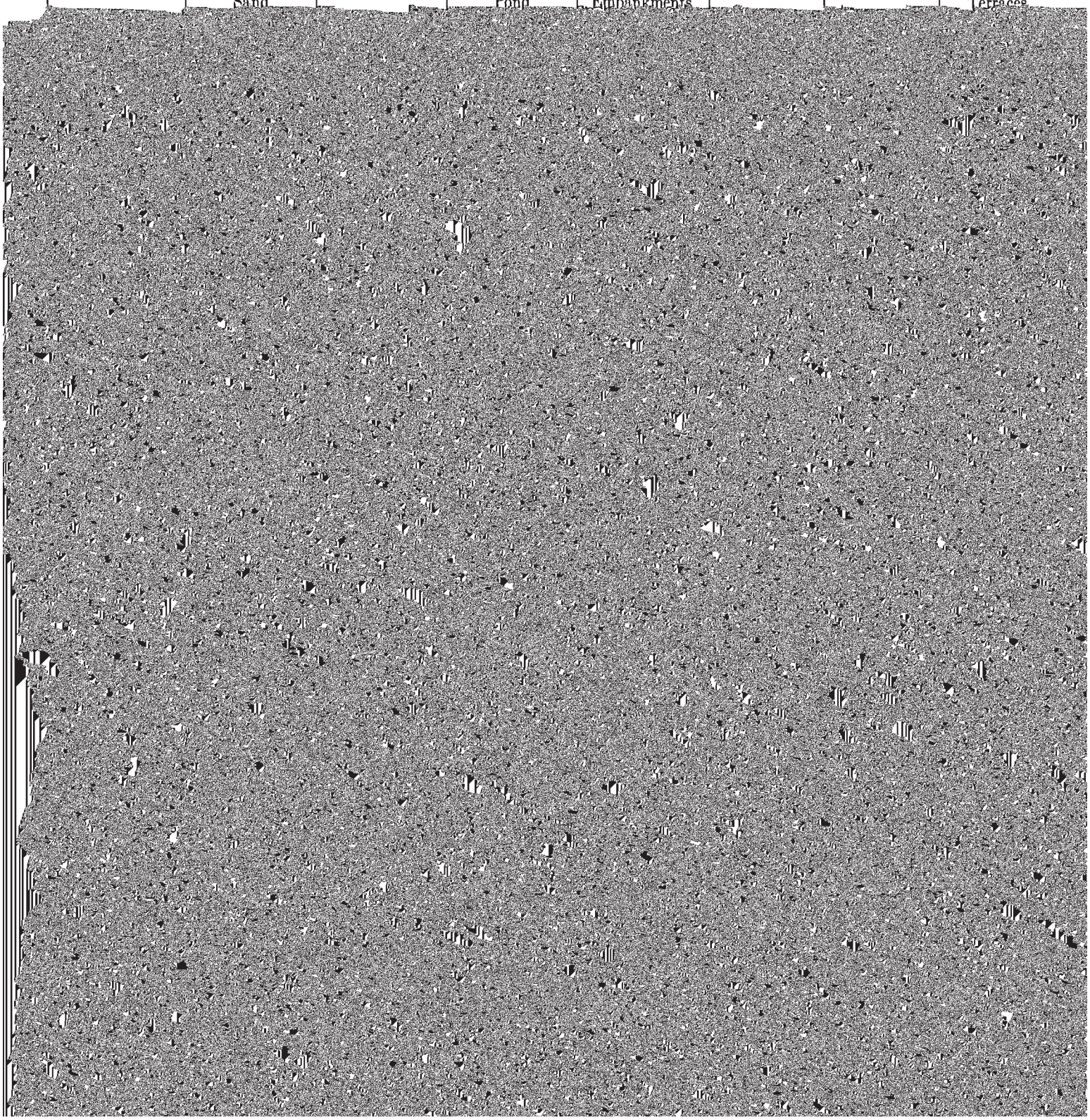


TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill	Local roads and streets
*Chantier: ChB, CsC—For Shale land part of CsC, see Shale land.	Severe: very slow permeability; less than 20 inches to shale.	Moderate if slope is 2 to 7 percent, severe if more than 7; less than 20 inches to nearly impervious shale.	Severe: clay texture; less than 20 inches to shale.	Severe: high shrink swell; less than 20 inches to shale.	Severe: clay texture; less than 20 inches to shale.	Severe: high shrink swell; less than 20 inches to shale.
Daglum: DaA	Severe: very slow permeability.	Slight	Severe: silty clay texture.	Severe: high shrink swell.	Severe: silty clay texture.	Severe: high shrink swell.
*Dupree: DoB, DsE—For Opal part of DoB, see Opal series; for Sansarc part of DsE, see Sansarc series.	Severe: very slow permeability; less than 20 inches to shale.	Moderate if slope is 2 to 7 percent, severe if more than 7; less than 20 inches to nearly impervious shale.	Severe: clay texture; less than 20 inches to shale.	Severe: high shrink swell; less than 20 inches to shale.	Severe: clay texture; less than 20 inches to shale.	Severe: high shrink swell; less than 20 inches to shale.
Ekalaka: EkA, EkC	Slight if tile is placed below 26 inches.	Severe: moderately rapid permeability in substratum.	Moderate: compact claypan subsoil.	Slight	Severe: moderately rapid permeability in substratum.	Slight
Farland: FaA, FaB	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: clay loam subsoil.	Moderate: moderate shrink swell in subsoil.	Moderate: clay loam subsoil; possible seepage below depth of 5 feet.	Moderate: ML or CL material; moderate shrink swell in subsoil.
*Flasher: FbF, FvD, FvE. For Vebar part of FvD and FvE, see Vebar series.	Severe: less than 20 inches to soft sandstone.	Severe: rapid permeability.	Moderate if slope is less than 15 percent, severe if more than 15; less than 20 inches to rippable sandstone.	Moderate if slope is less than 15 percent, severe if more than 15; less than 20 inches to rippable bedrock.	Severe: rapid permeability.	Moderate if slope is less than 15 percent, severe if more than 15; less than 20 inches to rippable bedrock.
*Glenross: Gb, Gr—For Regan part of Gr, see Regan series.	Severe: high water table.	Severe: high water table.	Severe: poorly drained; high water table.	Severe: poorly drained; high water table.	Severe: poorly drained; high water table.	Severe: poorly drained.

interpretations—Continued

Suitability as source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Poor: high shrink swell; less than 20 inches to shale.	Unsuited: no sand or gravel.	Poor: clay texture; salts.	Very slow permeability; less than 20 inches to nearly impervious shale.	Limited material; high volume change; susceptible to sliding.	(1)----------	Less than 20 inches to shale; very slow permeability; high concentrations of salt; very low available water capacity.	Less than 20 inches to shale; clay texture; very slow permeability.
Poor: high shrink swell.	Unsuited: no sand or gravel.	Poor: 7 inches of silt loam over claypan subsoil.	Very slow permeability; low seepage.	High shrink swell; medium to high compressibility.	Very slow permeability; claypan subsoil. [1]	Claypan subsoil; very slow permeability.	Very slow permeability; claypan subsoil.
Poor: high shrink swell.	Unsuited: no sand or gravel.	Poor: clay texture.	Very slow permeability; less than 20 inches to nearly impervious shale.	Limited material; high volume change; susceptible to sliding.	(1)----------	Less than 20 inches to shale; very low available water capacity; gently sloping to very steep.	Clay texture; very slow permeability; less than 20 inches to shale.
Fair: SM or ML material; more than 30 percent fines.	Poor: fines, no gravel.	Good to a depth of 14 inches, poor below; claypan subsoil.	High seepage; moderately rapid permeability in substratum.	Sandy material; poor resistance to piping.	Slow permeability; claypan subsoil. [1]	Susceptible to soil blowing; low or moderate available water capacity; claypan subsoil.	Claypan subsoil; slow permeability.
Fair: moderate shrink swell.	Unsuited: no sand or gravel.	Good to a depth of 8 inches, fair below; clay loam texture.	Moderate permeability.	Medium to high compressibility; moderate shrink swell; possible piping in substratum material.	Moderate permeability; nearly level or gently sloping.	High available water capacity; deep root zone; moderately slow water intake rate.	Long, smooth, nearly level to gently sloping areas; moderate permeability.
Good if slope is less than 15 percent, fair if 15 to 25, poor if more than 25.	Unsuited: less than 20 inches to soft sandstone; fines, no gravel.	Poor: loamy fine sand; less than 20 inches to bedrock.	High seepage; less than 20 inches to soft sandstone.	Limited material; poor resistance to piping; high seepage.	(1)----------	Very low available water capacity; less than 20 inches to soft sandstone; undulating to steep areas.	Sandy texture; less than 20 inches to soft sandstone; susceptible to soil blowing; undulating to steep, short slopes.
Poor: poorly drained.	Poor: fines; no gravel; high water table.	Poor: poorly drained; thin surface layer; salts.	High water table; good dugout site.	Good stability in subsoil; poor stability and poor resistance to piping in substratum.	High water table; wet areas lower than available outlets.	High water table; high salt concentrations.	(1).

TABLE 6.—*Engineering*

interpretations—Continued

Suitability as source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Fair: moderate shrink swell.	Unsuited: possible source of sand and gravel below 60 inches.	Good	Some areas subject to flooding; nearly level; moderate permeability.	Fair to good stability and compaction characteristics.	Moderate permeability; some areas subject to flooding.	High available water capacity; some areas subject to flooding.	(1).
Poor: poorly drained; high shrink swell.	Unsuited: no sand or gravel.	Poor: poorly drained.	Good dugout site; frequent ponding.	Clayey material; high volume change; fair to poor stability and compaction characteristics.	Very slow permeability; clay texture; frequent ponding.	Frequent ponding; poorly drained; claypan subsoil.	(1).
Poor: high shrink swell.	Unsuited: no sand or gravel.	Poor: 3 inches of silty clay loam over claypan subsoil.	Very slow permeability; 20 to 40 inches to nearly impervious shale.	High volume change; fair to poor stability and compaction characteristics.	Very slow permeability; clay texture; shale at a depth of 20 to 40 inches. [1]	Claypan subsoil; very slow permeability.	Claypan subsoil; very slow permeability.
Fair if slope is less than 25 percent, severe if more than 25; ML or CL material.	Unsuited: no sand or gravel.	Poor: thin layer.	20 to 40 inches to bedrock; possible seepage in fractures of bedrock.	Limited material; medium or high compressibility; poor or good resistance to piping.	20 to 40 inches to bedrock; gently undulating to steep areas. [1]	20 to 40 inches to bedrock; low or moderate available water capacity; gently sloping to steep areas.	20 to 40 inches to bedrock; gently undulating to steep areas; mostly short, irregular slopes.
Poor: high shrink swell.	Unsuited: no sand or gravel.	Poor: silty clay texture.	Subject to flooding; nearly level.	High volume change; fair to poor stability and compaction characteristics.	Moderately slow or slow permeability; subject to flooding.	Moderate or high available water capacity; subject to flooding; slow water intake rate.	(1).
Fair: AASHO group index of 5 to 10.	Unsuited: possible source below a depth of 60 inches.	Good	Moderate permeability; possible seepage in substratum.	Poor stability and compaction characteristics; poor resistance to piping.	Moderate permeability; moderately rapid permeability below a depth of 55 inches.	High available water capacity; moderate water intake rate; deep root zone.	Long, smooth slopes; erosive; moderate permeability.

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill	Local roads and streets
*Moreau: MbD. For Wayden part of MbD, see Wayden series.	Severe: slow permeability; 20 to 40 inches to shale.	Severe: 20 to 40 inches to shale.	Severe: silty clay and clay textures.	Severe: high shrink swell.	Severe: silty clay and clay textures; 20 to 40 inches to rippable bedrock.	Severe: high shrink swell.
*Morton: McB, MdA, MdB, MfA, MgB. For Belfield part of MdA and MdB, see Belfield series; for Farland part of MfA, see Farland series; for Lantry part of MgB, see Lantry series.	Severe: less than 40 inches to bedrock.	Severe: less than 40 inches to bedrock.	Moderate: less than 40 inches to rippable bedrock.	Moderate: moderate shrink swell; less than 40 inches to rippable bedrock.	Moderate: less than 40 inches to rippable bedrock.	Moderate or severe: AASHO group index of 5 to 15.
Natriborolls, channeled: Na. Too variable to be rated.						
*Opal: OaB, OhB, OpA, OsC, OtB. For Hurley part of OhB, see Hurley series; for Promise part of OpA, see Promise series; for Sansarc part of OsC, see Sansarc series. No valid interpretations can be made for Slickspots part of OtB.	Severe: very slow permeability; 20 to 40 inches to shale.	Slight if slope is 0 to 2 percent, moderate if 2 to 7, severe if more than 7; nearly impervious shale.	Severe: clay texture.	Severe: high shrink swell.	Severe: clay texture.	Severe: high shrink swell.
*Parshall: Pa, Pe. For Ekalaka part of Pe, see Ekalaka series.	Slight [2]	Severe: moderately rapid permeability.	Severe: subject to run-in water; loamy fine sand and fine sand textures in substratum.	Severe: subject to run-in water.	Severe: moderately rapid permeability. [2]	Moderate: subject to run-in water.
*Promise: PrA, PrB, PsA, Pw. For Swanboy part of Pw, see Swanboy series. No valid interpretations can be made for Slickspots part of PsA.	Severe: very slow or slow permeability.	Slight if slope is less than 2 percent, moderate if 2 to 6.	Severe: clay and silty clay textures.	Severe: high shrink swell.	Severe: clay and silty clay textures.	Severe: high shrink swell.

interpretations—Continued

Suitability as source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Poor: high shrink swell.	Unsuited: no sand or gravel.	Poor: silty clay and clay textures.	20 to 40 inches to shale; possible lateral seepage.	High volume change; limited material; fair to poor stability.	Slow permeability; 20 to 40 inches to shale.[1]	Low available water capacity; 20 to 40 inches to shale; mostly sloping to steep areas.	Slow permeability; 20 to 40 inches to shale; gently undulating to steep areas; short, irregular slopes.
Fair or poor: ML–CL or CL material; AASHO group index of 5 to 15.	Unsuited: no sand or gravel.	Good	Moderate permeability; possible seepage in fractures of bedrock.	Limited material; medium or high compressibility.	Moderate permeability; 20 to 40 inches to bedrock.	Moderate available water capacity; moderately slow water intake rate; 20 to 40 inches to bedrock.	Moderate permeability; 20 to 40 inches to bedrock.
Poor: high shrink swell.	Unsuited: no sand or gravel.	Poor: clay texture.	Very slow permeability; 20 to 40 inches to nearly impervious shale.	High volume change; fair to poor stability and compaction characteristics.	Very slow permeability; 20 to 40 inches to shale; clay texture.[1]	20 to 40 inches to shale; very slow permeability; low or very low available water capacity.	20 to 40 inches to shale; very slow permeability.
Fair: SM or ML material; more than 30 percent fines.	Poor: fines; no gravel.	Good	Moderately rapid permeability; high seepage.	Poor resistance to piping; moderate permeability	Subject to run-in water; moderately rapid per-	Subject to run-in water; moderate available	Moderately rapid permeability.

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill	Local roads and streets
Reeder: RaA, RaB, RaC	Severe: 20 to 40 inches to sandstone.	Severe: 20 to 40 inches to sandstone.	Moderate: 20 to 40 inches to rippable sandstone.	Moderate: 20 to 40 inches to rippable sandstone.	Moderate: 20 to 40 inches to rippable sandstone.	Moderate: AASHO group index mostly 5 to 8.
Regan Mapped only with Glenross series.	Severe: high water table.[2]	Severe: high water table.	Severe: very poorly drained; high water table.	Severe: very poorly drained; high water table.	Severe: very poorly drained; high water table.	Severe: very poorly drained.
*Regent: RbC, RmB, RpA, RpB. For Moreau part of RmB, see Moreau series; for Ridgeview part of RpA and RpB, see Ridgeview series.	Severe: slow permeability; 20 to 40 inches to shale.	Slight if slope is less than 2 percent, moderate if 2 to 7, severe if more than 7.	Severe: silty clay texture.	Severe: high shrink swell.	Severe: silty clay texture.	Severe: high shrink swell.
Reliance: RsA, RsB	Severe: moderately slow permeability.	Slight if slope is less than 2 percent, moderate if 2 to 6; 40 to 60 inches to nearly impervious shale.	Slight	Severe or moderate: moderate or high shrink swell.	Moderate: silty clay loam texture.	Severe: CL or CH material; plasticity index more than 15.

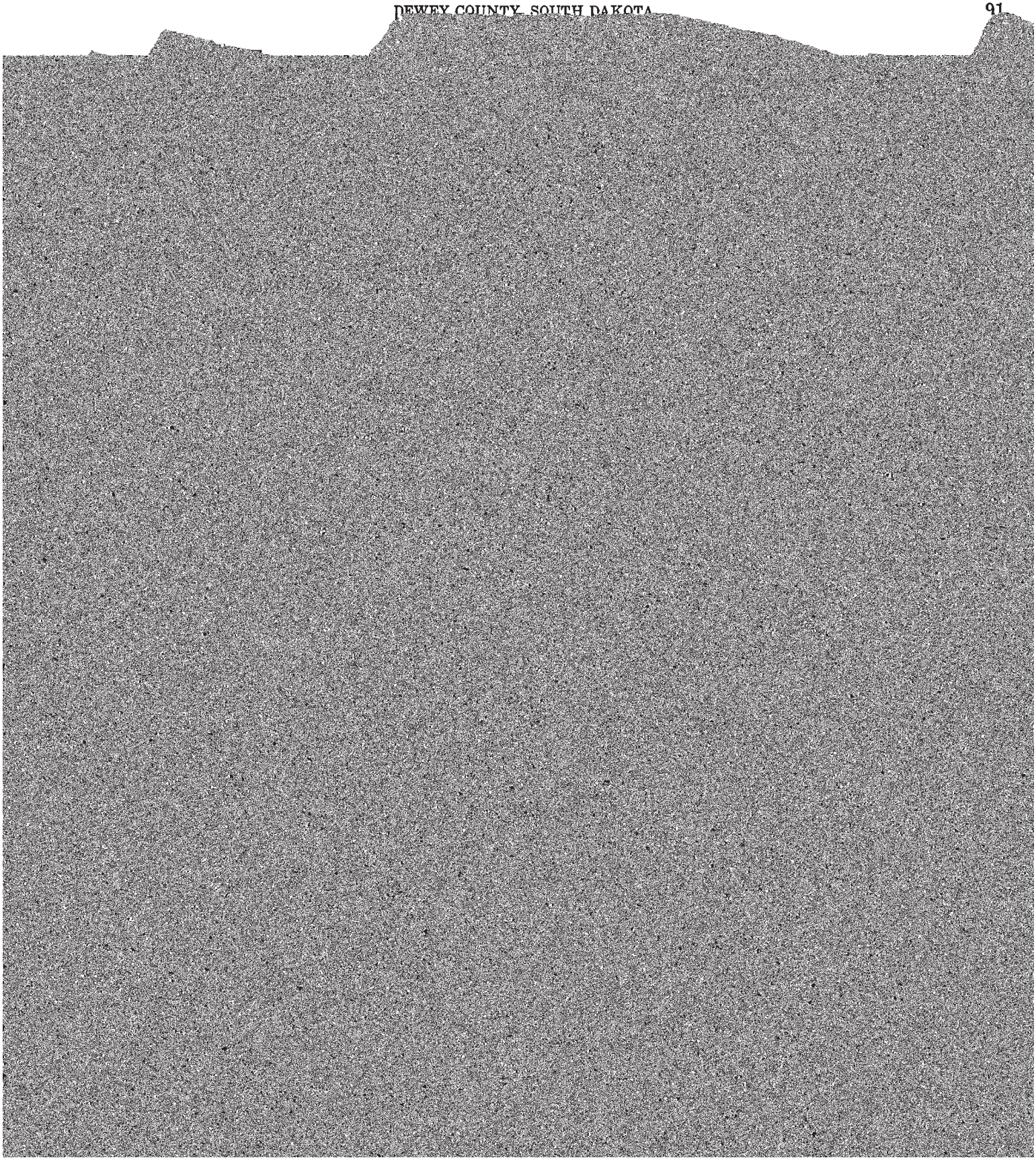


TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill	Local roads and streets
*Sansarc: SaE, SbC, SbE, ScF. For Dupree part of SaE, see Dupree series; for Opal part of SbC and SbE, see Opal series; for Shale land part of ScF, see Shale land.	Severe: slow permeability; less than 20 inches to nearly impervious shale.	Severe: most slopes more than 7 percent.	Severe: clay texture.	Severe: high shrink swell.	Severe: clay texture.	Severe: high shrink swell.
*Schamber: SdC, SfF. For Sansarc part of SfF, see Sansarc series.	Slight [2] if slope is less than 8 percent, moderate if 8 to 15, severe if more than 15.	Severe: rapid permeability.	Severe: very gravelly material.	Slight if slope is less than 8 percent, moderate if 8 to 15, severe if more than 15.	Severe: rapid permeability.	Slight if slope is less than 8 percent, moderate if 8 to 15, severe if more than 15.
Shale land: Sh	Severe: very slow permeability.	Severe: most slopes more than 7 percent.	Severe: bedded shale.	Severe: high shrink swell.	Severe: clay shales.	Severe: high shrink swell.
Shambo: Sm	Slight or moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Slight	Slight	Moderate: moderate frost-action potential.
Swanboy: Sw, Sy. No valid interpretations can be made for Slickspots part of Sy.	Severe: very slow permeability.	Slight	Severe: clay texture.	Severe: high shrink swell.	Severe: clay texture.	Severe: high shrink swell.
Tally: Ta	Slight [2]	Severe: moderately rapid permeability.	Severe: loamy fine sand texture in substratum.	Slight	Severe: moderately rapid permeability.	Slight
*Trembles: Th, Tr. For Havrelon part of Th, see Havrelon series; for Banks part of Tr, see Banks series.	Slight or severe: some areas subject to flooding. [2]	Severe: moderately rapid permeability.	Slight or severe: some areas subject to flooding.	Slight or severe: some areas subject to flooding.	Severe: moderately rapid permeability.	Slight or severe: some areas subject to flooding.

interpretations—Continued

Suitability as source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Poor: high shrink swell.	Unsuited: no sand or gravel.	Poor: clay texture.	Slow permeability; less than 20 inches to shale; possible lateral seepage in shale.	Limited material; high volume change; fair to poor stability and compaction characteristics.	Well drained. [1]	Very low available water capacity; less than 20 inches to shale; mostly sloping to steep.	Less than 20 inches to shale; sloping to steep.
Good if slope is less than 15 percent, fair if 15 to 25, poor if more than 25.	Good or fair depending on amount of fines.	Poor: gravelly surface layer; coarse textured below.	Rapid permeability; high seepage.	High seepage; high permeability if compacted.	([1])	Very shallow to sand and gravel; rapid permeability; very low or low available water capacity.	Very shallow to sand and gravel; short, irregular slopes; rapid permeability.
Severe: high shrink swell.	Unsuited	Unsuited: shale at a depth of less than 6 inches.	Very slow permeability; very shallow to shale; mostly steep slopes.	Poor stability and compaction characteristics.	([1])	Unsuited	([1]).
Fair: ML–CL or ML material; plasticity index less than 15.	Unsuited: no sand or gravel.	Good	Moderate permeability; possible seepage in substratum.	Poor stability, compaction characteristics, and resistance to piping.	Moderate permeability; nearly level areas.	High available water capacity; deep root zone; moderately slow water intake rate.	Moderate permeability; nearly level.
Poor: high shrink swell.	Unsuited: no sand or gravel.	Poor: clay texture.	Very slow permeability; low seepage.	High volume change; fair to poor stability and compaction characteristics.	Very slow permeability; salts; clayey material.	Very slow permeability; high salt concentrations.	Very slow permeability; clay texture.
Good	Poor: fines; no gravel.	Good	Moderately rapid permeability; high seepage.	Poor resistance to piping; moderate permeability if compacted.	Moderately rapid permeability; nearly level.	Moderate available water capacity; moderately rapid water intake rate; deep root zone.	Moderately rapid permeability; nearly level.
Fair: SM or ML material; more than 30 percent fines.	Poor or unsuited: fines; possible source below 60 inches.	Good	Moderately rapid permeability; high seepage.	Poor resistance to piping; moderate permeability if compacted.	Moderately rapid permeability; some areas subject to flooding.	Moderate or high available water capacity; moderately rapid water intake rate; deep root zone.	([1]).

TABLE 6.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary landfill	Local roads and streets
*Vebar: VeB, VfB---------- For Flasher part of VfB, see Flasher series.	Severe: 20 to 40 inches to sandstone.	Severe: moderately rapid permeability; 20 to 40 inches to sandstone.	Moderate: 20 to 40 inches to rippable sandstone.	Moderate: 20 to 40 inches to rippable sandstone.	Severe: moderately rapid permeability.	Slight if slope is less than 8 percent, moderate if 8 to 15, severe if more than 15.
*Wayden: WaF---------- For Moreau part of WaF, see Moreau series.	Severe: slow permeability; less than 20 inches to shale; slopes more than 8 percent.	Severe: less than 20 inches to shale; slopes more than 7 percent.	Severe: silty clay and clay textures; less than 20 inches to rippable shale.	Severe: high shrink swell.	Severe: silty clay and clay textures; less than 20 inches to rippable shale.	Severe: high shrink swell.

[1] Generally not applicable.

come by special planning or design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome that major soil reclamation and special designs are required.

Soil suitability is expressed as *good, fair,* and *poor,* which have respectively meanings that are similar to the terms slight, moderate, and severe.

Septic tank absorption fields are affected by the kind of soil material within a depth of 18 inches to 6 feet. Permeability, depth to water table, depth to bedrock, and susceptibility to flooding are soil properties that affect the absorption of effluent. Soil slope affects difficulty of layout and construction and also increases the risk of soil erosion, lateral seepage, and downslope flow of effluent.

Sewage lagoons are affected by such soil properties as permeability, soil slope, depth to water table, depth to bedrock, and susceptibility to flooding.

Shallow excavations, less than 6 feet deep, refer to those made for basements, graves, open ditches, pipelines, sewer lines, and underground cables. The ratings or moderately permeable, can withstand heavy traffic, and are easy to excavate.

Local roads and streets have an all-weather surface that is expected to carry automobile traffic all year, but no fast-moving heavy trucks. Ratings are based on soil drainage, soil slope, the AASHO and Unified classifications of soil material, shrink-swell potential, susceptibility to frost action, and depth to bedrock.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the ease of excavating the material at borrow areas and the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided adequate drainage.

Ratings for *sand and gravel* are based on the probability that a soil is a source of sand and gravel. These areas are identified on the soil map. They provide guidance as to where to look for sand and gravel, but the ratings indicate source, not the size of the deposit.

Topsoil is soil material to be used in topdressing an area where vegetation is to be established and main-

interpretations—Continued

Suitability as source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Fair: SM material; more than 30 percent fines.	Poor: fines; no gravel.	Good	Moderately rapid permeability; high seepage.	Poor resistance to piping; moderate permeability if compacted.	Moderately rapid permeability; 20 to 40 inches to soft sandstone.	Low available water capacity; moderately rapid water intake rate; 20 to 40 inches to bedrock.	20 to 40 inches to bedrock; subject to soil blowing; moderately rapid permeability.
Poor: high shrink swell.	Unsuited: no sand or gravel.	Poor: silty clay and clay textures.	Slow permeability; less than 20 inches to shale; possible lateral seepage in shale.	High volume change; limited material; fair to poor stability and compaction characteristics.	[1]	Very low available water capacity; less than 20 inches to shale; mostly rolling to steep.	Less than 20 inches to shale; short, convex, rolling to steep slopes; erosive.

[1] Possible source of pollution for domestic water supplies.

properties that affect the installation and performance of surface and subsurface drainage systems. These are soil permeability, depth to water table, stability in ditchbanks, flooding, and availability of outlets.

Irrigation is influenced by water intake rate, permeability, available water capacity, depth of rooting zone, salinity, soil slope, depth to water table, susceptibility to flooding, and the hazard of erosion and soil blowing.

Terraces and diversions are affected by features affecting their stability or hindering layout and construction. Other hazards are sedimentation in channels and the difficulty of establishing and improving a plant cover. Features that affect the suitability of a soil are the uniformity and steepness of soil slope, permeability, depth to bedrock or other unfavorable material, and susceptibility to erosion and soil blowing.

Engineering test data

Tables 7 and 8 contain engineering test data for some of the major soils in Dewey County. These tests were made to help evaluate the soils for engineering

successively higher moisture content, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Table 8 is a summary of engineering tests made on samples collected along proposed highway routes in Dewey County and adjacent counties. The samples were taken at depths that reflected changes in color and texture. Therefore, some samples may include material from more than one major soil horizon. As a result, the range in properties shown in table 8 may differ from those shown for the same series in table 5.

Table 8 has one column not previously explained, the estimated CBR or *California bearing ratio*, defined as a ratio of the load-supporting capacity of a soil as compared to that of a standard crushed limestone. A soil having a CBR of 16 supports 16 percent of the load that would be supported by the standard crushed lime-

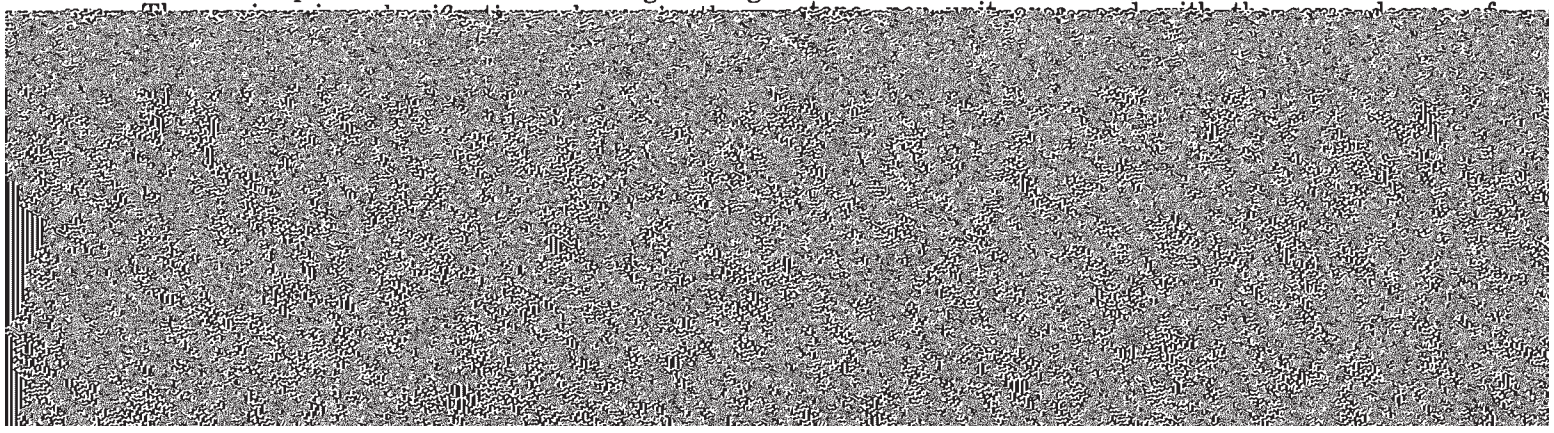


TABLE 7.—*Engineering test data on soil*

[Tests performed by the South

Soil and location	Parent material	Report number	Depth	Moisture-density[1]	
				Maximum dry density	Optimum moisture
			In	*Lb per cu ft*	*Pct*
Belfield loam: 1,700 feet south of northeast corner sec. 36, T. 17 N., R. 22 E.	Clayey shale of the Hell Creek Formation.	445 446	10–18 31–44	93 100	24 21
Dupree clay: 400 feet west of northeast corner sec. 18, T. 10 N., R. 27 E.	Clay from the Pierre Shale Formation.	453 454	3–13 [5]18–60	89 87	28 29
Glenross fine sandy loam: 1,160 feet north and 600 feet east of southwest corner sec. 31, T. 17 N., R. 24 E.	Sandy alluvium from Hell Creek and Fox Hills Formations.	441 442	1–4 9–26	106 107	17 18
Morton loam: 950 feet north and 1,850 feet east of southwest corner sec. 15, T. 12 N., R. 24 E.	Silt loams and loams weathered in place from loamy shale.	457 458	6–15 29–46	108 104	14 18
Reeder loam: 150 feet southwest of center sec. 5, T. 12 N., R. 22 E.	Sandy material from Fox Hills Formation.	462	9–24	104	17
Regent silty clay loam: 2,730 feet north and 225 feet west of southeast corner sec. 6, T. 13 N., R. 22 E.	Clayey beds of the Fox Hills Formation.	455 456	6–18 [5]38–60	89 88	26 28
Rhoades loam: 350 feet north of southwest corner sec. 26, T. 17 N., R. 22 E.	Clayey shale of the Hell Creek Formation.	444	[5]32–60	85	27
Sansarc clay: Northwest corner sec. 5, T. 11 N., R. 28 E.	Clay from Pierre Shale.	447 448	4–10 16–60	83 84	31 33
Schamber gravelly sandy loam: 3,150 feet east and 1,700 feet south of northwest corner sec. 34, T. 10 N., R. 27 E.	Old alluvium along Cheyenne River.	451 452	17–28 28–63	120 112	10 15
Trembles loam: 1,950 feet north and 790 feet east of southwest corner sec. 8, T. 14 N., R. 24 E.	Alluvium.	449 450	9–36 36–60	109 106	15 16
Vebar fine sandy loam: 360 feet west and 150 feet north of southeast corner sec. 35, T. 17 N., R. 24 E.	Loamy sand weakly consolidated material from Fox Hills Formation.	439 440	7–17 24–48	109 102	15 16

[1] Based on AASHO designation: T 99, Method A (*1*).

[2] Mechanical analysis according to AASHO Designation: T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data in this table are not suitable for naming textural classes for soil.

ering of deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by (1) the physical and mineral 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

samples taken from 11 soil profiles

Dakota Department of Highways]

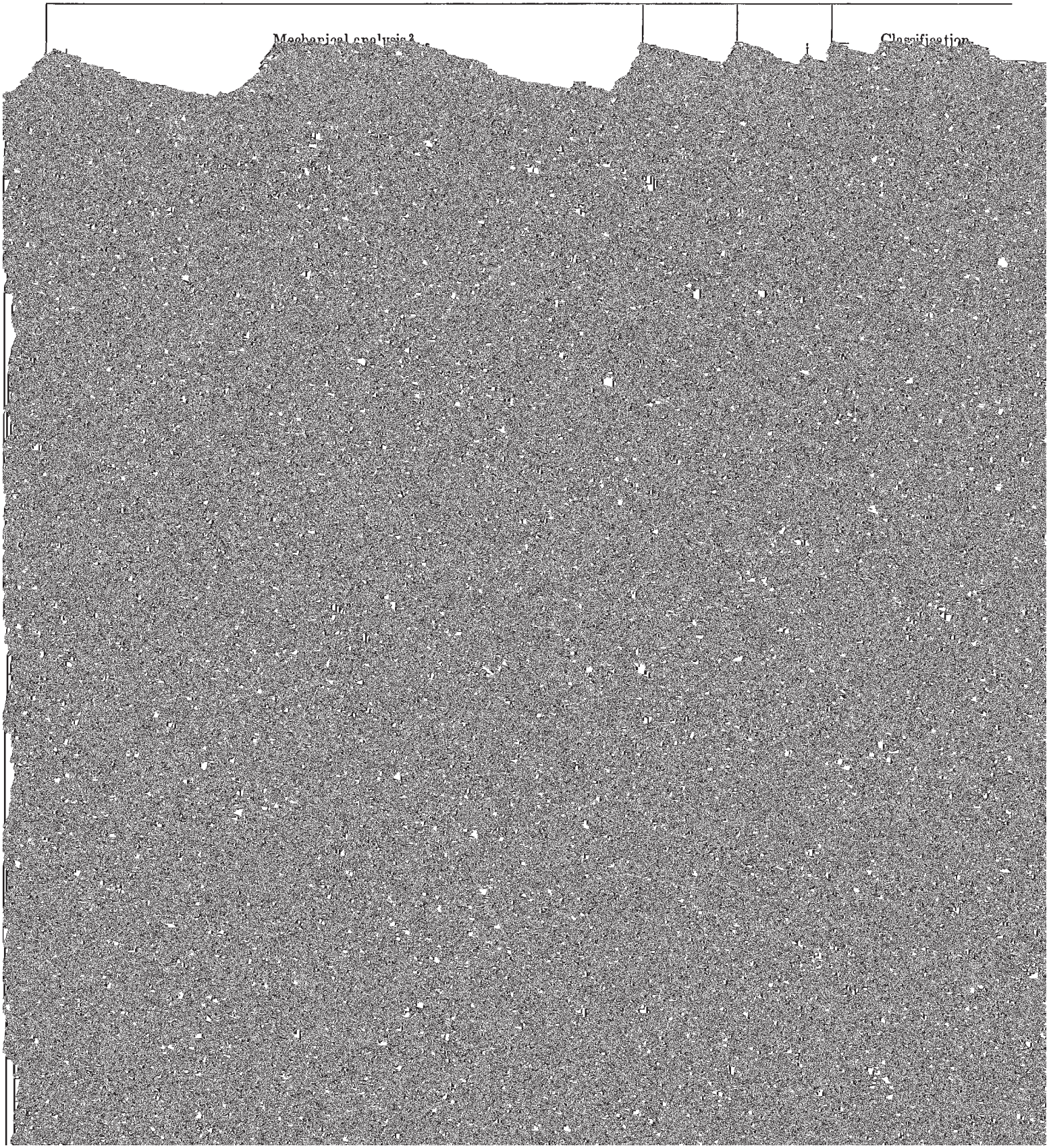
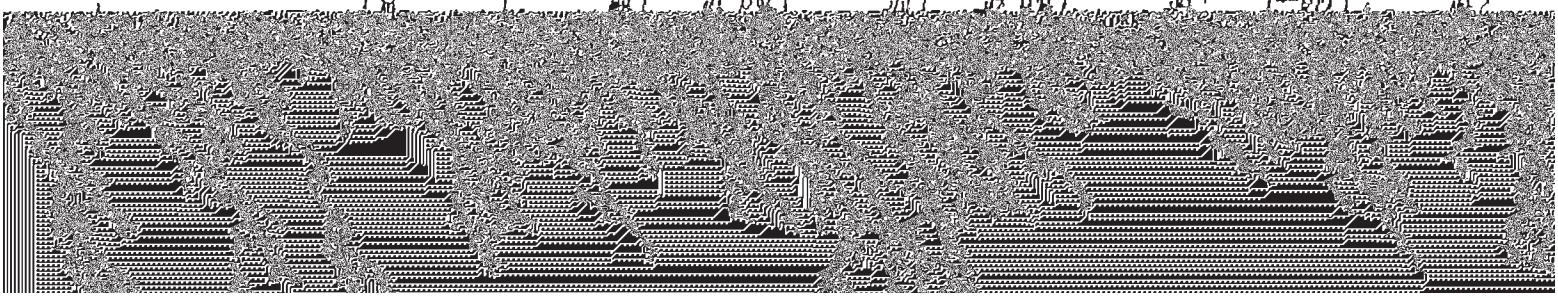


TABLE 8.—*Engineering test data on soil samples*

[Samples taken in Dewey County and surrounding counties.

Soil	Horizon	Number of samples tested	Mechanical analysis[1]					
			Percentage less than 3 inches passing sieve—					
			No. 10 (2.0 mm)		No. 40 (0.42 mm)		No. 200 (0.074 mm)	
			Range	Average	Range	Average	Range	Average
Absher.	A	2	----------	100	98–100	100	66–73	71
	B	22	99–100	100	98–100	100	62–100	81
	C	29	98–100	100	97–100	99	69–99	84
Agar.	A	26	98–100	100	94–100	98	75–100	90
	B	59	97–100	100	93–100	98	81–100	91
	C	90	95–100	100	90–100	97	75–100	90
Arvada.	B	6	79–100	94	71–100	90	57–100	82
	C	11	96–100	99	93–100	99	88–100	96
Belfield.	B	12	99–100	100	97–100	99	74–97	86
	C	3	----------	100	99–100	100	61–93	77
	C[6]	8	----------	100	87–100	97	59–100	84
Cabba.	C	5	97–100	99	96–100	98	52–100	80
	C[6]	7	99–100	100	93–100	98	49–100	82
Chantier.	A	2	98–100	100	94–100	98	90–97	94
	B	1	----------	100	----------	98	----------	96
	C	6	99–100	100	95–100	98	87–100	94
	C[6]	19	97–100	99	94–100	98	89–100	95
Daglum.	C	2	----------	100	----------	100	66–84	75
Dupree.	A	1	----------	100	----------	97	----------	94
	B	3	90–100	97	86–100	95	83–100	92
	C	4	98–100	100	96–100	99	89–98	94
	C[6]	30	99–100	100	94–100	98	86–100	95
Ekalaka.	A	17	98–100	100	97–100	98	34–84	59
	B	13	98–100	100	87–100	97	49–72	60
	C	39	94–100	99	83–100	96	31–77	54
Farland.	A	4	98–100	99	96–100	98	65–94	79
	B	8	96–100	99	93–100	97	68–90	79
	C	4	94–100	99	86–100	96	70–95	83
	2C	6	94–100	99	90–100	97	32–81	57
Flasher.	A	7	98–100	100	94–100	98	26–56	41
	C	51	86–100	98	78–100	95	17–58	37
	C[6]	42	96–100	99	92–100	98	16–91	54
Havrelon.	C	1	----------	99	----------	99	----------	60
	2C	4	95–100	99	93–100	98	26–89	58
Heil.	A	1	----------	97	----------	90	----------	68
	B	4	94–100	98	85–100	93	61–97	79
Hurley.	A	4	----------	100	93–100	96	74–99	87
	B	10	99–100	100	95–100	99	87–100	96
	C	29	97–100	99	94–100	98	74–100	91



taken along proposed highway routes

Tests performed by the South Dakota Department of Highways]

Liquid limit [2]		Plasticity index [3]		Classification			Estimated CBR
Range	Average	Range	Average	AASHO [4] (Old index)	AASHO [5] (New index)	Unified	
26–40	33	9–19	14	A–6(9)	A–6(8)	CL	7
23–80	51	5–56	30	A–7–6(18)	A–7–6(26)	CH	3
26–75	50	7–53	29	A–7–6(18)	A–7–6(26)	CL	3
34–47	41	12–19	15	A–7–6(10)	A–7–6(15)	ML–CL	5
35–46	41	12–27	19	A–7–6(12)	A–7–6(19)	CL	5
32–48	40	9–28	18	A–6(12)	A–6(17)	CL	5
27–91	59	6–66	36	A–7–6(20)	A–7–6(31)	CH	2
15–92	53	3–58	30	A–7–6(19)	A–7–6(33)	CH	3
37–68	52	19–40	29	A–7–6(18)	A–7–6(27)	CH	3
30–54	42	8–33	20	A–7–6(12)	A–7–6(15)	CL	5
45–59	52	18–39	28	A–7–6(18)	A–7–6(25)	CH	3
30–52	41	13–28	20	A–7–6(12)	A–7–6(16)	CL	5
26–69	48	4–34	18	A–7–6(13)	A–7–6(17)	ML–CL	4
66–69	60	36–53	44	A–7–6(20)	A–7–6(47)	CH	1
	83		49	A–7–6(20)	A–7–5(57)	MH–CH	1
70–93	82	41–62	51	A–7–5(20)	A–7–5(57)	CH	1
74–117	96	47–82	64	A–7–5(20)	A–7–5(72)	CH	1
26–61	44	8–46	27	A–7–6(16)	A–7–6(19)	CL	4
	69		38	A–7–5(20)	A–7–5(42)	MH–CH	1
79–99	89	42–64	53	A–7–5(20)	A–7–5(58)	MH–CH	1
68–90	79	46–59	52	A–7–6(20)	A–7–6(56)	CH	1
64–114	89	36–86	60	A–7–6(20)	A–7–6(67)	CH	1
23–50	37	0–30	15	A–6(7)	A–6(7)	CL	6
29–59	44	12–33	22	A–7–6(11)	A–7–6(11)	CL	4
18–62	40	3–37	20	A–6(8)	A–6(8)	CL	5
32–61	46	8–39	23	A–7–6(14)	A–7–6(19)	CL	4
34–52	43	13–32	22	A–7–6(14)	A–7–6(18)	CL	4
35–53	44	15–32	23	A–7–6(14)	A–7–6(20)	CL	4
19–57	38	0–36	17	A–6(8)	A–6(7)	CL	6
23–38	30	4–16	10	A–4(1)	A–4(1)	SC	8
20–34	27	0–15	7	A–4(0)	A–4(0)	SM–SC	10
5–68	37	0–44	15	A–6(6)	A–6(6)	CL	6
	32		14	A–6(7)	A–6(6)	CL	8
20–34	27	0–15	6	A–4(5)	A–4(2)	ML–CL	10
	48		19	A–7–6(12)	A–7–6(13)	ML–CL	4
38–45	42	19–27	23	A–7–6(14)	A–7–6(18)	CL	5
48–57	53	20–32	26	A–7–6(17)	A–7–6(25)	MH–CH	3
52–92	72	22–63	42	A–7–6(20)	A–7–6(49)	CH	1
40–81	61	20–54	36	A–7–6(20)	A–7–6(37)	CH	2
61–100	80	33–67	50	A–7–5(20)	A–7–5(55)	CH	1
31–43	37	5–16	10	A–4(8)	A–4(10)	ML–CL	6
26–39	33	5–14	9	A–4(8)	A–4(8)	ML–CL	7
20–48	34	3–23	12	A–6(9)	A–6(10)	CL	7
4–55	30	0–23	9	A–4(1)	A–4(1)	SC	8
51–65	58	29–45	36	A–7–6(20)	A–7–6(39)	CH	2
53–65	59	33–43	38	A–7–6(20)	A–7–6(42)	CH	2

TABLE 8.—*Engineering test data on soil samples*

Soil	Horizon	Number of samples tested	Mechanical analysis[1]					
			Percentage less than 3 inches passing sieve—					
			No. 10 (2.0 mm)		No. 40 (0.42 mm)		No. 200 (0.074 mm)	
			Range	Average	Range	Average	Range	Average
Morton.	A	38	97–100	100	96–100	99	60–94	77
	B	37	95–100	99	93–100	98	58–91	75
	C	79	97–100	100	95–100	99	61–96	98
	C[6]	42	98–100	100	96–100	99	56–100	80
Opal.	A	51	99–100	100	94–100	98	84–100	93
	B	87	96–100	99	91–100	98	83–100	94
	C	131	99–100	100	96–100	99	89–100	96
	C[6]	263	97–100	100	93–100	99	86–100	96
Promise.	A	37	96–100	99	93–100	98	84–100	93
	B	110	97–100	99	92–100	98	85–100	95
	C	237	99–100	100	93–100	98	86–100	95
	C[6]	46	98–100	100	96–100	99	91–100	96
Reeder.	A	1	----------	98	----------	95	----------	59
	B	3	91–100	98	72–100	90	26–86	56
	C	9	71–100	95	64–100	91	27–72	49
	C[6]	3	----------	100	----------	100	83–96	90
Regent.	A	21	99–100	100	96–100	99	72–97	99
	B	42	97–100	100	92–100	98	73–100	87
	C	40	98–100	100	95–100	99	76–100	88
	C[6]	11	99–100	100	98–100	99	48–100	80
Reliance.	A	12	98–100	99	87–100	96	64–100	85
	B	31	98–100	100	92–100	98	68–100	88
	C	30	96–100	99	91–100	97	66–100	87
	C[6]	11	99–100	100	98–100	99	90–100	95
Rhoades.	A	10	95–100	99	91–100	97	44–94	69
	B	18	99–100	100	93–100	98	76–99	88
	C	47	91–100	99	89–100	98	66–100	86
	2C	6	98–100	100	96–100	99	43–95	69
	C[6]	52	99–100	100	94–100	99	60–100	86
Sansarc.	A	7	99–100	100	80–100	94	57–100	80
	C	28	97–100	99	93–100	98	80–100	92
	C[6]	105	98–100	100	94–100	98	85–100	94
Schamber.	A	3	46–100	82	22–100	69	6–78	42
	C	45	30–100	69	10–100	55	0–54	29
	2C	20	9–100	63	0–100	55	0–74	32
	C[6]	20	87–100	96	77–100	93	51–100	81
Swanboy.	A	28	99–100	100	95–100	98	85–100	93
	B	11	97–100	99	83–100	96	70–100	90
	C	98	93–100	99	85–100	96	75–100	90
	C[6]	8	99–100	100	94–100	99	91–100	97
Trembles.	C	5	----------	100	98–100	99	35–70	52
Vebar.	A	8	97–100	100	93–100	98	31–67	49
	B	9	96–100	99	93–100	98	34–67	51
	C	30	86–100	98	82–100	97	18–73	46

[1] Mechanical analysis according to AASHO Designation: T 88. Results by this procedure may differ somewhat from the results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by hydrometer method and the various grain-size fractions are calculated on the basis of all the material, up to and including that 3 inches in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from the calculations of grain-size fractions. The mechanical analysis data in this table are not intended for naming textural classes of soil.

taken along proposed highway routes—Continued

Liquid limit [2]		Plasticity index [3]		Classification			Estimated CBR
Range	Average	Range	Average	AASHO [4] (Old index)	AASHO [5] (New index)	Unified	
29–40	35	5–17	11	A–6(8)	A–6(8)	ML–CL	6
26–58	42	3–35	19	A–7–6(12)	A–7–6(14)	CL	5
25–54	40	8–33	20	A–6(12)	A–6(15)	CL	5
23–69	46	4–46	25	A–7–6(15)	A–7–6(20)	CL	4
45–79	62	18–46	32	A–7–5(20)	A–7–5(35)	MH–CH	2
53–88	71	29–58	43	A–7–6(20)	A–7–6(47)	CH	1
55–93	74	29–61	44	A–7–6(20)	A–7–6(51)	CH	1
56–98	77	30–65	47	A–7–6(20)	A–7–6(54)	CH	1
45–71	58	18–39	28	A–7–5(19)	A–7–5(31)	MH–CH	2
49–87	68	26–56	41	A–7–6(20)	A–7–6(45)	CH	1
52–85	69	28–54	40	A–7–6(20)	A–7–6(45)	CH	1
56–103	80	32–66	48	A–7–5(20)	A–7–5(56)	CH	1
----------	33	----------	18	A–6(8)	A–6(7)	CL	7
25–49	37	13–25	19	A–6(8)	A–6(8)	CL	6
22–51	37	3–31	17	A–6(6)	A–6(5)	SC	6
59–63	61	36–42	39	A–7–6(20)	A–7–6(38)	CH	2
34–68	51	12–47	29	A–7–6(18)	A–7–6(26)	CH	3
43–68	56	20–48	34	A–7–6(19)	A–7–6(32)	CH	3
41–77	59	22–54	37	A–7–6(20)	A–7–6(36)	CH	2
37–78	58	20–52	36	A–7–6(20)	A–7–6(30)	CH	2
34–48	41	11–22	16	A–7–6(11)	A–7–6(15)	ML–CL	5
36–59	48	16–35	25	A–7–6(16)	A–7–6(24)	CL	4
35–59	47	17–35	26	A–7–6(16)	A–7–6(24)	CL	4
46–83	65	24–58	41	A–7–6(20)	A–7–6(45)	CH	2
23–45	34	0–25	12	A–6(8)	A–6(7)	CL	7
48–85	66	28–61	44	A–7–6(20)	A–7–6(42)	CH	2
37–83	60	17–59	38	A–7–6(20)	A–7–6(35)	CH	2
26–65	46	8–48	28	A–7–6(15)	A–7–6(18)	CL	4
36–93	65	15–70	42	A–7–6(20)	A–7–6(40)	CH	2
52–92	74	21–62	41	A–7–5(20)	A–7–5(20)	MH–CH	1
50–101	76	25–64	44	A–7–5(20)	A–7–5(20)	MH–CH	1
53–125	89	31–88	59	A–7–5(20)	A–7–5(20)	CH	1
9–68	39	0–25	12	A–6(2)	A–6(2)	SM–SC	5
7–54	30	0–29	12	A–2–6(0)	A–2–6(0)	SC	----------
13–51	32	0–30	12	A–2–6(0)	A–2–6(0)	SC	----------
36–95	66	16–62	39	A–7–6(20)	A–7–6(34)	CH	2
46–75	60	21–42	31	A–7–6(20)	A–7–6(34)	MH–CH	2
31–134	82	22–103	52	A–7–5(20)	A–7–5(54)	CH	1
49–105	77	24–76	50	A–7–6(20)	A–7–6(52)	CH	1
49–158	104	22–128	75	A–7–6(20)	A–7–6(85)	CH	1
26–34	30	0–18	8	A–4(3)	A–4(2)	ML–CL	8
23–37	30	2–15	8	A–4(3)	A–4(2)	SM–SC	8
26–44	35	5–25	15	A–6(5)	A–6(5)	CL	6
20–43	32	0–24	11	A–6(3)	A–6(2)	SM–SC	8

[2] Based on AASHO Designation: T 89–60.
[3] Based on AASHO Designation: T 90–61.
[4] Based on AASHO Designation: M 145–49.
[5] Based on AASHO Designation: M 145–66I.
[6] Soft bedrock.

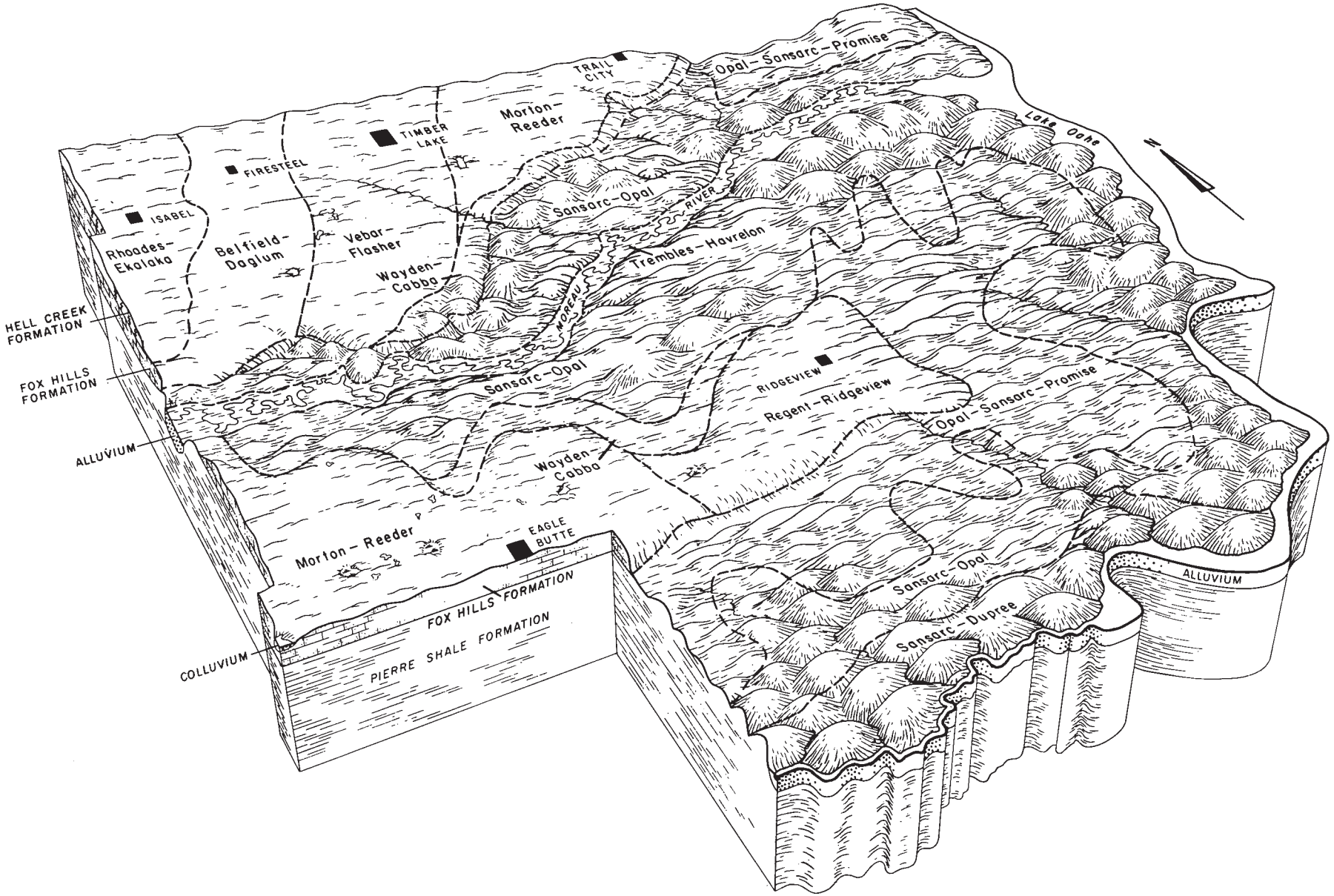
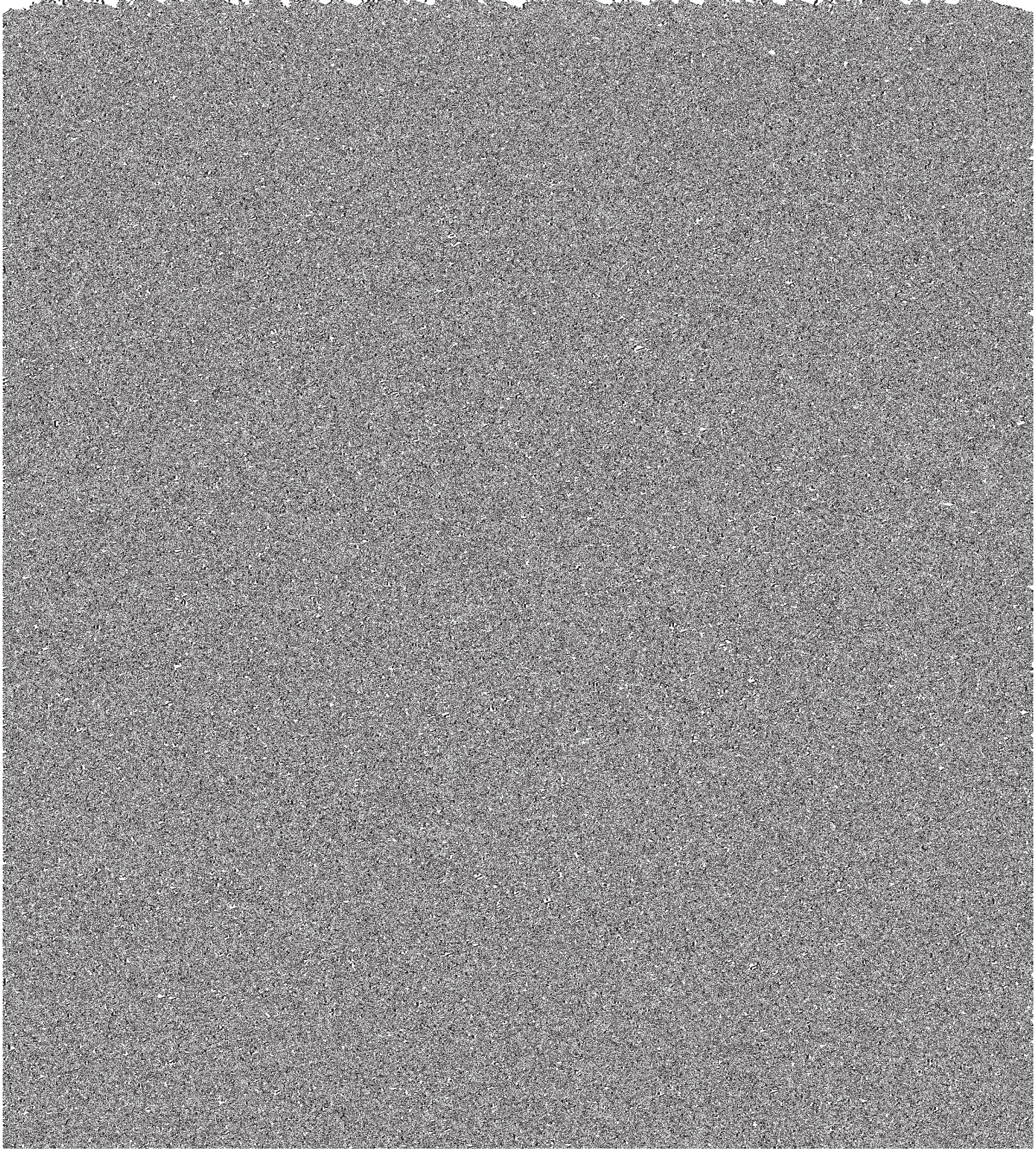


Figure 21.—**Soil associations and geologic formations in Dewey County.**

understand their behavior and their response to manipulation. First through classification, and then through

so that soils of similar genesis, or mode of origin, are grouped. The same property or subdivisions of this



soil moisture, and fine stratification. The names of suborders have two syllables. The last syllable indicates the order. An example is *Boroll* (*Bor,* meaning northern or cool, and *oll,* from Mollisol).

GREAT GROUP.—Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of soil horizons and features. The horizons used to make separations are those in which clay, carbonates, and other constituents have accumulated or have been removed; and those that have pans that interfere with growth of roots, movement of water, or both. Some features used are soil acidity, soil climate, soil composition, and soil color. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haploboroll (*Hapl,* meaning simple horizon, *bor* for northern or cool, and *oll* from Mollisols).

SUBGROUP.—Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. The names of the subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Haploborolls (a typical Haploboroll).

FAMILY.—Soil families are separated within a sub-

lignite coal in the area of Firesteel and Isabel has been inactive for several years. Eagle Butte, Isabel, and Timber Lake are the principal retail and community centers. Lake Oahe, on the east and south boundaries of the county, represents a potential for recreational development.

Climate [9]

The climate of Dewey County is semiarid and is characterized by cold winters, hot summers, and little winter precipitation. Growing season rainfall is marginal for adapted crops. The recently formed Lake Oahe extending along the eastern border of the county may have some small effect on the climate in its immediate vicinity. Elsewhere in the county, the climate is not affected by bodies of water or other physical features.

The climatic summary for this county is based on 42 years (1926–67) of weather observations at Timber Lake, which is at an elevation of 2,150 feet in the north-central part of the county. Climatic conditions at Timber Lake are typical of those throughout the county. On the average, the annual precipitation throughout the county is expected to be within 1 inch of that at Timber Lake and the annual temperature

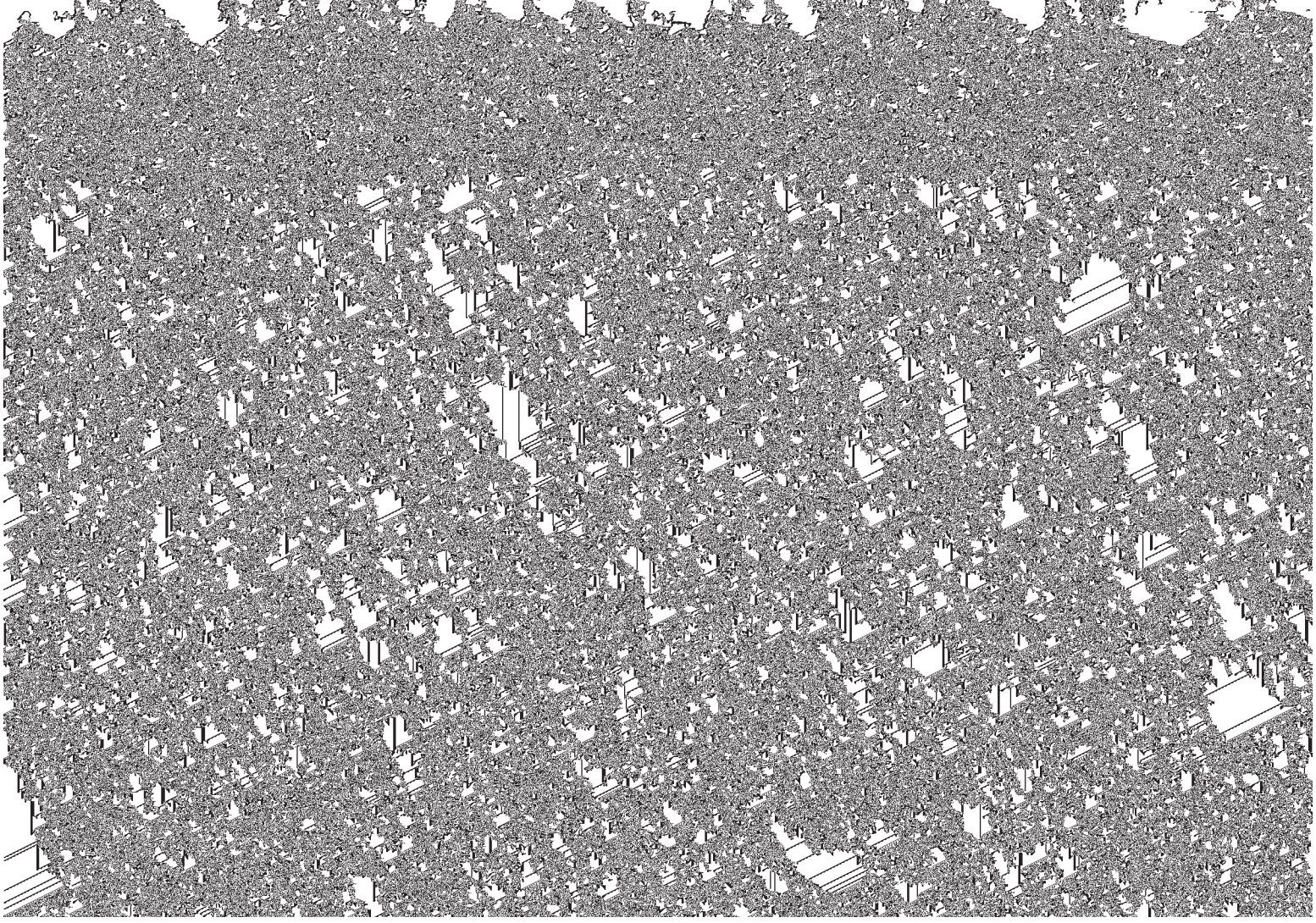


TABLE 10.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data recorded at Timber Lake, S. Dak., 1926–67. Prepared by William F. Lytle, South Dakota State University]

Probability	Dates for given probability and temperature					
	16° F	20° F	24° F	28° F	32° F	36° F
After a specified date in spring:						
90 percent	March 15	March 25	April 5	April 13	May 2	May 7
70 percent	March 24	April 3	April 13	April 21	May 8	May 14
50 percent	April 8	April 18	April 26	May 4	May 18	May 25
30 percent	April 23	May 2	May 9	May 16	May 27	June 5
10 percent	May 2	May 11	May 17	May 24	June 2	June 12
Before a specified date in fall:						
10 percent	October 12	September 28	September 21	September 13	September 4	August 25
30 percent	October 20	October 7	September 29	September 21	September 11	September 1
50 percent	November 2	October 22	October 11	October 3	September 22	September 13
70 percent	November 14	November 6	October 24	October 15	October 3	September 24
90 percent	November 22	November 15	November 1	October 22	October 10	October 1

TABLE 11.—*Temperature and precipitation*

[Data recorded at Timber Lake, S. Dak., 1926–67. Prepared by William F. Lytle, South Dakota State University]

Month	Temperature				Precipitation						Average number of days with—	
	Average daily maximum	Average daily minimum	Two years in 10 will have—		Average total	Record		One year in 10 will have—		Average snowfall	Snowfall of 1 inch or more	Snow cover of 1 inch or more
			Average daily maximum equal to or higher than—	Average daily minimum equal to or lower than—		Maximum total	Minimum total	Less than—	More than—			
	°F	°F	°F	°F	In	In	In	In	In	In		
January	24.2	2.5	35.5	−7.4	0.57	4.03	0.00	0.09	1.34	6.2	2	15
February	28.8	6.5	39.2	−3.6	.57	2.36	.03	.12	1.18	6.8	3	12
March	39.5	17.4	48.0	10.6	1.02	4.86	.01	.14	2.28	8.0	3	8
April	56.9	31.2	63.4	27.1	1.60	4.55	0	.41	3.26	2.6	1	2
May	69.3	42.7	76.1	38.2	2.60	6.81	0	.85	4.94	.6	0	0
June	78.2	52.6	84.4	49.2	3.87	9.02	.54	1.45	6.84	0	0	0
July	87.4	58.9	93.1	55.2	2.00	4.80	.08	.65	3.69	0	0	0
August	85.3	56.5	90.0	53.2	1.86	5.09	.16	.59	3.47	0	0	0
September	73.8	45.4	80.3	41.2	1.22	3.40	.11	.28	2.48	0	0	0
October	62.1	34.8	68.3	30.6	1.00	3.38	0	.14	2.29	1.0	0	0
November	42.2	20.0	49.2	14.7	.48	2.47	0	.06	1.14	3.3	1	4
December	30.1	9.0	38.5	1.5	.39	2.81	0	.06	.90	4.0	2	11
Year	56.5	31.5	59.1	29.5	17.24	[1]26.37	[2]5.82	11.12	24.02	32.5	12	53

[1] In 1953.
[2] In 1934.

expected about once in 2 to 3 years and of 4 inches or more about once in 25 years.

Seasonal snowfall averages 32.5 inches. Strong winds often accompany the snowfall and cause large drifts in and near sheltered areas, whereas open fields are nearly bare.

Sunshine, wind, and relative humidity are estimated for the county from data obtained at Bismarck, N. Dakota, and at Huron and Rapid City. The sun shines, on the average, about 65 percent of daylight hours. The greatest amount, 75 percent, occurs in July and the least, 50 percent, in December.

Relative humidity usually varies widely from early morning to afternoon and occasionally from day to day. It ranges from about 42 percent in afternoon to 82 percent in early morning in summer and from about 64 percent in afternoon to 77 percent in early morning in winter. A cold front with a much colder, drier air mass occasionally replaces a very warm and humid air mass.

Windspeed averages about 11 miles per hour. The prevailing winds are from the northwest in winter and from the south-southeast in summer. A windspeed of 50 miles per hour or more can occur any month, but is most likely in summer during thunderstorms. Thunderstorms can be expected about 10 times per month

in June and July, 9 in August, and 6 in May; the annual average is about 40.

Hail occasionally accompanies the thunderstorms and may occur at anywhere about 1 to 2 times per year. Hail is most likely in June and July, but can occur as early as March and as late as October.

Evaporation from a large pan indicates the potential water loss from soil, pastures, and crops. The average annual evaporation from the Weather Bureau Class A pan in this area is about 50 inches. An average of about 41 inches evaporates during the period May through October. The annual evaporation from lakes is about 36 inches. The water loss from soil and crops is usually less, depending upon the available soil moisture.

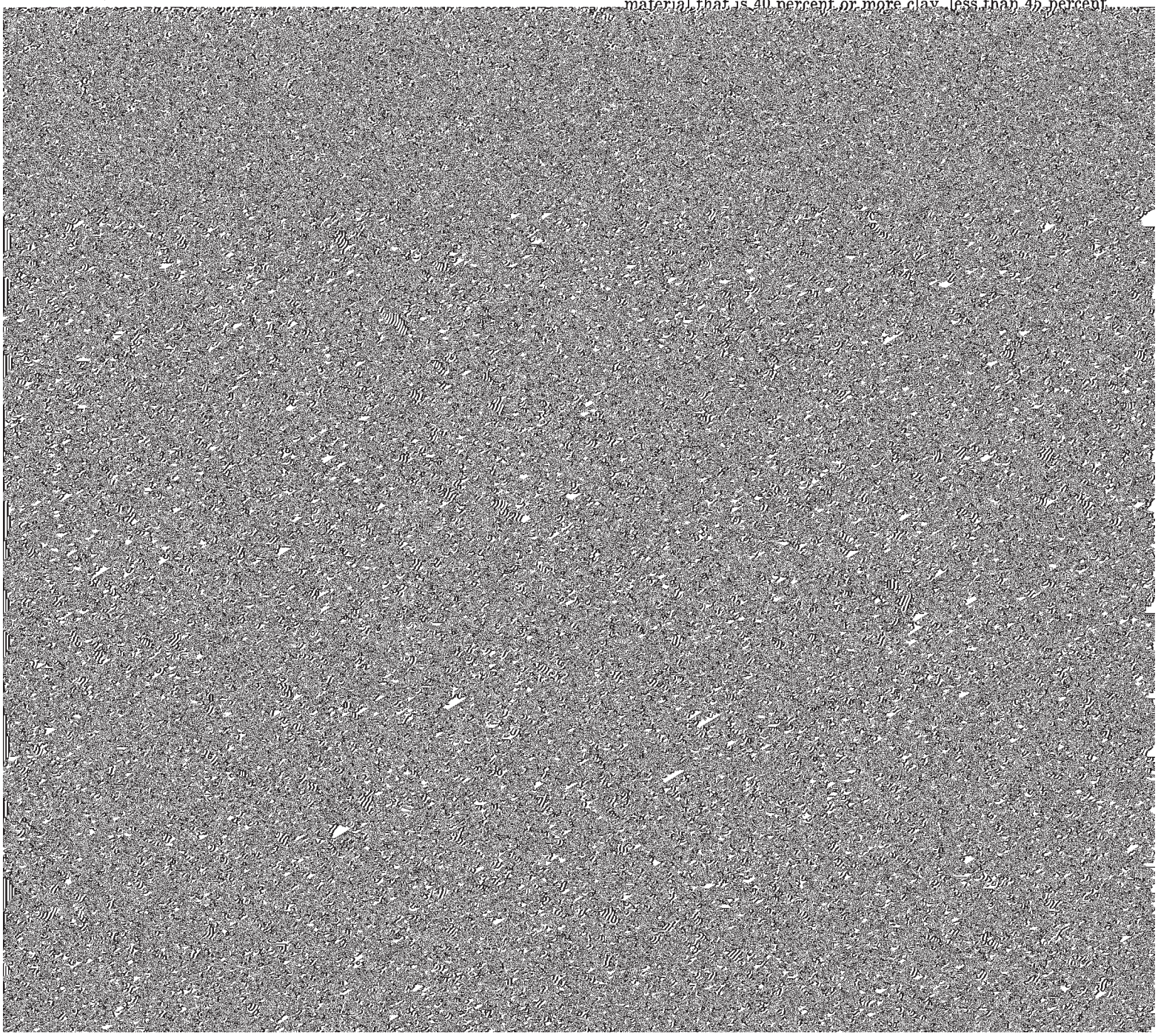
Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Chiseling. Tillage of soil with an implement having one or more soil penetrating points that loosen the subsoil and brings *clods* to the surface. A form of emerging tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent



called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

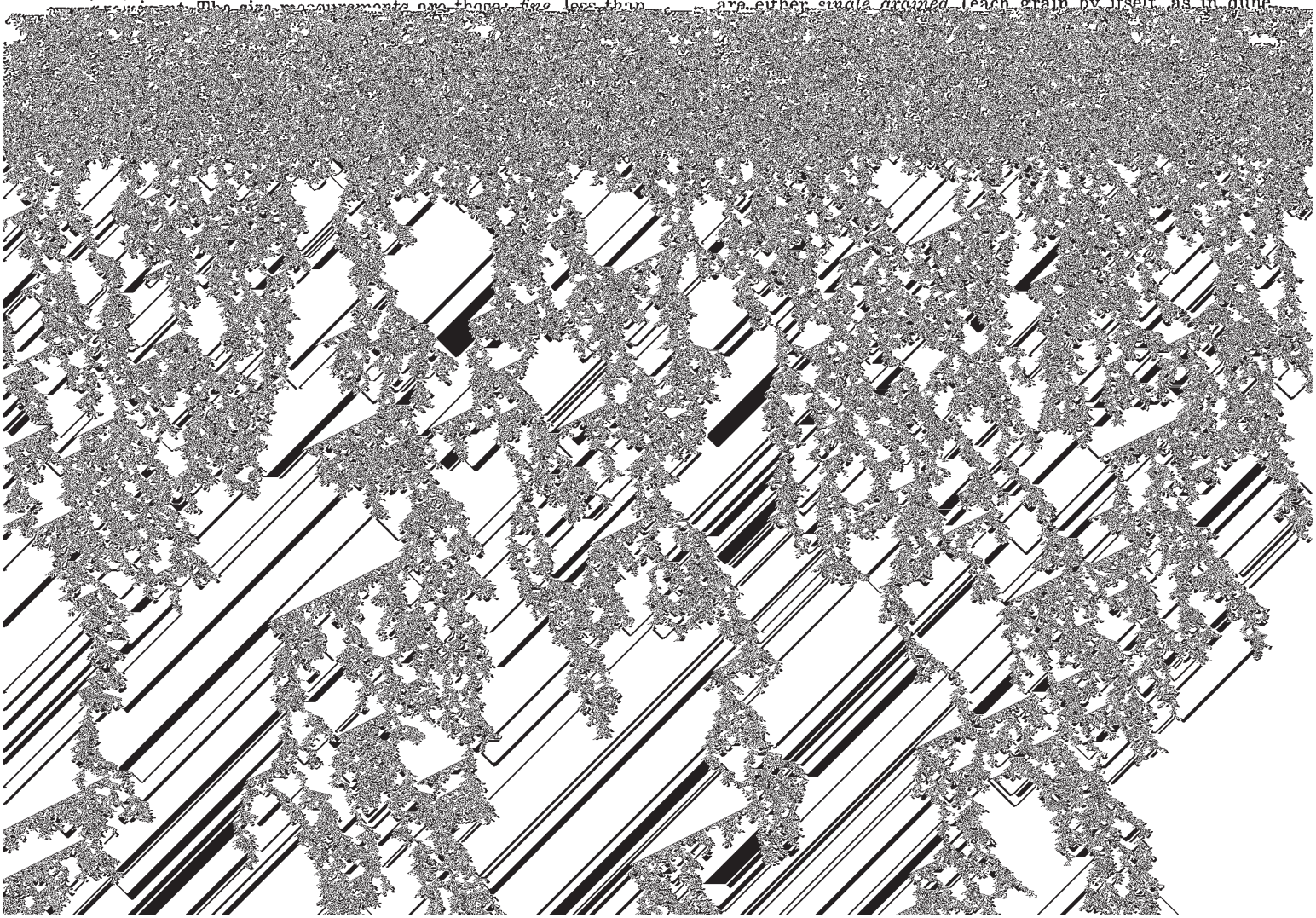
Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and [illegible]. The size measurements are those [illegible] less than

in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

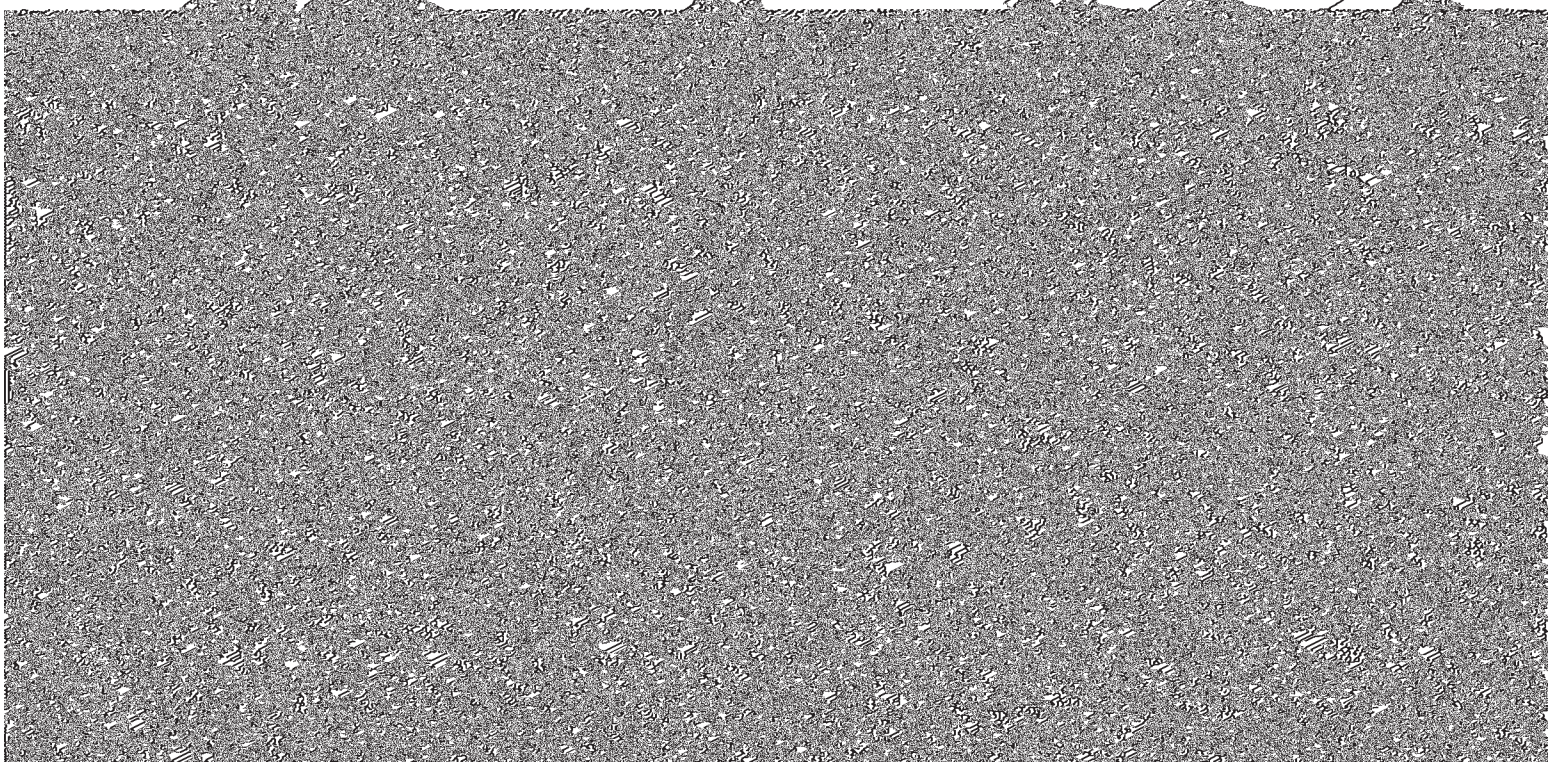
Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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



GUIDE TO MAPPING UNITS

Map symbol	Mapping unit	Page	Range site		Capability unit		Pasture group	Windbreak group
			Name	Page	Symbol	Page	Symbol	Number
AbA	Absher silt loam, 0 to 2 percent slopes	10	Thin Claypan	57	VIs-1	63	---	10
AcA	Absher-Slickspots complex, 0 to 2 percent slopes	12	----------	--	--------	--	---	---
	Absher soil	--	Thin Claypan	57	VIs-1	63	---	10
	Slickspots	--	----------	--	VIIIs-3	64	---	---
AgB	Agar silt loam, 2 to 6 percent slopes	12	Silty	56	IIe-1	59	F	3
ArB	Archin-Slickspots complex, 2 to 9 percent slopes	13	----------	--	--------	--	---	---
	Archin soil	--	Claypan	56	VIe-9	62	---	10
	Slickspots	--	----------	--	VIIIs-3	64	---	---
AsA	Arvada-Slickspots complex, 0 to 3 percent slopes	14	----------	--	--------	--	---	---
	Arvada soil	--	Thin Claypan	57	VIs-1	63	---	10
	Slickspots	--	----------	--	VIIIs-3	64	---	---
BdA	Belfield-Daglum silt loams, 0 to 2 percent slopes	16	----------	--	IIIs-1	61	---	---
	Belfield soil	--	Clayey	56	--------	--	E	4
	Daglum soil	--	Claypan	56	--------	--	C	9
BrA	Belfield-Reeder loams, 0 to 2 percent slopes	16	----------	--	IIIs-1	61	---	---
	Belfield soil	--	Clayey	56	--------	--	E	4
	Reeder soil	--	Silty	56	--------	--	F	3
BrB	Belfield-Reeder loams, 2 to 6 percent slopes	16	----------	--	IIIe-3	60	---	---
	Belfield soil	--	Clayey	56	--------	--	E	4
	Reeder soil	--	Silty	56	--------	--	F	3
BrC	Belfield-Reeder loams, 6 to 9 percent slopes	16	----------	--	IVe-7	61	---	---
	Belfield soil	--	Clayey	56	--------	--	E	4
	Reeder soil	--	Silty	56	--------	--	F	3
CbE	Cabba-Lantry silt loams, 15 to 25 percent slopes	17			VIIe-1	63		10



GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Range site		Capability unit		Pasture group	Windbreak group
			Name	Page	Symbol	Page	Symbol	Number
EkC	Ekalaka fine sandy loam, 6 to 9 percent slopes	23	Sandy	56	VIe-6	62	---	10
FaA	Farland silt loam, 0 to 2 percent slopes	24	Silty	56	IIc-2	60	F	3
FaB	Farland silt loam, 2 to 6 percent slopes	24	Silty	56	IIe-1	59	F	3
FbF	Flasher loamy fine sand, 25 to 40 percent slopes	24	Shallow	56	VIIe-4	63	---	10
FvD	Flasher-Vebar complex, 6 to 15 percent slopes	24	----------	--	VIe-10	62	---	---
	Flasher soil	--	Shallow	56	-------	--	---	10
	Vebar soil	--	Sandy	56	-------	--	H	5
FvE	Flasher-Vebar complex, 15 to 25 percent slopes	25	----------	--	VIIe-4	63	---	10
	Flasher soil	--	Shallow	56	-------	--	---	---
	Vebar soil	--	Sandy	56	-------	--	---	---
Gb	Glenross fine sandy loam	26	Saline Lowland	55	VIw-4	63	---	10
Gr	Glenross-Regan fine sandy loams	26	----------	--	VIw-4	63	---	10
	Glenross soil	--	Saline Lowland	55	-------	--	---	---
	Regan soil	--	Subirrigated	55	-------	--	J	---
Hc	Heil soils	27	Closed Depression	55	VIs-1	63	B	10
HsB	Hurley-Slickspots complex, 2 to 9 percent slopes	28	----------	--	-------	--	---	---
	Hurley soil	--	Thin Claypan	57	VIs-1	63	---	10
	Slickspots	--	----------	--	VIIIs-3	64	---	---
In	Intermittent lakes	28	----------	--	VIIIw-1	64	---	---
LmD	Lantry-Morton silt loams, 6 to 15 percent slopes	29	----------	--	-------	--	---	---
	Lantry soil	--	Thin Upland	56	VIe-3	62	---	10
	Morton soil	--	Silty	56	IIIe-1	60	F	3
Lo	Lohler silty clay	30	Overflow	55	IIc-1	59	F	1
Lp	Lohler and Havrelon soils	30	Overflow	55	IIc-1	59	---	1
	Lohler soil	--	----------	--	-------	--	F	---
	Havrelon soil	--	----------	--	-------	--	G	---
LwA	Lowry silt loam, 0 to 2 percent slopes	32	Silty	56	IIe-1	59	F	3
LwB	Lowry silt loam, 2 to 6 percent slopes	32	Silty	56	IIe-1	59	F	3
Ma	Mine pits and dumps	32	----------	--	VIIIs-2	64	---	---
MbD	Moreau-Wayden silty clays, 9 to 25 percent slopes	33	----------	--	VIe-4	62	---	10
	Moreau soil	--	Clayey	56	-------	--	---	---
	Wayden soil	--	Shallow	56	-------	--	---	---
McB	Morton silt loam, 2 to 6 percent slopes	35	Silty	56	IIe-1	59	F	3
MdA	Morton-Belfield complex, 0 to 2 percent slopes	35	----------	--	IIc-2	60	---	---
	Morton soil	--	Silty	56	-------	--	F	3
	Belfield soil	--	Clayey	56	-------	--	E	4
MdB	Morton-Belfield complex, 2 to 6 percent slopes	35	----------	--	IIe-1	59	---	---
	Morton soil	--	Silty	56	-------	--	F	3
	Belfield soil	--	Clayey	56	-------	--	E	4
MfA	Morton-Farland silt loams, 0 to 2 percent slopes	35	Silty	56	IIc-2	60	F	3
MgB	Morton-Lantry silt loams, 2 to 9 percent slopes	35	----------	--	IIIe-1	60	---	---
	Morton soil	--	Silty	56	-------	--	F	3
	Lantry soil	--	Thin Upland	56	-------	--	G	8
Na	Natriborolls, channeled	36	Overflow	55	VIw-1	62	---	10

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Range site		Capability unit		Pasture group	Windbreak group
			Name	Page	Symbol	Page	Symbol	Number
OaB	Opal clay, 2 to 9 percent slopes	36	Clayey	56	IIIe-4	60	I	4
OhB	Opal-Hurley complex, 0 to 9 percent slopes	37		--		--	---	---
	Opal soil	--	Clayey	56	IIIe-4	60	I	4
	Hurley soil	--	Thin Claypan	57	VIs-1	63	---	10
OpA	Opal-Promise clays, 1 to 4 percent slopes	37	Clayey	56	IIIs-3	61	I	4
OsC	Opal-Sansarc clays, 6 to 15 percent slopes	37		--	VIe-4	62	---	10
	Opal soil	--	Clayey	56		--	---	---
	Sarsarc soil	--	Shallow	56		--	---	---
OtB	Opal-Slickspots complex, 2 to 6 percent slopes	37		--		--	---	---
	Opal soil	--	Clayey	56	IIIe-4	60	I	4
	Slickspots	--		--	VIIIs-3	64	---	---
Pa	Parshall fine sandy loam	38	Sandy	56	IIIe-7	60	H	1
Pe	Parshall-Ekalaka fine sandy loams	38	Sandy	56	IIIe-7	60	H	---
	Parshall soil	--		--		--	---	1
	Ekalaka soil	--		--		--	---	5
PrA	Promise clay, 0 to 2 percent slopes	39	Clayey	56	IIIs-3	61	I	4
PrB	Promise clay, 2 to 6 percent slopes	39	Clayey	56	IIIe-4	60	I	4
PsA	Promise-Slickspots complex, 0 to 2 percent slopes	39		--		--	---	---
	Promise soil	--	Clayey	56	IIIs-3	61	I	4
	Slickspots	--		--	VIIIs-3	64	---	---
Pw	Promise-Swanboy clays, channeled	39	Overflow	55	VIw-1	62	---	10
RaA	Reeder loam, 0 to 2 percent slopes	41	Silty	56	IIc-2	60	F	3
RaB	Reeder loam, 2 to 6 percent slopes	41	Silty	56	IIe-1	59	F	3
RaC	Reeder loam, 6 to 9 percent slopes	41	Silty	56	IIIe-1	60	F	3
RbC	Regent silty clay loam, 6 to 9 percent slopes	42	Clayey	56	IIIe-1	60	F	3
RmB	Regent-Moreau complex, 2 to 9 percent slopes	43	Clayey	56	IIIe-1	60	---	---
	Regent soil	--		--		--	F	3
	Moreau soil	--		--		--	I	4
RpA	Regent-Ridgeview silty clay loams, 0 to 2 percent slopes	43	Clayey	56	IIc-2	60	---	---
	Regent soil	--		--		--	F	3
	Ridgeview soil	--		--		--	E	4
RpB	Regent-Ridgeview silty clay loams, 2 to 6 percent slopes	43	Clayey	56	IIe-1	59	---	---
	Regent soil	--		--		--	F	3
	Ridgeview soil	--		--		--	E	4
RsA	Reliance silty clay loam, 0 to 2 percent slopes	44	Silty	56	IIc-2	60	F	3
RsB	Reliance silty clay loam, 2 to 6 percent slopes	44	Silty	56	IIe-1	59	F	3
RtB	Rhoades-Daglum complex, 2 to 6 percent slopes	45		--	VIs-1	63	---	---
	Rhoades soil	--	Thin Claypan	57		--	---	10
	Daglum soil	--	Claypan	56		--	C	9

Map symbol	Mapping unit	Page	Range site		Capability unit		Pasture group	Windbreak group
			Name	Page	Symbol	Page	Symbol	Number
RvA	Ridgeview silty clay loam, 0 to 2 percent slopes	46	Clayey	56	IIIs-3	61	E	4
SaE	Sarsarc-Dupree clays, 9 to 45 percent slopes	46		--	VIIs-2	63	---	10
	Sansarc soil	--	Shallow	56	-------	--	---	---
	Dupree soil	--	Dense Clay	57	-------	--	---	---
SbC	Sansarc-Opal clays, 6 to 15 percent slopes	47		--	VIs-3	63	---	10
	Sansarc soil	--	Shallow	56	-------	--	---	---
	Opal soil	--	Clayey	56	-------	--	---	---
SbE	Sansarc-Opal clays, 15 to 25 percent slopes	47		--	VIIs-2	63	---	10

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