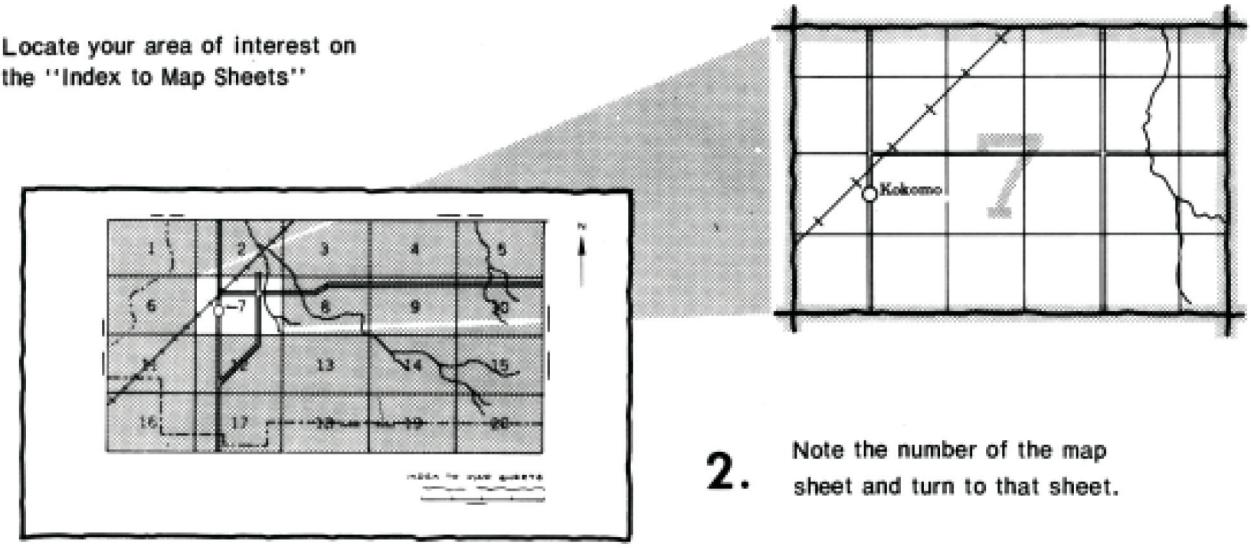
SOIL SURVEY OF

STANLEY COUNTY, SOUTH DAKOTA

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

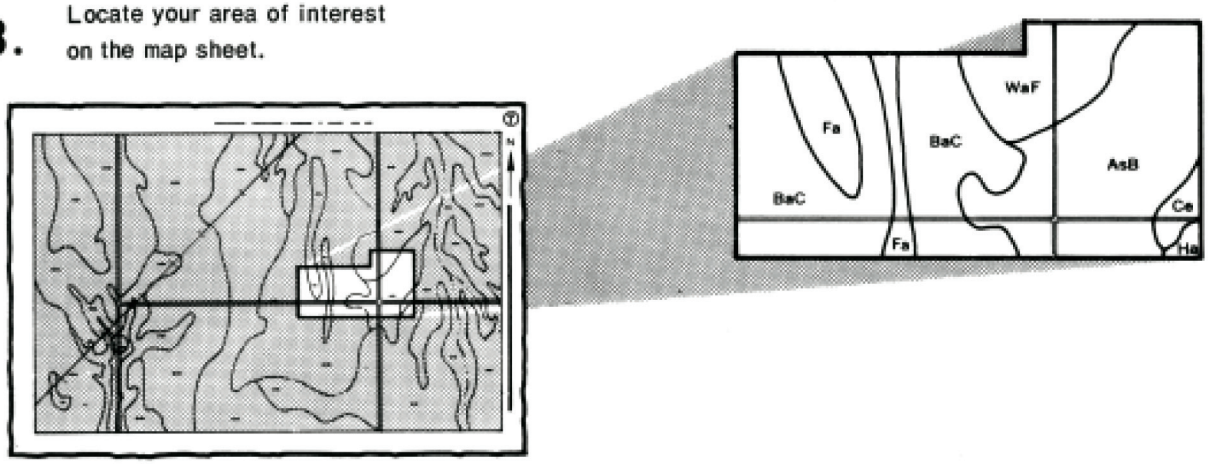
HOW TO USE

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

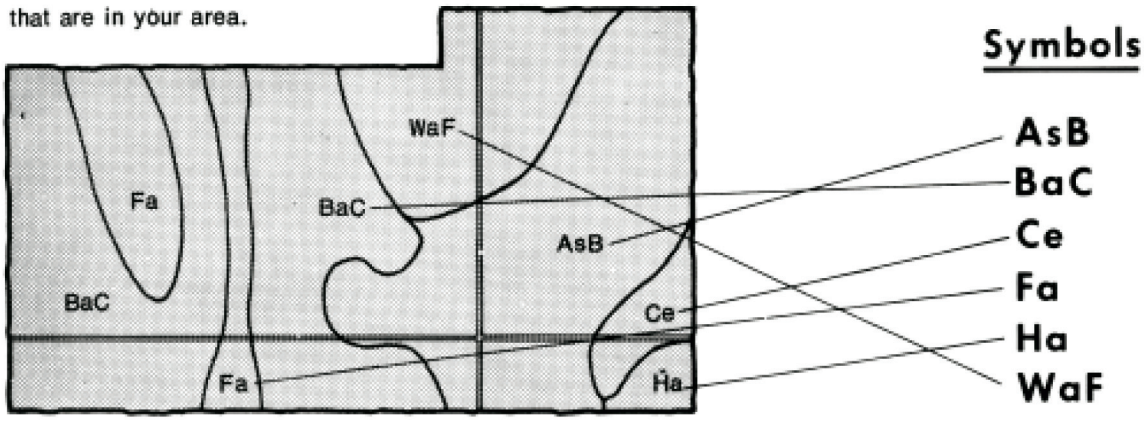


2. Note the number of the map sheet and turn to that sheet.

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

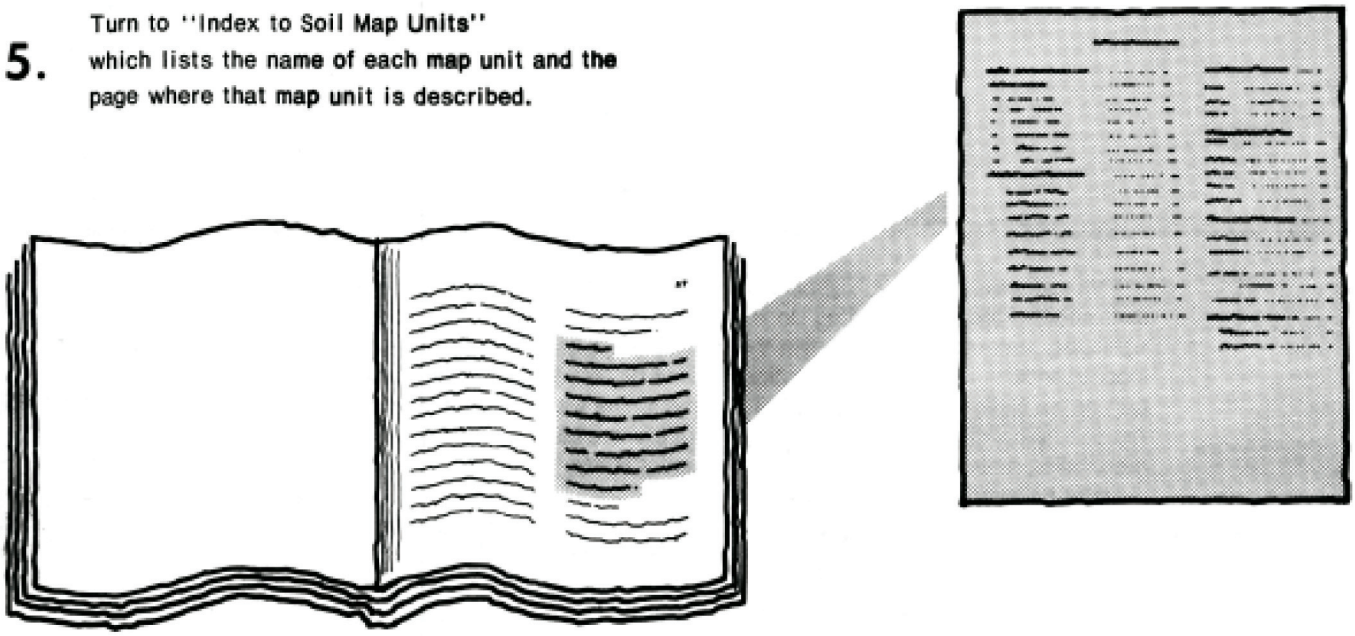


4. List the map unit symbols that are in your area.

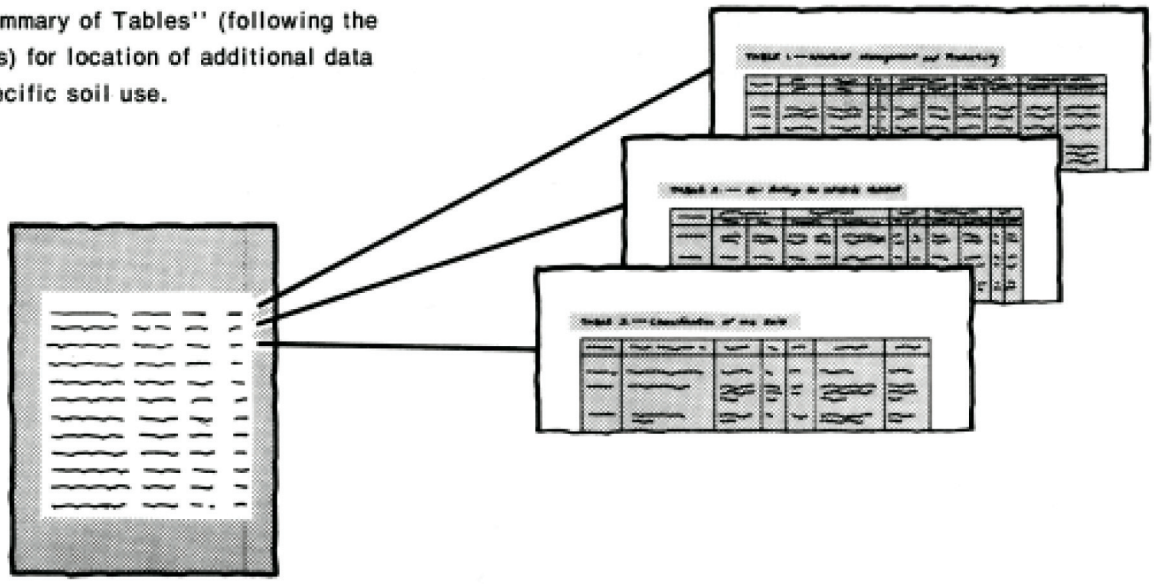


THIS SOIL SURVEY

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



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



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

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

This survey was made cooperatively by the United States Department of Agriculture, Soil Conservation Service and Forest Service; the United States Department of the Interior, Bureau of Indian Affairs; and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Stanley County Conservation District. Stanley County contributed funds for completion of the survey. Major fieldwork was performed in the period 1968-76. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1976.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

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Issued September 1980

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Foreword

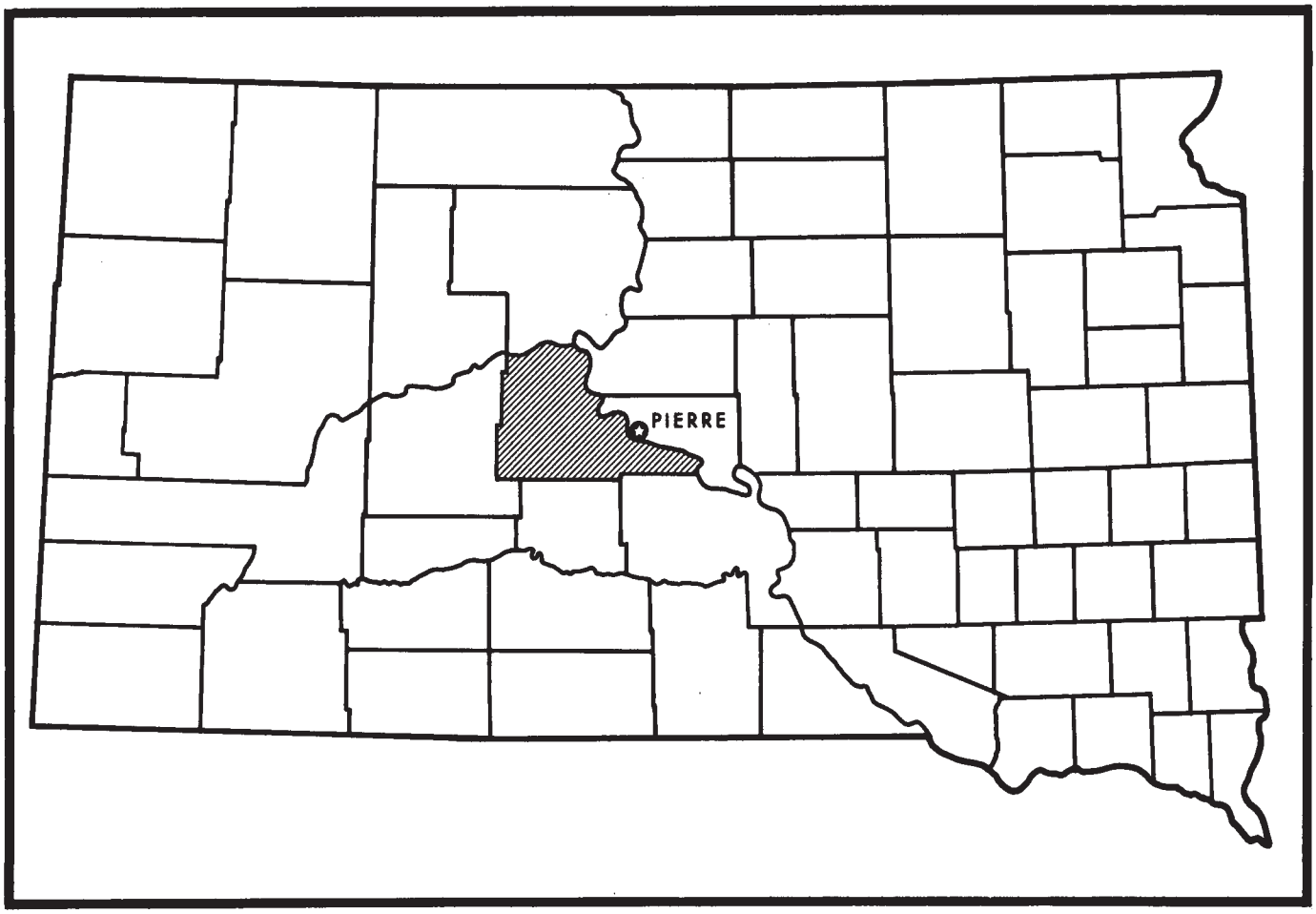
This soil survey contains information that can be used in land-planning programs in Stanley County, South Dakota. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed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

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

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

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

R. D. Swenson
State Conservationist
Soil Conservation Service



Location of Stanley County in South Dakota.

SOIL SURVEY OF STANLEY COUNTY, SOUTH DAKOTA

By Glenn A. Borchers, Soil Conservation Service

Soils surveyed by Glenn A. Borchers, James L. Driessen, Bruce O. Kunze, Kendall K. Olson, Loren D. Schultz, and Miles W. Smalley, Soil Conservation Service

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

STANLEY COUNTY is in the central part of South Dakota. It has a total area of 968,960 acres, of which about 64,000 acres is areas of water. About 16,128 acres is Indian land. According to the 1970 census, the county has a population of 2,457, and Ft. Pierre, the county seat, in the east-central part of the county, has a population of 1,448. Ft. Pierre is the only incorporated town in the county. The unincorporated village of Wendte is in the center of the county, and the unincorporated village of Hayes is in the west-central part. Post offices are located in Pierre, Hayes, and Mission Ridge.

General nature of the county

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

Climate

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

Stanley County is usually warm in summer, but hot spells are frequent and cool days occasional. The county is very cold in winter, when arctic air frequently surges over the area. Most of the precipitation falls during the warm period, and rainfall is normally heaviest late in spring and early in summer. Winter snowfall is normally not too heavy, and it is blown into drifts, so that much of the ground is free of snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Pierre, South Dakota, in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 19 degrees F, and the average daily minimum temperature is 9 degrees. The lowest temperature on record, which occurred at Pierre on January 29, 1966, is -33 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred on July 10, 1966, is 113 degrees.

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

Of the total annual precipitation, 14 inches, or 80 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 12 inches. The heaviest 1-day rainfall during the period of record was 3.52 inches at Pierre on August 2, 1953. Thunderstorms occur on about 40 days each year, and most occur in summer. Hail falls in scattered small areas during some of these storms.

Average seasonal snowfall is 29 inches. The greatest snow depth at any one time during the period of record was 29 inches. On an average of 31 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year. Blizzards occur several times each winter.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible in summer and 55 percent in winter.

Physiography and relief

Most of Stanley County is within the Pierre Hills region in the Missouri Plateau section of the Great Plains physiographic province (*5*). The eastern edge, however, is in the Missouri River Trench, which in part is occupied by Lake Oahe and Lake Sharpe, impoundments on the river.

The Pierre Hills generally are gently undulating to rolling, but they are hilly to steep in areas along Lake Oahe and Lake Sharpe and along the Bad River. The

Missouri River, which flows south and southeast along the eastern border of the county, has cut a trench 2 to 4 miles wide and 300 to 400 feet deep. Elevation ranges from about 1,420 feet above sea level in the southeastern part of the county to about 2,250 feet above sea level in the western part.

Settlement

Stanley County was established in 1873 by an act of the legislature of Dakota Territory and was formally organized in 1889. It was named after General David S. Stanley, who was commander at Fort Sully. Prior to 1914, it included the areas that are now known as Haakon County and Jackson County.

Fort Pierre is the oldest continuous settlement in the state. In 1743, the Verendrye brothers buried a lead plate on a hill overlooking the town and claimed the land for France. In 1817, a fort was built nearby to provide shelter and protection for the fur traders. Railway transportation was extended through the county to the Black Hills in 1907.

By 1890, the county had a population of 1,028. The population reached 14,975 in 1910, before Haakon and Jackson counties were formed. By 1920, it was 2,908, and it steadily declined during the drought and depression years. It increased rapidly during the construction of Oahe Dam. It increased to 4,085 by 1960, but it decreased to 2,457 by 1970.

Ranching and farming

The early settlers in Stanley County mostly were cattle ranchers. Water was available for their use in the rivers and in a few streams but was scarce in the open areas.

In the early 1900's, homesteaders converted much of the grassland into cropland. The grassland that remained was overgrazed. The farmers could not make a living on the small acreages during dry periods. During the depression and "dust bowl" days of the 1930's, many were forced to abandon their farms. They left the cropland bare and susceptible to erosion and soil blowing.

The Federal government bought about 35,000 acres of marginal cropland southeast of Fort Pierre in the mid 1930's. This land was supervised by the Soil Conservation Service for a number of years. Many acres were reseeded to grass. This area is now called Fort Pierre National Grasslands and is supervised by the Forest Service. Ranchers and farmers recognized the problems of water erosion, soil blowing, and overgrazing when they organized the Stanley County Conservation District in 1954.

About 75 percent of the acreage supports native grass and is used for grazing. In 1975, there were about 58,000 cattle of all classes (*6*). About 22,400 were beef cows held for breeding, and 200 were milk cows. There were about 1,500 hogs, 900 sheep, and 2,800 chickens.

About 22 percent of the county is used for cultivated crops or for tame pasture and hay. Winter wheat and grain sorghum are the main crops. In 1975, about 46,000 acres was planted to winter wheat and 10,000 acres to grain sorghum. Smaller acreages were planted to corn, oats, and spring wheat.

Because of the capabilities and potentials of the soils in the county, livestock and wheat probably will continue to be the basis of the local economy.

Natural resources

Soil is the most important resource in the county. It provides a growing medium for cultivated crops and for the grass grazed by livestock.

In most areas deep wells are important sources of water for domestic and livestock use. Some ranchers use pipelines to distribute the water. The Sundance Formation is the most widely used source of water. The wells are 1,750 feet to 2,700 feet deep. They are artesian. The water quality generally is poor; the artesian water is not suitable as irrigation water. A few shallow wells are along the Missouri and Bad Rivers. The water quality ranges from poor to good. Most of the water for livestock is provided by dams and dugouts that impound runoff. Lake Oahe and Lake Sharpe provide water of good quality for irrigation and other uses.

The chief mineral resource in the county is sand and gravel, which is used in construction and in maintenance of roads. Natural gas of low grade is in some wells in the Dakota Formation.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately.

The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, home buyers, and others.

General soil map for broad land use planning

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The associations in this county have been grouped for broad interpretive purposes. The four groups and the nine associations are described on the pages that follow.

Well drained and moderately well drained, nearly level and gently sloping soils on low terraces, alluvial fans, and flood plains

These soils are on low terraces, alluvial fans, and flood plains along the major drainageways in the county. They are dominantly nearly level but are gently sloping on some of the alluvial fans. They are deep and are loamy and clayey.

These soils make up about 2 percent of the county. About 80 percent of the acreage is range. Some areas are cultivated.

1. Swanboy-Wendte-Nimbro association

Deep, well drained and moderately well drained, nearly level and gently sloping, clayey and silty soils on low terraces, alluvial fans, and flood plains

This association is on flood plains, terraces, and fans adjacent to the major streams. It is dissected by many deep intermittent drainageways. Slopes are slightly concave or smooth in the areas of Swanboy soils and nearly level in the areas of Wendte and Nimbro soils.

This association makes up about 2 percent of the county. It is about 35 percent Swanboy and similar soils, 25 percent Wendte soils, 20 percent Nimbro soils, and 20 percent minor soils.

The well drained Swanboy soils are on foot slopes and fans at the outer edge of valleys and in narrow drainageways adjacent to flood plains. Slopes range from 0 to 6 percent. Typically, the surface layer is a thin layer of clay that is porous and that tends to crust. The subsoil is very firm and extremely firm clay. The underlying material is calcareous clay that contains salts.

The moderately well drained Wendte soils are on flood plains and low terraces. Slopes range from 0 to 2 percent. Typically, the surface layer is clay. The underlying material is stratified silty clay, clay, and silty clay loam.

The well drained and moderately well drained Nimbro soils are on flood plains and low terraces. Slopes are less than 2 percent. Typically, the surface layer is silty clay loam. The underlying material is stratified silty clay loam, clay loam, and fine sand.

Minor in this association are the well drained Promise and Sansarc soils on the adjacent uplands; the somewhat excessively drained Inavale soils adjacent to the large drainageways; the well drained and moderately well drained Munjor soils on flood plains; and Slickspots adjacent to some areas of the Swanboy soils.

About 80 percent of this association supports native grass and is used for grazing and hay. Most of the cropland is areas of Nimbro and Wendte soils. Alfalfa and corn are the main crops. Small grain and sorghum also are grown. The main concerns of management are keeping gullies from forming in areas of the Swanboy soils, improving tilth in areas of the Wendte soils, and improving fertility in areas of the Nimbro soils.

The Swanboy soils have poor potential and the Wendt and Nimbro soils good potential for cultivated crops and for tame pasture and hay, range, and openland and rangeland wildlife habitat. The Swanboy soils have poor

potential for most kinds of building site development and sanitary facilities because of a very high shrink-swell potential and restricted permeability. The Wendte and Nimbro soils have poor to fair potential for most kinds of building site development and sanitary facilities because of flooding.

Well drained, nearly level to moderately sloping soils on uplands and terraces

These soils are dominantly nearly level but are gently sloping and moderately sloping in some areas. They are deep and are loamy and silty.

These soils make up about 2 percent of the county. About 55 percent of the acreage is cropped. Alfalfa, corn, small grain, and sorghum are the main crops.

2. Lowry association

Deep, well drained, nearly level to moderately sloping, silty soils on uplands and terraces

This association is in areas on uplands and terraces where slopes are long and slightly convex. It makes up about 1 percent of the county. It is about 50 percent Lowry and similar soils and 50 percent minor soils.

The Lowry soils typically are silt loam throughout. The subsoil is very friable, and the underlying material is calcareous. Slopes range from 0 to 9 percent.

Minor in this association are Sansarc, Sully, Wendte, and Westover soils. Sansarc soils are shallow and clayey. They are in steep areas. Sully soils have a light colored surface layer. They are on slopes near drainageways. Wendte soils are moderately well drained and are on flood plains. Westover soils are loamy in the upper part and are underlain by sand and gravel. They are in steep areas near drainageways.

About 60 percent of this association is used for cultivated crops or tame pasture and hay. Alfalfa, corn, and small grain are the main crops. The main concerns of management are soil blowing and erosion.

This association has good potential for cultivated crops and for tame pasture and hay, range, rangeland and openland wildlife habitat, most kinds of building site development, and most sanitary facilities.

3. Ree-Canning association

Deep, well drained, nearly level to moderately sloping, loamy soils on terraces

This association is in smooth or slightly convex areas on high terraces. The soils dominantly are nearly level but are gently sloping and moderately sloping on the edges of the terraces and along drainageways.

This association makes up about 1 percent of the county. It is about 60 percent Ree and similar soils, 25 percent Canning and similar soils, and 15 percent minor soils.

The Ree soils typically have a loam surface layer. The subsoil is clay loam. The underlying material is clay loam and loam. Slopes range from 0 to 9 percent.

The Canning soils typically have a loam surface layer. The subsoil is friable sandy clay loam and clay loam. The upper part of the underlying material is sandy clay loam, and the lower part is calcareous sand and gravel. Slopes range from 0 to 9 percent.

Minor in this association are the poorly drained Kolls soils in depressions and the excessively drained Schamber soils on terrace rims and on ridges.

About 55 percent of this association is used for cultivated crops or tame pasture and hay. Alfalfa, small grain, and sorghum are the main crops. The main concern of management is conserving moisture. Controlling erosion also is a concern in the gently sloping and moderately sloping areas.

This association has good or fair potential for cultivated crops and for tame pasture and hay and openland wildlife habitat. It has good potential for range and rangeland wildlife habitat and for building site development. The Ree soils have fair potential and the Canning soils poor potential for most sanitary facilities. If the Canning soils are used as a site for sanitary facilities, the effluent can pollute shallow ground water.

Moderately well drained and well drained, nearly level to moderately sloping soils on uplands

These soils are dominantly nearly level and gently sloping but are steeper along drainageways and on ridges. They are moderately deep and deep and are silty and clayey.

These soils make up about 32 percent of the county. About 60 percent of the acreage is cropped. Alfalfa, small grain, and sorghum are the main crops.

4. Hurley-Millboro-McClure association

Deep, moderately well drained and well drained, nearly level and gently sloping, silty soils on uplands

This association generally consists of nearly level soils on uplands broken by small depressions and gently sloping soils on upland ridges. The Hurley soils are in concave or smooth areas, and the McClure and Millboro soils are in slightly convex areas.

This association makes up about 4 percent of the county. It is about 25 percent Hurley soils, 20 percent Millboro soils, 20 percent McClure and similar soils, and 35 percent minor soils.

The moderately well drained Hurley soils are in areas broken by small depressions. Slopes range from 0 to 3 percent. These soils typically have a thin surface layer of silt loam. The subsoil is very firm clay. The underlying material is clay.

The well drained Millboro soils are on slight rises. Slopes range from 0 to 6 percent. Typically, the surface layer is silty clay loam. The subsoil is clay. The underlying material is calcareous clay.

The well drained McClure soils are on slight rises.

Slopes range from 0 to 6 percent. Typically, the surface layer is silt loam. The subsoil is firm silty clay loam over very firm clay. The underlying material is calcareous clay and silty clay.

Minor in this association are the moderately well drained Carter soils in flat areas and slight swales; the poorly drained Hoven soils in depressions; and the well drained, clayey Opal and Sansarc soils along the larger drainageways.

About 55 percent of this association is used for cultivated crops or tame pasture and hay. Alfalfa, small grain, and sorghum are the main crops. Most of the cropland is areas of McClure and Millboro soils. Most of the native range is areas of Hurley soils. The main concerns of management are conserving moisture in the nearly level areas and controlling erosion in the gently sloping areas.

The Hurley soils have poor potential and the Millboro and McClure soils good potential for cultivated crops and for tame pasture and hay, range, and openland and rangeland wildlife habitat. All three soils have poor potential for most kinds of building site development because of a high or very high shrink-swell potential. They have poor potential for most sanitary facilities because of restricted permeability.

5. Promise-Opal association

Deep and moderately deep, well drained, nearly level to moderately sloping, clayey soils on uplands

This association is on uplands characterized by low ridges and shallow drainageways. The drainage pattern is well defined. Slopes generally are long and convex but are short and steep along some of the deeper drainageways.

This association makes up about 28 percent of the county. It is about 50 percent Promise soils, 30 percent Opal soils, and 20 percent minor soils (fig. 1).

The deep Promise soils are on the smoother parts of

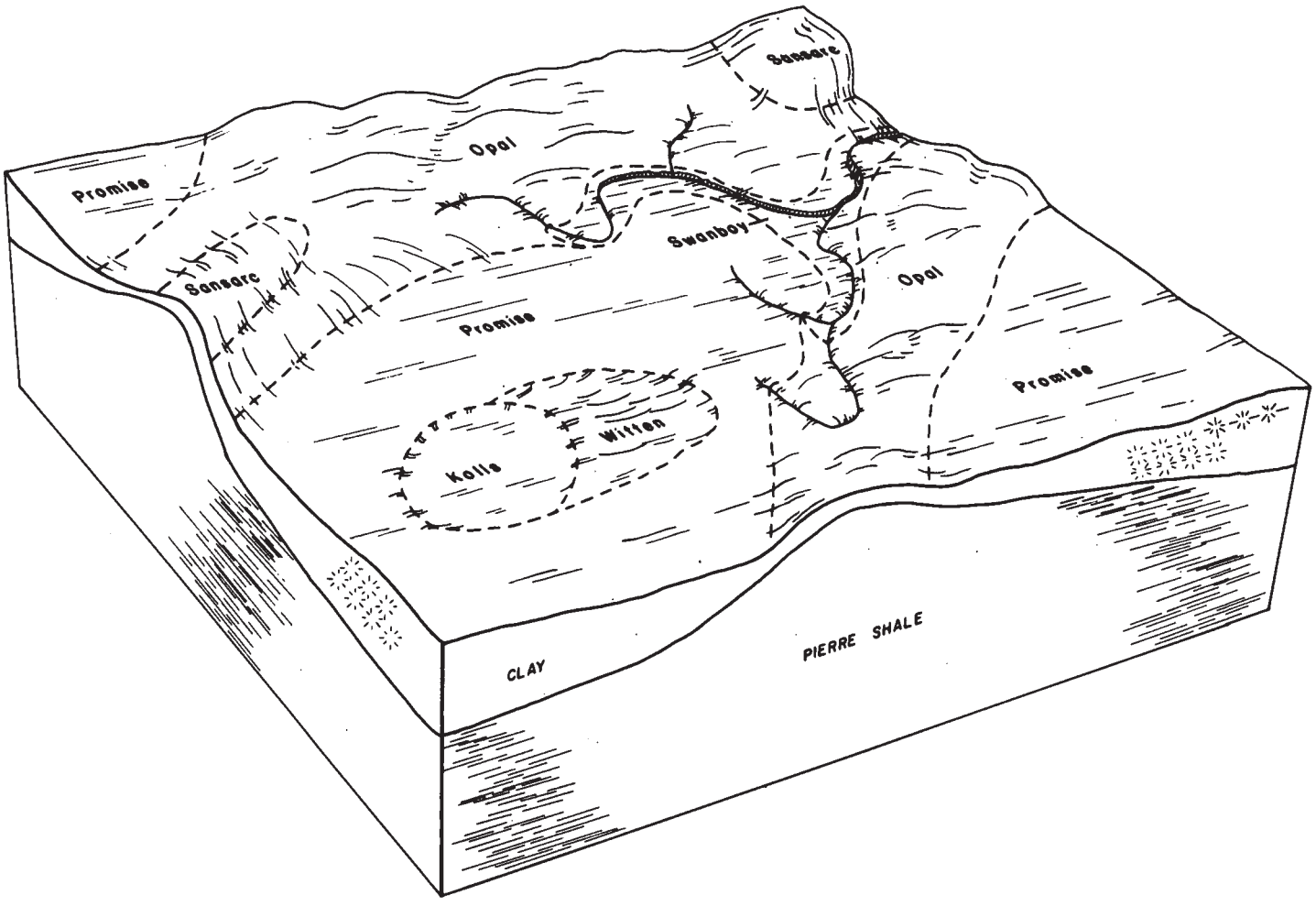


Figure 1.—Pattern of soils in the Promise-Opal association.

the landscape. Slopes range from 0 to 9 percent. Typically, these soils are clay throughout. The subsoil and underlying material are calcareous.

The moderately deep Opal soils are on the convex upper parts of the landscape. In this association they have a slope of 0 to 9 percent. Typically, the surface layer is clay. The subsoil is calcareous clay. The underlying material is calcareous clay and shaly clay. Soft shale is at a depth of about 33 inches.

Minor in this association are the poorly drained Kolls soils in depressions; the shallow Sansarc soils on the steeper, higher parts of the landscape and along drainageways; the dense Swanboy soils in drainageways; and the moderately well drained Witten soils in swales.

About 60 percent of this association is used for cultivated crops or tame pasture and hay. Alfalfa, small grain, and sorghum are the main crops. Most of the range is near the steeper drainageways. The main concerns of management are erosion and soil blowing.

This association has good to fair potential for cultivated crops and for tame pasture and hay, range, and rangeland and openland wildlife habitat. It has poor potential for building site development and most sanitary facilities because of a very high shrink-swell potential and restricted permeability.

Well drained and excessively drained, gently sloping to steep soils on uplands and terraces

These soils dominantly are strongly sloping and moderately sloping but are steeper along some drainageways and on terrace escarpments and are less steep in other areas. They make up about 64 percent of the county. Most of the acreage supports native grass and is used for grazing.

6. Chantier-Opal-Sansarc association

Shallow and moderately deep, well drained, gently sloping to strongly sloping, clayey soils on uplands

This association generally is on uplands between steep river breaks and more gently sloping uplands. Slopes are long and convex.

This association makes up about 7 percent of the county. It is about 45 percent Chantier and similar soils, 25 percent Opal and similar soils, 20 percent Sansarc soils, and 10 percent minor soils.

The shallow Chantier soils are in convex areas on the lower parts of the landscape. Slopes range from 2 to 15 percent. These soils typically have a thin surface layer of clay. The subsoil is extremely firm clay. The underlying material is clay and shaly clay. Soft shale is at a depth of about 18 inches.

The moderately deep Opal soils are on the higher parts of the landscape. In this association they have a slope of 3 to 15 percent. Typically, the surface layer is clay. The subsoil is calcareous, very firm clay. The underlying material is calcareous clay and shaly clay. Soft shale is at a depth of about 33 inches.

The shallow Sansarc soils are on the higher parts of the landscape. In this association they have a slope of 6 to 15 percent. Typically, the surface layer is clay. The underlying material is friable and very friable shaly and very shaly clay. Soft shale is at a depth of about 14 inches.

Minor in this association are the moderately well drained, nearly level Hurley soils.

Most of this association supports native grass and is used for grazing. The main concern of management is controlling erosion.

This association has fair potential for range and rangeland wildlife habitat. It has poor potential for cultivated crops and for tame pasture and hay and openland wildlife habitat. It has poor potential for building site development and sanitary facilities because of a very high shrink-swell potential, restricted permeability, and the limited depth to shale.

7. Lakoma-Okaton association

Moderately deep and shallow, well drained, gently sloping to steep, clayey soils on uplands

This association generally is on ridges and along drainageways in the uplands. It has a well defined drainage pattern. Slopes are long and convex.

This association makes up about 7 percent of the county. It is about 40 percent Lakoma and similar soils, 35 percent Okaton and similar soils, and 25 percent minor soils.

The moderately deep Lakoma soils are on ridges and smooth side slopes. Slopes range from 3 to 25 percent. Typically, the surface layer is clay. The subsoil is firm clay. The underlying material is shaly clay. Soft shale is at a depth of about 29 inches.

The shallow Okaton soils are on ridges and on convex slopes along drainageways. Slopes range from 6 to 40 percent. Typically, the surface layer is clay. The next layer is friable clay. The underlying material is shaly clay. Soft shale is at a depth of about 15 inches.

Minor in this association are the deep Promise soils in gently sloping areas on uplands; the gravelly Schamber soils in steep areas on high ridges; and the deep, dense Swanboy soils in drainageways.

Most of this association supports native grass and is used for grazing. Some of the gently sloping and moderately sloping areas of Lakoma soils are used for small grain. The main concern of management is controlling erosion.

This association has good to fair potential for range and rangeland wildlife habitat. It has fair to poor potential for cultivated crops and for tame pasture and hay and openland wildlife habitat. It has poor potential for building site development because of a high shrink-swell potential, restricted permeability, and the limited depth to shale.

8. Sansarc-Opal association

Shallow and moderately deep, well drained, moderately sloping to steep, clayey soils on uplands

This association generally is on ridges, hills, and breaks adjacent to the major drainageways in the uplands. It is dissected by many small draws and prominent drainageways. The less sloping areas are on the lower parts of the landscape and on some of the broader ridgetops.

This association makes up about 48 percent of the county. It is about 60 percent Sansarc soils, 20 percent Opal and similar soils, and 20 percent minor soils (fig. 2).

The shallow Sansarc soils are on the convex parts of the landscape. Slopes range from 6 to 40 percent. Typically, the surface layer is clay. The underlying material is friable and very friable shaly and very shaly clay. Soft shale is at a depth of about 14 inches.

The moderately deep Opal soils are on the smoother parts of the landscape. In this association they have a slope of 6 to 25 percent. Typically, the surface layer is clay. The subsoil is calcareous, very firm clay. The underlying material is calcareous clay and shaly clay. Soft shale is at a depth of about 33 inches.

Minor in this association are the shallow Chantier soils on foot slopes; rock outcrop in steep areas at midslope; the gravelly Schamber soils in steep areas on high ridges; and the deep, dense Swanboy soils and moderately well drained Wendte soils in the wider drainageways.

Most of this association supports native grass and is used as range. The main concern of management is controlling erosion.

This association has fair to good potential for range and rangeland wildlife habitat. It has poor potential for cultivated crops and for tame pasture and hay and openland wildlife habitat. It has poor potential for building site development and sanitary facilities because of a very high shrink-swell potential, restricted permeability, and the limited depth to shale.

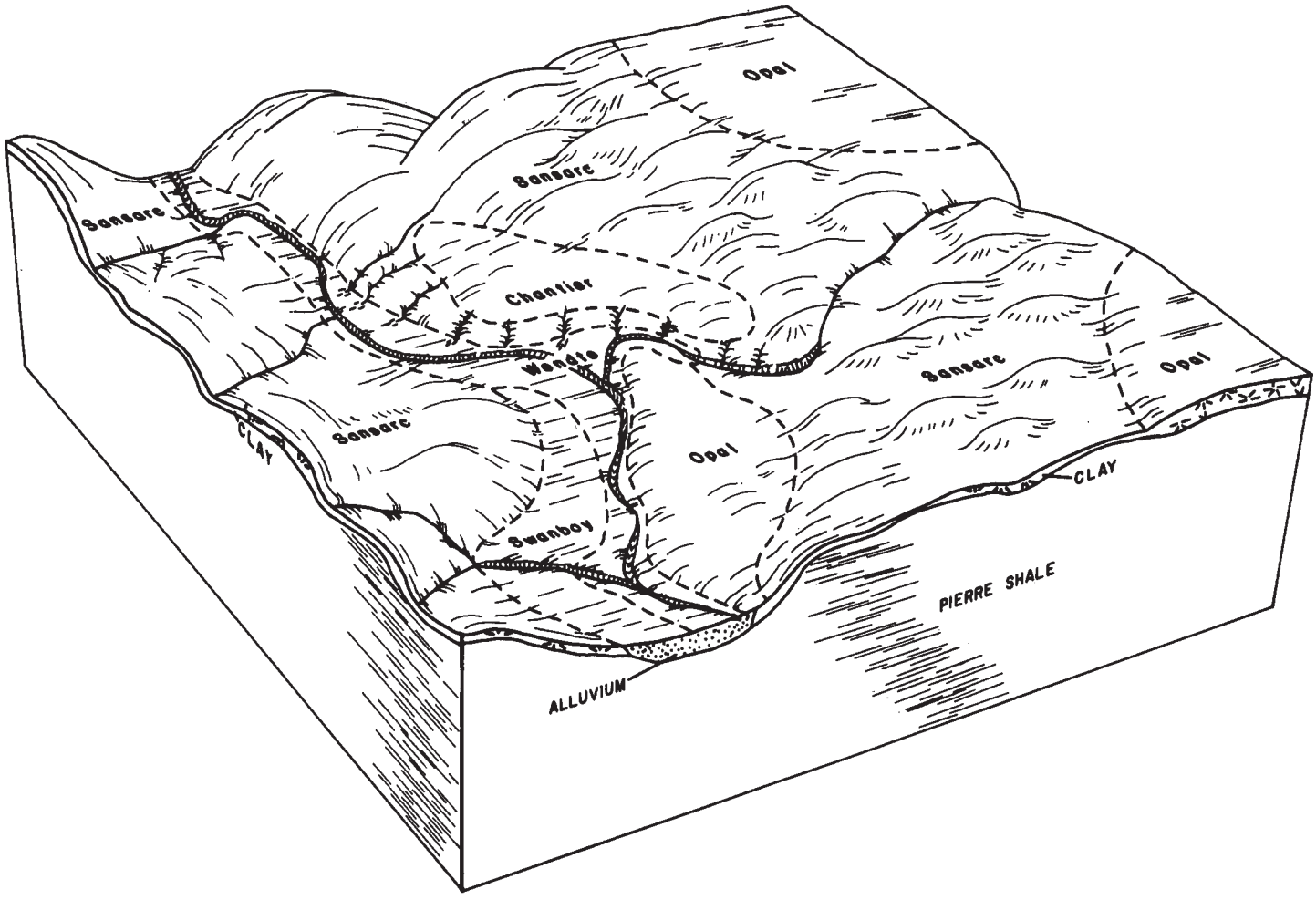


Figure 2.—Pattern of soils in the Sansarc-Opal association.

9. Schamber association

Excessively drained, moderately sloping to steep, loamy soils that are very shallow over sand and gravel; on terraces

This association is on high terrace remnants and terrace fronts where slopes generally are short and convex. It makes up about 2 percent of the county. It is about 40 percent Schamber soils and 60 percent minor soils.

The Schamber soils typically have a gravelly loam surface layer. The upper part of the underlying material is gravelly sandy loam. The lower part is sand and gravel, which is at a depth of about 14 inches. Slopes range from 6 to 40 percent.

Minor in this association are the well drained Canning, Murdo, and Ree soils in the less sloping areas and the shallow, clayey Sansarc soils on the lower parts of the landscape.

Most of this association supports native grass and is used for grazing. Sand and gravel is mined in some areas. Reclaiming these areas is a concern of management. The main concern is controlling erosion.

This association has poor potential for cultivated crops and for openland and rangeland wildlife habitat, range, and tame pasture and hay. It has poor potential for most kinds of building site development and sanitary facilities because slopes are moderately sloping to steep and seepage is a hazard.

Soil maps for detailed planning

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Promise clay, 3 to 6 percent slopes, is one of several phases in the Promise series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Munjor-Inavale complex is an example.

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

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

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

Soil descriptions

AgA—Agar silt loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and range from 5 to 75 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is friable silt loam and silty clay loam about 20 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has accumulations of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, calcareous silty clay loam and silt loam. In places the lower part of the subsoil contains more clay.

Included with this soil in mapping are small areas of Hoven and Lowry soils. These soils make up less than 10 percent of any one mapped area. Hoven soils have a claypan subsoil. They are in depressions. Lowry soils contain less clay in the subsoil than the Agar soil. Their position on the landscape is similar to that of the Agar

soil. Also included, in swales, is a soil having a surface layer that is more than 8 inches thick.

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

Most areas support native grass and are used for grazing. This soil has good potential for range, cultivated crops, tame pasture and hay, windbreaks and environmental plantings, and most kinds of building site development. It has fair potential for most sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and needleandthread. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is well suited to all of the cultivated crops commonly grown in the county. The main concern in managing cultivated areas is the periodic shortage of moisture characteristic of the climate. Tilth and the level of fertility are other concerns. Stubble mulching, crop residue management, and minimum tillage conserve moisture and help to control soil blowing. Stripcropping and field windbreaks also help to control soil blowing. Including grasses and legumes in the cropping system improves fertility and tilth. The soil is well suited to irrigation because it is nearly level and has a deep root zone and a high available water capacity.

Tame pasture plants can be successfully seeded on this soil. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is well suited to building site development and septic tank absorption fields.

The capability subclass is IIc; Silty range site.

AgB—Agar silt loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 5 to 50 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is friable silt loam and silty clay loam about 20 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part is calcareous and has accumulations of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, calcareous silty clay loam and silt loam. In places the lower part of the subsoil contains more clay.

Included with this soil in mapping are small areas of Hoven and Lowry soils. These soils make up less than 10 percent of any one mapped area. Hoven soils have a claypan subsoil. They are in depressions. Lowry soils contain less clay in the subsoil than the Agar soil. Their position on the landscape is similar to that of the Agar soil.

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

Most areas support native grass and are used for grazing. This soil has good potential for range, cultivated crops, tame pasture and hay, windbreaks and environmental plantings, and most kinds of building site development. It has fair potential for most sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and needleandthread. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is well suited to all of the cultivated crops commonly grown in the county. Controlling erosion and conserving moisture are the main concerns in managing cultivated areas. Tilth and the level of fertility are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks help to control soil blowing. The soil is suited to irrigation because it has a deep root zone and a high available water capacity. Controlling erosion is the major concern in managing irrigated areas.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is well suited to building site development and septic tank absorption fields.

The capability subclass is IIe; Silty range site.

AkA—Agar silt loam, clay substratum, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on the tops of ridges on loess-covered uplands. Areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 19 inches thick. It is dark grayish brown, friable silt loam in the upper part and grayish brown and pale brown, firm silty clay loam in the lower part. The upper part of the underlying material, to a depth of about 33 inches, is light brownish gray silty clay loam that has

accumulations of lime. The lower part to a depth of 60 inches is light brownish gray silty clay. In places clay is at a depth of more than 60 inches. In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Carter and Hurley soils. These soils make up less than 10 percent of any one mapped area. They are in concave areas and at the base of slopes. Their subsoil contains more clay than that of the Agar soil. Also, Hurley soils have accumulations of salts within a depth of 16 inches.

This Agar soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderate in the upper 33 inches and slow below. Runoff is slow. The shrink-swell potential is moderate in the upper part of the soil and high in the lower part of the underlying material.

Most areas support native grass and are used for grazing. This soil has good potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for most kinds of building site development and sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and needleandthread. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is well suited to all of the cultivated crops commonly grown in the county. The main concern in managing cultivated areas is the periodic shortage of moisture characteristic of the climate. Tilth, the level of fertility, and soil blowing are other concerns. Stubble mulching, crop residue management, and minimum tillage conserve moisture and help to control soil blowing. Stripcropping and field windbreaks also help to control soil blowing. Including grasses and legumes in the cropping system improves fertility and tilth.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

The shrink-swell potential is a limitation if this soil is used as a site for buildings. Reinforcing foundations and footings and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. The soil is a poor site for septic tank absorption fields because of the restricted permeability. Lagoons and holding tanks are suitable alternatives.

The capability subclass is IIc; Silty range site.

AkB—Agar silt loam, clay substratum, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on the tops of ridges on loess-covered uplands. Areas are irregular in shape and range from 5 to 70 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 19 inches thick. It is dark grayish brown, friable silt loam in the upper part and grayish brown and pale brown, firm silty clay loam in the lower part. The upper part of the underlying material, to a depth of about 33 inches, is light brownish gray silty clay loam that has accumulations of lime. The lower part to a depth of 60 inches is light brownish gray silty clay. In places clay is at a depth of more than 60 inches. In some areas the subsoil contains more clay.

Included with this soil in mapping are small areas of Carter and Hurley soils. These soils make up less than 10 percent of any one mapped area. They are in concave areas and at the base of slopes. Their subsoil contains more clay than that of the Agar soil. Also, Hurley soils have accumulations of salts within a depth of 16 inches.

This Agar soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderate in the upper 33 inches and slow below. Runoff is medium. The shrink-swell potential is moderate in the upper part of the soil and high in the lower part of the underlying material.

Most areas support native grass and are used for grazing. This soil has good potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for most kinds of building site development and sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and needleandthread. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is well suited to all of the cultivated crops commonly grown in the county. Controlling erosion and conserving moisture are the main concerns in managing cultivated areas. Tilth, the level of fertility, and soil blowing are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the moisture supply is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can

be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

The shrink-swell potential is a limitation if this soil is used as a site for buildings. Reinforcing foundations and footings and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. The soil is a poor site for septic tank absorption fields because of the restricted permeability. Lagoons and holding tanks are suitable alternatives.

The capability subclass is IIe; Silty range site.

CaA—Canning loam, 0 to 3 percent slopes. This well drained, nearly level soil is on high terraces. It is moderately deep over sand and gravel. Areas are irregularly shaped and range from 5 to more than 1,000 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray loam about 5 inches thick. The subsoil is brown and grayish brown, friable sandy clay loam and clay loam about 18 inches thick. The upper part of the underlying material, to a depth of about 32 inches, is light brownish gray sandy clay loam. The lower part to a depth of 60 inches is multicolored, calcareous sand and gravel. In some places the subsoil contains more clay. In other places the underlying sand and gravel is noncalcareous. In some areas it is 10 to 20 inches from the surface, and in others it is more than 40 inches from the surface.

Included with this soil in mapping are small areas of Schamber soils. These soils make up less than 10 percent of any one mapped area. They are steeper than the Canning soil. They have sand and gravel within a depth of 10 inches.

This Canning soil is medium in fertility and moderate in content of organic matter. It is somewhat droughty because of the underlying sand and gravel. Available water capacity is moderate. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Runoff is slow.

Most areas support native grass and are used for grazing or hay. This soil has good potential for range, fair potential for cultivated crops and for tame pasture and hay, and poor potential for windbreaks and environmental plantings. It has good potential for most kinds of building site development and poor potential for most sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, needleandthread, sideoats grama, and blue grama. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is suited to small grain and sorghum. Conserving moisture is the main concern in managing cultivated areas. Tilth and the level of fertility are other concerns. Stubble mulching and crop residue management conserve moisture and improve fertility and tilth.

Tame pasture plants can be successfully seeded on this soil. Alfalfa, crested wheatgrass, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

This soil is poorly suited to windbreaks and environmental plantings because it is somewhat droughty. It can support all types of plantings, but optimum growth rates are unlikely. Fallowing a year before planting conserves moisture. Cultivation and applications of herbicide control competing plants.

This soil is well suited to most kinds of building site development. It also is well suited to septic tank absorption fields, but the effluent can pollute shallow ground water.

The capability subclass is IIIs; Silty range site.

CaB—Canning loam, 3 to 6 percent slopes. This well drained, gently sloping soil is on high terraces. It is moderately deep over sand and gravel. Areas are irregular in shape and range from 5 to 60 acres in size. Slopes are smooth.

Typically, the surface layer is dark gray loam about 5 inches thick. The subsoil is brown and grayish brown, friable sandy clay loam and clay loam about 18 inches thick. The upper part of the underlying material, to a depth of about 32 inches, is light brownish gray sandy clay loam. The lower part to a depth of 60 inches is multicolored, calcareous sand and gravel. In some places the subsoil contains more clay. In other places the underlying sand and gravel is noncalcareous. In some areas it is 10 to 20 inches from the surface, and in others it is more than 40 inches from the surface.

Included with this soil in mapping are small areas of Schamber soils. These soils make up less than 10 percent of any one mapped area. They are steeper than the Canning soil. They have sand and gravel within a depth of 10 inches.

This Canning soil is medium in fertility and moderate in content of organic matter. It is somewhat droughty because of the underlying sand and gravel. Available water capacity is moderate. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Runoff is medium.

Most areas support native grass and are used for grazing or hay. This soil has good potential for range, fair potential for cultivated crops and for tame pasture and hay, and poor potential for windbreaks and environmental plantings. It has good potential for most kinds of building site development and poor potential for most sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, needleandthread, sideoats grama, and blue grama. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is suited to small grain and sorghum. Controlling erosion and conserving moisture are the main concerns in managing cultivated areas. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help

to control erosion, conserve moisture, and improve fertility and tilth.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion. Alfalfa, crested wheatgrass, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

This soil is poorly suited to windbreaks and environmental plantings because it is somewhat droughty. It can support trees and shrubs, but optimum growth rates are unlikely. Fallowing a year before planting conserves moisture. Cultivation and applications of herbicide control competing plants.

This soil is well suited to most kinds of building site development. It also is well suited to septic tank absorption fields, but the effluent can pollute shallow ground water.

The capability subclass is IIIe; Silty range site.

CaC—Canning loam, 6 to 9 percent slopes. This well drained, moderately sloping soil is on high terraces. It is moderately deep over sand and gravel. Areas are irregular in shape and range from 5 to 50 acres in size. Slopes are smooth.

Typically, the surface layer is dark gray loam about 5 inches thick. The subsoil is brown and grayish brown, friable sandy clay loam and clay loam about 18 inches thick. The upper part of the underlying material, to a depth of about 32 inches, is light brownish gray sandy clay loam. The lower part to a depth of 60 inches is multicolored, calcareous sand and gravel. In some places the subsoil contains more clay. In other places the underlying sand and gravel is noncalcareous. In some areas it is 10 to 20 inches from the surface, and in others it is more than 40 inches from the surface.

Included with this soil in mapping are small areas of Schamber soils. These soils make up less than 15 percent of any one mapped area. They are steeper than the Canning soil. They have sand and gravel within a depth of 10 inches.

This Canning soil is medium in fertility and moderate in content of organic matter. It is somewhat droughty because of the underlying sand and gravel. Available water capacity is moderate. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Runoff is medium.

Most areas support native grass and are used for grazing or hay. This soil has good potential for range, fair potential for cultivated crops and for tame pasture and hay, and poor potential for windbreaks and environmental plantings. It has good potential for most kinds of building site development and poor potential for most sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, needleandthread, sideoats grama, and blue grama. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is suited to small grain and sorghum. The main concerns in managing cultivated areas are controlling erosion and conserving moisture. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion, conserve moisture, and improve fertility.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion. Pubescent wheatgrass and intermediate wheatgrass are suitable.

This soil is poorly suited to windbreaks and environmental plantings because it is somewhat droughty. It can support trees and shrubs, but optimum growth rates are unlikely. Fallowing a year before planting conserves moisture. Cultivation and applications of herbicide control competing plants.

This soil is suitable as a site for most kinds of buildings. It also is suitable as a septic tank absorption field, but the effluent can pollute shallow ground water.

The capability subclass is IVe; Silty range site.

Cc—Carter-Hurley silt loams. These deep, moderately well drained, nearly level soils are on uplands. The Carter soil is on slight rises and in smooth areas. The Hurley soil is in small depressions. Both soils have a dense claypan subsoil. Areas are irregularly shaped and range from 5 to more than 200 acres in size. They are about 55 percent Carter soil and 35 percent Hurley soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Carter soil has a surface layer of dark gray silt loam about 2 inches thick. The subsurface layer is dark gray silty clay loam about 6 inches thick. The subsoil is extremely firm clay about 15 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is grayish brown and dark grayish brown clay and silty clay. Spots of gypsum are below a depth of about 33 inches. In places the slope is more than 3 percent.

Typically, the Hurley soil has a surface layer of gray silt loam about 3 inches thick. The subsoil is very firm clay about 16 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part has accumulations of lime and salts that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, olive gray, and gray clay.

Included with these soils in mapping are small areas of McClure, Millboro, and Promise soils and Slickspots. These included soils make up about 10 percent of any one mapped area. McClure and Millboro soils have a subsoil that contains less clay than that of either the Carter or the Hurley soil. They are on the higher convex parts of the landscape. Promise soils do not have a dense claypan subsoil. They are on the slightly higher parts of the landscape. Slickspots are in slight depressions. They have no plant cover.

The Carter soil is medium in fertility and moderate in content of organic matter. The Hurley soil is low in

fertility and in content of organic matter. In the Hurley soil, tilth is poor and plants are adversely affected by the high content of sodium in the subsoil. Available water capacity is moderate in the Carter soil and low in the Hurley soil. Permeability is very slow in both soils. Runoff is slow. The shrink-swell potential is very high.

Most areas support native grass and are used for grazing. These soils have fair potential for range, cultivated crops, and tame pasture and hay. They have poor potential for windbreaks and environmental plantings and for most kinds of building site development and most sanitary facilities.

These soils are best suited to range. The natural plant cover mainly is western wheatgrass, blue grama, and buffalograss. Overuse results in an increase in the extent of the buffalograss and blue grama. After continued overuse, some areas of the Hurley soil are bare and some are dominated by weeds and pricklypear.

The Hurley soil is poorly suited to cultivated crops and to tame pasture and hay. The Carter soil is better suited, but it occurs as areas so closely intermingled with areas of the Hurley soil that farming the two soils separately generally is not feasible. Small grain and sorghum are the best suited crops. Improving tilth and increasing the rate of water intake are the main concerns of management. Stubble mulching, managing crop residue, planting green manure crops, including grasses and legumes in the cropping system, and chiseling or subsoiling improve tilth and fertility, increase the rate of water intake, and conserve moisture.

These soils are poorly suited to windbreaks and environmental plantings because of the dense claypan subsoil and the high content of salts. If carefully managed, selected trees and shrubs can be planted for special purposes, but optimum growth rates are unlikely.

Because of the very high shrink-swell potential, these soils are poorly suited to building site development. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The soils generally are unsuitable as septic tank absorption fields because of the restricted permeability. Lagoons and holding tanks are suitable alternatives.

The Carter soil is in capability subclass IVs, Claypan range site; the Hurley soil is in capability subclass VIs, Thin Claypan range site.

ChB—Chantier clay, 2 to 9 percent slopes. This shallow, well drained, gently sloping and moderately sloping soil is on uplands. Areas are irregular in shape and range from 5 to more than 2,000 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown clay about 2 inches thick. The subsoil is grayish brown, extremely firm clay about 5 inches thick. The underlying material is about 11 inches thick. It is grayish brown and light brownish gray clay or shaly clay that has many streaks and spots of gypsum and other salts. Olive gray shale is at a depth of about 18 inches. In places the depth to shale is more than 20 inches.

Included with this soil in mapping are small areas of Opal, Sansarc, and Swanboy soils and Slickspots. These soils make up less than 10 percent of any one mapped area. Opal and Sansarc soils are on the higher parts of the landscape. They do not have visible salts near the surface. Also, Opal soils are more than 20 inches deep over shale. Swanboy soils are on foot slopes and along drainageways on the lower parts of the landscape. They do not have shale within a depth of 40 inches. Slickspots have salts at the surface and have no plant cover.

This Chantier soil is low in fertility and in content of organic matter. Tilth is very poor. The shrink-swell potential is very high. Available water capacity is very low. Permeability usually is very slow. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. Runoff is medium or rapid.

Most areas support native grass and are used for grazing. This soil has poor potential for range, cultivated crops, tame pasture and hay, windbreaks and environmental plantings, and building site development and sanitary facilities.

This soil is best suited to range. The natural plant cover mainly is a sparse stand of western wheatgrass and lesser amounts of green needlegrass. If the range is overused, the green needlegrass dies out. If overuse continues, the western wheatgrass thins out and is replaced by annual weeds. In dry years much of the surface is bare. Flexible stocking rates are needed because the extent of the plant cover varies widely between wet and dry years.

This soil generally is unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings. Tilth is very poor, and the subsoil is dense clay that has a high content of salts.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling and by the unstable nature of the underlying shale. The soil generally is unsuitable as a septic tank absorption field because it is very slowly permeable and is shallow over shale. Other sites should be selected.

The capability subclass is VIs; Dense Clay range site.

CsC—Chantier-Sansarc clays, 3 to 15 percent slopes. These shallow, well drained, gently sloping to strongly sloping soils are on uplands that generally are dissected by gullies and shallow drainageways. The Chantier soil is in smooth, concave areas at midslope or on the lower side slopes. The Sansarc soil is on ridges, knolls, and side slopes. Areas are irregular in shape and range from 5 to more than 300 acres in size. They are about 45 to 60 percent Chantier soil and 30 to 45 percent Sansarc soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Chantier soil has a surface layer of grayish brown clay about 2 inches thick. The subsoil is grayish brown, extremely firm clay about 5 inches thick. The underlying material is about 11 inches thick. It is grayish brown and light brownish gray clay or shaly clay that has many streaks and spots of gypsum and other salts. Soft shale is at a depth of about 18 inches. In places the depth to shale is more than 20 inches.

Typically, the Sansarc soil has a surface layer of light brownish gray clay about 4 inches thick. The underlying material is light brownish gray, friable and very friable shaly and very shaly clay about 10 inches thick. Soft shale is at a depth of about 14 inches.

Included with these soils in mapping are small areas of Swanboy soils and Rock outcrop. These inclusions make up less than 10 percent of any one mapped area. Swanboy soils are along the drainageways. They do not have shale within a depth of 40 inches. Rock outcrop is in the steeper convex areas.

The Chantier and Sansarc soils are low in fertility and in content of organic matter. They have a shallow root zone. Available water capacity is very low. Permeability is very slow in the Chantier soil and slow in the Sansarc soil. Runoff is medium or rapid on both soils. The shrink-swell potential is very high.

Nearly all areas support native grass and are used for grazing. The Chantier soil has poor potential and the Sansarc soil fair potential for range. Both soils have poor potential for cultivated crops and for tame pasture and hay, windbreaks and environmental plantings, and building site development and sanitary facilities.

These soils are best suited to range. The natural plant cover mainly is a sparse stand of western wheatgrass and lesser amounts of green needlegrass on the Chantier soil and little bluestem, western wheatgrass, green needlegrass, and big bluestem on the Sansarc soil. Sod-forming short grasses are lacking on the Chantier soil. If range on the Chantier soil is overused, the green needlegrass dies out, the western wheatgrass thins out, and both of the grasses are replaced by weeds. If range on the Sansarc soil is overused, the bluestems and green needlegrass are replaced by western wheatgrass and blue grama. In dry years much of the surface is bare in areas of the Chantier soil. The topography is suitable for stock water dams, but the soils are unstable and siltation is rapid.

These soils generally are unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings. In both soils, tilth is very poor and the depth to shale is a limitation. Also, the subsoil of the Chantier soil is dense clay that has a high content of salts.

These soils are poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling and by the unstable nature of the underlying shale. The soils generally are unsuitable as septic tank absorption fields because they are very slowly or slowly permeable and are shallow over shale. Other sites should be selected.

The capability subclass is VIs; Chantier soil in Dense Clay range site, Sansarc soil in Shallow Clay range site.

CwB—Chantier-Swanboy clays, 2 to 9 percent slopes. These shallow and deep, well drained, gently sloping and moderately sloping soils are in valleys on uplands that generally are dissected by drainageways and gullies. The Chantier soil is on the higher knolls and ridges. The gently sloping Swanboy soil is in concave areas adjacent to the drainageways. Areas are long and narrow and range from 10 to 300 acres in size. They are 40 to 60 percent Chantier soil and 35 to 50 percent Swanboy soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Chantier soil has a surface layer of grayish brown clay about 2 inches thick. The subsoil is grayish brown, extremely firm clay about 5 inches thick. The underlying material is about 11 inches thick. It is grayish brown and light brownish gray clay or shaly clay that has many streaks and spots of gypsum and other salts. Soft shale is at a depth of about 18 inches. In places the depth to shale is more than 20 inches.

Typically, the Swanboy soil has a surface layer of grayish brown clay about 1 inch thick. This layer is porous and tends to crust. The subsoil is grayish brown, very firm and extremely firm clay about 9 inches thick. The underlying material to a depth of 60 inches is grayish brown and olive gray, calcareous clay that has specks of gypsum and other salts. In places shale is 40 to 60 inches from the surface.

Included with these soils in mapping are small areas of Opal, Promise, Sansarc, and Wendte soils. These included soils make up 5 to 10 percent of any one mapped area. Opal and Promise soils are in convex areas on the higher parts of the landscape. They do not have accumulations of salts within a depth of 15 inches. The shallow Sansarc soils are along drainageways. Wendte soils are on the lower parts of the landscape. They contain less clay than the Chantier and Swanboy soils, are stratified, and do not have accumulations of salts within a depth of 15 inches.

The Chantier and Swanboy soils are low in fertility and in content of organic matter. Tilth is very poor. Available water capacity is very low. Permeability usually is very slow. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. Runoff is rapid. The shrink-swell potential is very high.

Most areas support native grass and are used for grazing. These soils have poor potential for range, cultivated crops, tame pasture and hay, windbreaks and environmental plantings, and building site development and most sanitary facilities.

These soils are best suited to range. The natural plant cover mainly is a sparse stand of western wheatgrass

and lesser amounts of green needlegrass. If the range is overused, the green needlegrass dies out. If overuse continues, the western wheatgrass thins out and is replaced by annual weeds and pricklypear. In dry years much of the surface is bare. Flexible stocking rates are needed because the extent of the plant cover varies widely between wet and dry years.

These soils generally are unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings. Tilth is very poor in both soils, and the subsoil of the Chantier soil is dense clay that has a high content of salts.

These soils are poorly suited to building site development because they both have a very high shrink-swell potential and because the underlying material of the Chantier soil is unstable. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The soils generally are not suitable as septic tank absorption fields because of the restricted permeability. Lagoons and holding tanks are suitable alternatives on the Swanboy soil. They are not suitable, however, on the shallow Chantier soil.

The capability subclass is VIs; Dense Clay range site.

Do—Dorna silt loam. This deep, well drained, nearly level soil is on terraces. Areas are irregularly shaped and range from 6 to more than 60 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The upper part of the underlying material, to a depth of about 24 inches, is brown, very friable silt loam that has streaks of lime. The lower part to a depth of 60 inches is brown and grayish brown clay. Accumulations of salt crystals are below a depth of 42 inches. In some areas depth to the clayey part of the underlying material is more than 40 inches, and in other areas it is less than 20 inches. In places the slope is more than 2 percent.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate or high. Permeability is moderate in the upper 24 inches and slow below. Runoff is slow. The shrink-swell potential is high in the clayey part of the underlying material.

Most areas are cultivated. This soil has good potential for cultivated crops and for range, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for most kinds of building site development and sanitary facilities.

This soil is well suited to all of the cultivated crops commonly grown in the county. The main concern in managing cultivated areas is controlling soil blowing. Conserving moisture and improving fertility are other concerns. Stubble mulching, crop residue management, and minimum tillage help to control soil blowing, conserve moisture, and improve fertility. Stripcropping and field windbreaks also help to control soil blowing. Including grass and legumes in the cropping system increases the content of organic matter and improves fertility and tilth.

Seeding this soil to suitable tame pasture plants is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and needleandthread. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama and a decrease in the extent of bluestems and green needlegrass.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides. Fallowing a year prior to planting also conserves moisture.

The shrink-swell potential is a limitation if this soil is used as a site for buildings. Reinforcing foundations and footings and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. The soil is a poor site for septic tank absorption fields because of the restricted permeability. It is suitable, however, as a site for other waste disposal systems, such as sewage lagoons.

The capability subclass is IIe; Silty range site.

Ho—Hoven silt loam. This deep, poorly drained, level soil is in depressions in the uplands. It is frequently flooded for very long periods in the spring. Areas are oval and range from 3 to 90 acres in size. The surface is uneven in areas where small mounds rise above low spots.

Typically, the surface layer is gray silt loam about 2 inches thick. The subsoil is very firm clay about 13 inches thick. It is dark gray in the upper part and is gray and calcareous in the lower part. The underlying material to a depth of 60 inches is gray clay. Accumulations of lime and gypsum are below a depth of 32 inches. In places, the surface layer is more than 6 inches thick and the subsoil contains less sodium.

This soil is medium in fertility and moderate in content of organic matter. Tilth is poor; tilling is difficult both when the soil is wet and when it is dry. The availability of plant nutrients is adversely affected by the high content of sodium in the subsoil. Available water capacity is moderate. The dense claypan subsoil releases moisture slowly to plants during dry periods. The water table is perched 0.5 foot above the surface to 1.5 feet below in the spring. The water table and the claypan subsoil restrict root penetration. Permeability usually is very slow. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. The shrink-swell potential is high.

Most areas support native grass and are used for grazing or hay. This soil has fair potential for range. It has poor potential for cultivated crops and for tame pasture and hay, windbreaks and environmental plantings, and building site development and most sanitary facilities.

This soil is best suited to range. The natural plant cover mainly is western wheatgrass and lesser amounts of sedges. If the range is overused, the western wheatgrass is replaced by saltgrass, buffalograss, and sedges. The extent of sedges and rushes increases during wet periods, and the extent of buffalograss increases during dry periods. If the site is trampled by livestock when the soil is wet, annuals and weeds invade. The soil is an excellent site for dugouts and stock water developments.

This soil generally is unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings because of the seasonal wetness and the sodium affected subsoil. Artificial drainage generally is not feasible because suitable outlets are not available. A few areas are cropped with adjacent soils, but the crops drown in wet years. Western wheatgrass is the best species for planting if cultivated areas are seeded to grass. Garrison creeping foxtail and reed canarygrass also are suited.

This soil generally is unsuitable as a site for buildings and most sanitary facilities because of the flooding.

The capability subclass is VIs; Closed Depression range site.

HrA—Hurley silt loam, 0 to 3 percent slopes. This deep, moderately well drained, nearly level soil is on uplands. Areas are irregularly shaped and range from 3 to more than 300 acres in size. The surface generally is uneven because in most areas mounds rise a few inches above low spots.

Typically, the surface layer is gray silt loam about 3 inches thick. The subsoil is very firm clay about 16 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part has accumulations of lime and salts that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, olive gray, and gray clay. In places the slope is more than 3 percent. In some areas shale is 20 to 30 inches from the surface.

Included with this soil in mapping are small areas of Carter, McClure, Millboro, and Promise soils. These soils make up less than 15 percent of any one mapped area. They are on the higher parts of the landscape. Their subsoil contains less sodium than that of the Hurley soil.

This Hurley soil is low in fertility and in content of organic matter. The availability of plant nutrients is adversely affected by the sodium in the subsoil. Tilth is very poor; tilling is difficult both when the soil is wet and when it is dry. The dense claypan subsoil restricts root penetration. Available water capacity is low. Permeability is very slow. Runoff is slow. The shrink-swell potential is very high.

Most areas support native grass and are used for grazing. A few areas are cropped with adjacent soils. This soil has poor potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings and for building site development and most sanitary facilities.

This soil is best suited to range. The natural plant cover mainly is blue grama, western wheatgrass, and buffalograss. Overuse results in a decrease in the extent of blue grama and western wheatgrass and an increase in the extent of buffalograss. After continued overuse, some areas are bare and weeds and pricklypear occupy the site.

This soil generally is unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings. It has a claypan subsoil and a high content of sodium, both of which adversely affect crops.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The soil generally is unsuitable as a septic tank absorption field because of the restricted permeability. It is suitable, however, as a site for other waste disposal systems, such as sewage lagoons.

The capability subclass is VIs; Thin Claypan range site.

Hs—Hurley-Slickspots complex. This map unit consists dominantly of a deep, moderately well drained, nearly level Hurley soil and Slickspots on uplands. The Hurley soil is on slight mounds, and the Slickspots are in depressions. Slopes are uneven. Areas are irregularly shaped and range from 3 to more than 70 acres in size. They are about 45 to 60 percent Hurley soil and 30 to 45 percent Slickspots. The Hurley soil and Slickspots occur as areas so intermingled that mapping them separately is not practical.

Typically, the Hurley soil has a surface layer of gray silt loam about 3 inches thick. The subsoil is very firm clay about 16 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part has accumulations of lime and salts that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, olive gray, and gray clay. In places shale is 20 to 30 inches from the surface.

The surface of the Slickspots is so crusted that it is nearly impervious to water. Visible accumulations of salts are at or near the surface. The soil material to a depth of 60 inches is dense, massive clay.

Included with the Hurley soil and the Slickspots in mapping are small areas of Carter, McClure, Millboro, and Promise soils. These soils make up less than 10 percent of any one mapped area. They are on the higher parts of the landscape. Their subsoil contains less sodium than that of the Hurley soil.

The Hurley soil is low in fertility and in content of organic matter. The availability of plant nutrients is

adversely affected by the sodium in the subsoil. Tilth is very poor; tilling is difficult both when the soil is wet and when it is dry. Available water capacity is low. Permeability is very slow. The dense claypan subsoil restricts root penetration. The shrink-swell potential is very high. The Slickspots generally have no plant cover and are nearly impervious to water. Runoff is very slow on both the Hurley soil and the Slickspots.

Most areas support native grass and are used for grazing. This map unit has poor potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings and for building site development and most sanitary facilities.

This map unit is best suited to range. The natural plant cover on the Hurley soil mainly is blue grama, western wheatgrass, and buffalograss. Overuse results in a decrease in the extent of blue grama and western wheatgrass and an increase in the extent of buffalograss. If overuse continues, weeds and pricklypear occupy the site. The Slickspots support a sparse stand of annual weeds and cacti during wet periods.

This map unit generally is unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings because of the claypan subsoil, the high content of sodium, and the bare areas.

Because of the very high shrink-swell potential, this map unit is poorly suited to building site development. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The unit generally is unsuitable as a site for septic tank absorption fields because of the restricted permeability. It is suitable, however, as a site for other waste disposal systems, such as sewage lagoons.

The Hurley soil is in capability subclass VIs, Thin Claypan range site; Slickspots are in capability subclass VIIIs, not assigned a range site.

In—Inavale fine sand. This deep, somewhat excessively drained, nearly level soil is along the part of the Missouri River below Oahe Dam. It is protected from floodwater by the dam. Areas are long and narrow. Hummocks 2 to 4 feet high are in some areas.

Typically, the surface layer is light brownish gray fine sand about 7 inches thick. The underlying material to a depth of 60 inches is pale brown fine sand.

Included with this soil in mapping are small, smooth areas of Munjor soils. These soils make up less than 10 percent of any one mapped area. They contain more silt and clay than the Inavale soil.

This Inavale soil is low in fertility and in content of organic matter. Available water capacity is low. Permeability is rapid. The water table is at a depth of 4 to 6 feet during periods when the discharge from the dam is high. Runoff is slow.

Most areas support native cottonwoods, shrubs, and grass. Evergreens are the best suited trees. Because of the seasonal high water table, however, deciduous trees can grow well after they are established. This soil has fair potential for range and windbreaks and environmental plantings. Because of the low available water capacity and the hazard of soil blowing, it has poor potential for cultivated crops and for tame pasture and hay. It has good potential for most kinds of building site development and poor potential for most sanitary facilities.

In the areas used as range, the main concern of management is soil blowing. The loose sand is highly susceptible to soil blowing if the surface is disturbed or bare. The native plant cover mainly is sand bluestem, prairie sandreed, little bluestem, and needleandthread. If the range is overused, the bluestems are replaced by prairie sandreed. After continued overuse, bare areas are common and soil blowing is a serious problem.

This soil is a better site for dwellings and small buildings without basements than for those with basements because of the high water table. The effluent from sanitary facilities can pollute shallow ground water.

The capability subclass is VIe; Sands range site.

KeA—Kirley loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on high terraces. Areas are irregular in shape and range from 5 to more than 100 acres in size. Slopes are smooth.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsurface layer is about 3 inches of dark grayish brown clay loam. The subsoil is grayish brown, firm and very firm clay about 23 inches thick. In the lower part it is calcareous and has accumulations of lime that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray clay loam and loam. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of Promise soils. These soils make up less than 10 percent of any one mapped area. They contain more clay than the Kirley soil.

This Kirley soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderately slow. Runoff is slow. The shrink-swell potential is high.

Most areas support native grass and are used for grazing and hay. This soil has good potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for most kinds of building site development and sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass and green needlegrass. Overuse causes an increase in the extent of western wheatgrass and blue grama and a decrease in the extent of green needlegrass. If overuse continues, western wheatgrass is replaced by blue grama and buffalograss.

This soil is well suited to all of the cultivated crops commonly grown in the county. Winter wheat and grain sorghum are the main crops. The main concern of

management is the periodic shortage of moisture characteristic of the climate. Tilth and the level of fertility are other concerns. Stubble mulching, crop residue management, and minimum tillage conserve moisture. Including grasses and legumes in the cropping system improves fertility and tilth.

Tame pasture plants can be successfully seeded on this soil. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the moisture supply is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

The shrink-swell potential is a limitation if this soil is used as a site for buildings. Reinforcing foundations and footings and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. The slow absorption of liquid waste is a limitation in septic tank absorption fields. Enlarging the absorption area helps to overcome this limitation.

The capability subclass is IIc; Clayey range site.

KeB—Kirley loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on high terraces. Areas are irregular in shape and range from 5 to 100 acres in size. Slopes are smooth and slightly convex.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsurface layer is about 3 inches of dark grayish brown clay loam. The subsoil is grayish brown, firm and very firm clay about 23 inches thick. In the lower part it is calcareous and has accumulations of lime that extend into the underlying material. The underlying material to a depth of about 60 inches is light brownish gray clay loam and loam. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of Promise soils. These soils make up less than 10 percent of any one mapped area. They contain more clay than the Kirley soil.

This Kirley soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderately slow. Runoff is medium. The shrink-swell potential is high.

Most areas support native grass and are used for grazing and hay. This soil has good potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for most kinds of building site development and sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass and green needlegrass. Overuse causes an increase in the extent of western wheatgrass and blue grama and a decrease in the extent of green needlegrass. If overuse continues, the western wheatgrass is replaced by blue grama and buffalograss.

This soil is well suited to all of the cultivated crops commonly grown in the county. Winter wheat and grain sorghum are the main crops. Erosion is the main concern of management. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion, conserve moisture, and improve fertility and tilth.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides. Planting the trees on the contour helps to control erosion.

The slow absorption of liquid waste is a limitation if this soil is used as a septic tank absorption field. Enlarging the absorption area helps to overcome this limitation. The shrink-swell potential is a limitation on building sites. Reinforcing foundations and footings and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling.

The capability subclass is IIe; Clayey range site.

Ko—Kolls clay. This deep, poorly drained, level soil is in depressions in the uplands. It is frequently flooded. Areas are oval and range from about 3 to 40 acres in size.

Typically, the surface layer is dark gray clay about 4 inches thick. The subsoil is firm and very firm clay about 16 inches thick. It is gray in the upper part and dark gray in the lower part. The underlying material to a depth of 60 inches is gray clay that has accumulations of lime.

Included with this soil in mapping are small areas of Hoven soils on the rims of the depressions. These soils make up less than 10 percent of any one mapped area. They contain sodium in the subsoil.

This Kolls soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability usually is very slow. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. The water table is perched 0.5 foot above the surface to 1.5 feet below in the spring. The shrink-swell potential is high.

Most areas support native grass and are used for grazing or hay. This soil has fair potential for range. It has poor potential for cultivated crops and for tame pasture and hay, windbreaks and environmental plantings, and building site development and most sanitary facilities.

This soil is suited to range. The natural plant cover mainly is western wheatgrass and lesser amounts of sedges. If the range is overused, the western wheatgrass is replaced by saltgrass and buffalograss

and the extent of sedges increases. The extent of sedges and rushes increases during wet periods, and that of buffalograss increases during dry periods. If the site is trampled by livestock when the soil is wet, annuals and weeds invade. The soil is an excellent site for stock water dugouts.

This soil generally is unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings because of the seasonal wetness. Drainage generally is not feasible because suitable outlets are not available. A few areas are cropped with adjacent soils, but the crops drown in wet years. Western wheatgrass is the best species for planting if cultivated areas are seeded to grass. Garrison creeping foxtail and reed canarygrass also are suited.

This soil generally is unsuitable as a site for buildings and most sanitary facilities because of the flooding.

The capability subclass is Vw; Closed Depression range site.

LaB—Lakoma clay, 3 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. Areas are irregularly shaped and range from 4 to more than 200 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown, calcareous clay about 5 inches thick. The subsoil is grayish brown and light brownish gray, calcareous, firm clay about 16 inches thick. The underlying material is light brownish gray, calcareous shaly clay about 8 inches thick. Light gray, soft shale is at a depth of about 29 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is darker.

Included with this soil in mapping are small areas of the shallow Okaton soils on ridgetops and along drainageways. These soils make up less than 5 percent of any one mapped area.

This Lakoma soil is medium in fertility and moderate in content of organic matter. Available water capacity is low or very low. Permeability usually is slow. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. Runoff is medium. The shrink-swell potential is high.

Most areas are cultivated. A few areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops and for tame pasture and hay and range. It has fair potential for windbreaks and environmental plantings and poor potential for building site development and sanitary facilities.

This soil is suited to small grain and sorghum. Erosion and soil blowing are the main concerns in managing cultivated areas. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing. Timely tillage improves tilth. Chiseling or subsoiling improves water intake.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, little bluestem, and sideoats grama. Overgrazing results in an increase in the extent of western wheatgrass and blue grama and a decrease in the extent of bluestems, needlegrasses, and sideoats grama.

This soil is suited to windbreaks and environmental plantings, but optimum growth is unlikely. Fallowing a year before planting conserves moisture. Planting the trees on the contour also conserves moisture and helps to control erosion.

The shrink-swell potential is a limitation if this soil is used as a site for buildings. Reinforcing foundations and footings and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling and by the unstable nature of the underlying shale. The soil generally is unsuitable as a septic tank absorption field because it is slowly permeable and moderately deep over bedrock. It is a poor site for sewage lagoons because of the moderate depth over bedrock.

The capability subclass is IIIe; Clayey range site.

LaC—Lakoma clay, 6 to 9 percent slopes. This moderately deep, well drained, moderately sloping soil is on uplands. Areas are irregularly shaped and range from 4 to more than 200 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown, calcareous clay about 5 inches thick. The subsoil is grayish brown and light brownish gray, calcareous, firm clay about 16 inches thick. The underlying material is light brownish gray, calcareous shaly clay about 8 inches thick. Light gray, soft shale is at a depth of about 29 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is darker.

Included with this soil in mapping are small areas of the shallow Okaton soils on ridgetops and on short slopes along drainageways. These soils make up less than 10 percent of any one mapped area.

This Lakoma soil is medium in fertility and moderate in content of organic matter. Available water capacity is low or very low. Permeability usually is slow. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. Runoff is medium. The shrink-swell potential is high.

Most areas support native grass and are used for grazing or hay. A few areas are cultivated. This soil has good potential for range and tame pasture and hay. It has fair potential for cultivated crops and for windbreaks and environmental plantings and poor potential for building site development and sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass,

little bluestem, and sideoats grama. Overgrazing results in an increase in the extent of western wheatgrass and blue grama and a decrease in the extent of bluestems, needlegrasses, and sideoats grama.

This soil is suited to small grain and sorghum. Controlling erosion and soil blowing, conserving moisture, and improving fertility and tilth are the main concerns in managing cultivated areas. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing. Timely tillage improves tilth, and chiseling or subsoiling improves water intake. Including grasses and legumes in the cropping system improves fertility and tilth.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

This soil is suited to windbreaks and environmental plantings, but optimum growth is unlikely. Fallowing a year before planting conserves moisture. Planting on the contour also conserves moisture and helps to control erosion.

The shrink-swell potential is a limitation if this soil is used as a site for buildings. Reinforcing foundations and footings and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling and by the unstable nature of the underlying shale. The soil generally is unsuitable as a septic tank absorption field because it is slowly permeable and moderately deep over bedrock. It is a poor site for sewage lagoons because of the moderate depth over bedrock.

The capability subclass is IVe; Clayey range site.

LkD—Lakoma-Okaton clays, 6 to 15 percent slopes. These moderately deep and shallow, well drained, moderately sloping and strongly sloping soils are on upland ridges and along entrenched drainageways. The Lakoma soil is on the smooth side slopes and the broader ridgetops. The Okaton soil is on the narrow ridges and the steeper convex side slopes. Areas are irregularly shaped and range from 5 to several hundred acres in size. They are about 40 to 55 percent Lakoma soil and 30 to 40 percent Okaton soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Lakoma soil has a surface layer of dark grayish brown, calcareous clay about 5 inches thick. The subsoil is grayish brown and light brownish gray, firm, calcareous clay about 16 inches thick. The underlying material is light brownish gray, calcareous shaly clay about 8 inches thick. Light gray, soft shale is at a depth of about 29 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is darker.

Typically, the Okaton soil has a surface layer of grayish brown, calcareous clay about 3 inches thick. The next 7 inches is grayish brown, calcareous, friable clay. The underlying material is light brownish gray, calcareous shaly clay about 5 inches thick. Light brownish gray and light gray shale is at a depth of about 15 inches. In places the content of clay is higher.

Included with these soils in mapping are small areas of Chantier, Murdo, Schamber, and Swanboy soils. These included soils make up less than 15 percent of any one mapped area. The shallow Chantier soils are in concave areas on foot slopes. They contain more salts and are more dense than the Lakoma and Okaton soils. Murdo and Schamber soils are on ridges. They have gravel at or near the surface. Swanboy soils are in drainageways. They are more than 60 inches deep over shale, and they are more dense and contain more salts than the Lakoma and Okaton soils.

The Lakoma soil is medium in fertility and moderate in content of organic matter. The Okaton soil is low in fertility and in content of organic matter. Available water capacity is low or very low in both soils. Permeability is slow. Runoff is rapid. The shrink-swell potential is high.

Most areas support native grass and are used for grazing. These soils have good potential for range. They have poor potential for cultivated crops and for tame pasture and hay, windbreaks and environmental plantings, and building site development and sanitary facilities.

These soils are best suited to range. The natural plant cover mainly is little bluestem, western wheatgrass, sideoats grama, and green needlegrass. Overuse results in a decrease in the extent of little bluestem, green needlegrass, and sideoats grama and an increase in the extent of western wheatgrass and blue grama. After continued overuse, yucca and forbs are the dominant plants and the surface of the Okaton soil is bare in many areas. The topography is suitable for stock water dams, but the soils are unstable and siltation is rapid.

These soils generally are unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings. The hazard of erosion is severe on these moderately sloping and strongly sloping soils. If the slope is less than 9 percent, the Lakoma soil can be used for tame pasture and hay. The two soils generally occur as areas so intermingled, however, that managing them separately is not feasible.

The shrink-swell potential is a limitation if these soils are used as sites for buildings. Reinforcing foundations and footings and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling and by the unstable nature of the underlying shale. The soils generally are unsuitable as sites for sanitary facilities because they are slowly permeable and shallow or moderately deep over bedrock.

The capability subclass is VIe; Lakoma soil in Clayey range site, Okaton soil in Shallow Clay range site.

LoA—Lowry silt loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands and terraces. Areas are irregular in shape and range from 5 to several hundred acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is dark grayish brown and grayish brown, very friable silt loam about 13 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places clay is 20 to 40 inches from the surface. In some areas on the lower parts of the landscape, the dark colors extend to a greater depth and the subsoil contains more clay.

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

Most areas are cultivated. This soil has good potential for cultivated crops and for tame pasture and hay, range, windbreaks and environmental plantings, and most kinds of building site development and sanitary facilities.

This soil is well suited to all of the cultivated crops commonly grown in the county. Corn, sorghum, and winter wheat are the main crops. The main concerns of management are conserving moisture and controlling soil blowing. Tilth, the level of fertility, and the content of organic matter are other concerns. Minimum tillage helps to control erosion and soil blowing, conserves moisture, and improves fertility. Stripcropping and field windbreaks also help to control soil blowing. Including grasses and legumes in the cropping system increases the content of organic matter and improves fertility. The soil is well suited to irrigation because it is nearly level and has a deep root zone and a high available water capacity.

Tame pasture plants can be successfully seeded on this soil. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and needleandthread. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is well suited to building site development and septic tank absorption fields.

The capability subclass is IIe; Silty range site.

LoB—Lowry silt loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands and terraces. Areas are long and narrow and range from 5 to 150 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is dark grayish brown and grayish brown, very friable silt loam about 13 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places clay is 20 to 40 inches from the surface. In some areas the surface layer is lighter in color.

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

Most areas are cultivated. This soil has good potential for cultivated crops and for tame pasture and hay, range, windbreaks and environmental plantings, and most kinds of building site development and sanitary facilities.

This soil is well suited to all of the cultivated crops commonly grown in the county. Corn, sorghum, and winter wheat are the main crops. The main concerns of management are erosion and soil blowing. Conserving moisture, improving tilth and fertility, and increasing the content of organic matter are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility. Stripcropping and field windbreaks also help to control soil blowing. Including grasses and legumes in the cropping system increases the content of organic matter and improves fertility. The soil is well suited to irrigation because it has a deep root zone and a high available water capacity.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and needleandthread. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is well suited to building site development and septic tank absorption fields.

The capability subclass is IIe; Silty range site.

LoC—Lowry silt loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands and terraces. Areas are narrow and range from 5 to 30 acres in size. Slopes are short and convex.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is dark grayish brown and grayish brown, very friable silt loam about 13 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places clay is 20 to 40 inches from the surface. In some areas the surface layer is lighter in color.

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

Most areas are cultivated. This soil has good potential for cultivated crops and for tame pasture and hay, range, windbreaks and environmental plantings, and most kinds of building site development and sanitary facilities.

This soil is suited to all of the cultivated crops commonly grown in the county. Winter wheat and sorghum are the main crops. The main concerns of management are erosion and soil blowing. Conserving moisture, improving tilth and fertility, and increasing the content of organic matter are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility. Stripcropping and field windbreaks also help to control soil blowing. Including grasses and legumes in the cropping system increases the content of organic matter and improves fertility.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, big bluestem, needleandthread, and blue grama. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. Bunch grasses should not be planted alone because of the erosion hazard.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is well suited to building site development and septic tank absorption fields.

The capability subclass is IIIe; Silty range site.

McA—McClure silt loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on the flatter ridgetops on loess-covered uplands. Areas are irregular in shape and range from 5 to more than 100 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 25 inches thick. It is brown and pale brown, firm silty clay loam in the upper part and grayish brown, very firm clay in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown and light brownish gray clay and silty clay. In places depth to the clayey material is more than 40 inches. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of Carter, Hoven, Hurley, and Millboro soils. These soils make up less than 15 percent of any one mapped area. The subsoil of the Carter, Hurley, and Millboro soils contains more clay than that of the McClure soil. Carter and Hurley soils are in concave areas, and the landscape position of Millboro soils is similar to that of the McClure soil. Hoven soils are poorly drained and are in depressions.

This McClure soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability is moderately slow in the subsoil and slow in the underlying material. Runoff is slow. The shrink-swell potential is high in the subsoil.

Most areas support native grass and are used for grazing. This soil has good potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for most kinds of building site development and sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, needleandthread, and blue grama. If the range is overused, the green needlegrass is replaced by the western wheatgrass and blue grama.

This soil is well suited to all of the cultivated crops commonly grown in the county. Sorghum and winter wheat are the main crops. The main concern of management is the periodic shortage of moisture characteristic of the climate. Tilth, the level of fertility, and soil blowing are other concerns. Stubble mulching, crop residue management, and minimum tillage conserve moisture and help to control soil blowing. Stripcropping and field windbreaks also help to control soil blowing. Including grasses and legumes in the cropping system improves fertility and tilth.

Tame pasture plants can be successfully seeded on this soil. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

The shrink-swell potential is a limitation if this soil is used as a site for buildings. Reinforcing foundations and footings and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. The soil is a poor septic tank absorption field because of the restricted permeability. It is suitable, however, as a site for other waste disposal systems, such as sewage lagoons.

The capability subclass is IIc; Silty range site.

McB—McClure silt loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on the flatter ridgetops on loess-covered uplands. Areas are irregular in shape and range from 5 to more than 100 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 25 inches thick. It is brown and pale brown, firm silty clay loam in the upper part and grayish brown, very firm clay in the lower part. The lower part is calcareous and has spots of lime that extend into the underlying material. The underlying material to a depth of 60 inches is grayish brown and light brownish gray clay and silty clay. In places depth to the clayey material is more than 40 inches. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of Carter, Hoven, Hurley, and Millboro soils. These soils make up less than 15 percent of any one mapped area. The subsoil of the Carter, Hurley, and Millboro soils contains more clay than that of the McClure soil. Carter and Hurley soils are in concave areas, and the landscape position of Millboro soils is similar to that of the McClure soil. Hoven soils are poorly drained and are in depressions.

This McClure soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability is moderately slow in the subsoil and slow in the underlying material. Runoff is medium. The shrink-swell potential is high in the subsoil.

Most areas support native grass and are used for grazing. This soil has good potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for most kinds of building site development and sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, needleandthread, and blue grama. If the range is overused, the green needlegrass is replaced by the western wheatgrass and blue grama.

This soil is well suited to all of the cultivated crops commonly grown in the county. Sorghum and winter wheat are the main crops. Controlling erosion is the main concern in managing cultivated areas. Controlling soil blowing also is a concern. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

The shrink-swell potential is a limitation if this soil is used as a site for buildings. Reinforcing foundations and footings and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. The soil is a poor septic tank absorption field because of the restricted permeability. It is suitable, however, as a site for other waste disposal systems, such as sewage lagoons.

The capability subclass is IIe; Silty range site.

MoA—Millboro silty clay loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are irregular in shape and range from 3 to more than 500 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silty clay loam about 8 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, firm clay about 28 inches thick. It is calcareous and has spots of lime in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay. It has spots and streaks of gypsum in the lower part. In places the subsoil contains more clay. In some areas the surface layer contains less clay. In other areas the dark colors extend to a depth of more than 20 inches.

Included with this soil in mapping are small areas of Hurley and Kolls soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Hurley soils are in concave areas. They have a claypan subsoil. The poorly drained Kolls soils are in depressions.

This Millboro soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability is slow. Runoff also is slow. The shrink-swell potential is very high.

Most areas are cultivated. A few areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops and for tame pasture and hay and range and fair potential for windbreaks and environmental plantings. It has poor potential for building site development and most sanitary facilities.

This soil is well suited to most of the cultivated crops commonly grown in the county. Sorghum and winter wheat are the main crops. The main concerns of management are improving tilth and controlling soil blowing. Improving fertility and conserving moisture are other concerns. Stubble mulching, crop residue management, and minimum tillage conserve moisture and help to control soil blowing. Stripcropping and field windbreaks also help to control soil blowing. Grasses and legumes in the cropping system, chiseling or subsoiling, and timely tillage improve water intake, fertility, and tilth.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and blue grama. If the range is overused, the green needlegrass is replaced by the western wheatgrass. After continued overuse, the western wheatgrass is replaced by blue grama, buffalograss, and forbs.

Seeding this soil to suitable tame pasture plants is effective in controlling soil blowing and improving tilth.

Alfalfa, crested wheatgrass, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

Optimum growth of the trees or shrubs grown as windbreaks and environmental plantings is unlikely on this soil. Fallowing a year prior to planting helps to control competing plants and conserves moisture. Applying herbicides and cultivating after the trees or shrubs are planted control weeds.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The soil generally is unsuitable as a septic tank absorption field because of the restricted permeability. It is suitable, however, as a site for other waste disposal systems, such as sewage lagoons.

The capability subclass is IIIs; Clayey range site.

MoB—Millboro silty clay loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 3 to more than 400 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown silty clay loam about 8 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, firm clay about 28 inches thick. It is calcareous and has spots of lime in the lower part. The underlying material to a depth of 60 inches is grayish brown, calcareous clay. It has spots and streaks of gypsum in the lower part. In places the subsoil contains more clay. In some areas the surface layer contains less clay. In other areas the dark colors extend to a depth of more than 20 inches.

Included with this soil in mapping are small areas of Hurley and Kolls soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Hurley soils are in concave areas. They have a claypan subsoil. The poorly drained Kolls soils are in depressions.

This Millboro soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability is slow. Runoff is medium. The shrink-swell potential is very high.

Most areas are cultivated. A few areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops and for tame pasture and hay and range and fair potential for windbreaks and environmental plantings. It has poor potential for building site development and most sanitary facilities.

This soil is well suited to most of the cultivated crops commonly grown in the county. Sorghum and winter wheat are the main crops. Erosion and soil blowing are the main concerns of management. Improving tilth and conserving moisture are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing. Grasses and legumes in the cropping system, timely tillage, and chiseling or subsoiling improve water intake, fertility, and tilth.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and blue grama. If the range is overused, the green needlegrass is replaced by the western wheatgrass. If overuse continues, the western wheatgrass is replaced by blue grama, buffalograss, and forbs.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing and improving tilth. Alfalfa, crested wheatgrass, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

Optimum growth of the trees and shrubs grown as windbreaks and environmental plantings is unlikely on this soil. Fallowing a year prior to planting helps to control competing plants and conserves moisture. Applying herbicides and cultivating after the trees or shrubs are planted control weeds. Planting the trees on the contour helps to control erosion.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. The soil generally is unsuitable as a septic tank absorption field because of the restricted permeability. It is suitable, however, as a site for other waste disposal systems, such as sewage lagoons.

The capability subclass is IIIe; Clayey range site.

Mu—Munjor-Inavale complex. These deep, moderately well drained to somewhat excessively drained, nearly level soils are on low terraces and flood plains along streams. They are protected from floodwater by the Oahe Dam. The Munjor soil is in smooth or slightly concave areas. The Inavale soil is in convex areas on ridges. Areas are long and narrow and range from 10 to 150 acres in size. They are 45 to 60 percent Munjor soil and 30 to 45 percent Inavale soil. The two soils occur as areas so intermingled or so small that mapping them separately is not practical.

Typically, the Munjor soil has a surface layer of grayish brown fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is light brownish gray, stratified loam, fine sandy loam, and loamy fine sand.

Typically, the Inavale soil has a surface layer of light brownish gray fine sand about 7 inches thick. The underlying material to a depth of 60 inches is pale brown fine sand.

Included with these soils in mapping are small areas of Nimbro soils. These included soils make up about 10 percent of any one mapped area. They contain more silt and clay than the Munjor and Inavale soils. They are on

the higher parts of the landscape away from the streams.

The Munjor and Inavale soils are low in fertility and in content of organic matter. Available water capacity is high in the Munjor soil and low in the Inavale soil. Permeability is moderately rapid in the Munjor soil and rapid in the Inavale soil. In both soils the water table is at a depth of 4 to 6 feet when the discharge from the dam is high. Runoff is slow.

Most areas support native cottonwoods, shrubs, and grass. The Munjor soil has good potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Inavale soil has fair potential for range and windbreaks and environmental plantings. It has poor potential for cultivated crops and for tame pasture and hay. Both soils have good potential for most kinds of building site development and poor potential for most sanitary facilities.

These soils are well suited to range. The major concern in managing range is soil blowing. The sandy material is highly susceptible to soil blowing if the surface is disturbed or bare. The native plant cover mainly is big bluestem, sand bluestem, prairie sandreed, switchgrass, and little bluestem. If the range is overused, the bluestems and switchgrass are replaced by prairie sandreed, sand dropseed, and weeds. After continued overuse, bare areas are common and soil blowing is a serious problem.

The Munjor soil is suited to cultivated crops, but the Inavale soil generally is unsuited. The main concern of management is controlling soil blowing. Conserving moisture, improving fertility, and increasing the content of organic matter are other concerns. Stubble mulching, crop residue management, and stripcropping help to control soil blowing. Planting green manure crops and applying animal manure and fertilizer improve fertility and increase the content of organic matter.

Seeding these soils to suitable tame pasture plants is effective in controlling soil blowing. Alfalfa, crested wheatgrass, and intermediate wheatgrass are suitable.

These soils are well suited to windbreaks and environmental plantings. They are better suited to evergreens than to deciduous trees. Applying herbicides and cultivating control weeds after the trees are planted. Planting evergreens directly in sod helps to control soil blowing in the areas of Inavale soil.

These soils are better as sites for dwellings and small buildings without basements than as sites for dwellings and small buildings with basements because of the high water table. The effluent from sanitary facilities can pollute shallow ground water.

The Munjor soil is in capability subclass IIIe, Overflow range site; the Inavale soil is in capability subclass VIe, Sands range site.

Nb—Nimbro silty clay loam. This deep, well drained and moderately well drained, nearly level soil is on flood plains and low terraces. It is subject to rare flooding. Areas are long and narrow and range from 3 to 130 acres in size.

Typically, the surface layer is gray silty clay loam about 8 inches thick. The upper part of the underlying material, to a depth of about 16 inches, is grayish brown silty clay loam. The lower part to a depth of 60 inches is light brownish gray clay loam stratified with fine sand (fig. 3). In places the surface layer is lighter in color.

Included with this soil in mapping are small areas of Promise, Swanboy, and Wendte soils. These soils make up less than 10 percent of any one mapped area. They contain more clay than the Nimbro soil. Promise and Swanboy soils are on foot slopes and fans above the Nimbro soil. Wendte soils are in positions on the landscape similar to those of the Nimbro soil.

This Nimbro soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderate. Runoff is slow. The shrink-swell potential is moderate.

Most areas support native trees, shrubs, and grass. Native trees are along streams and drainageways. This soil has good potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for most kinds of building site development and fair potential for most sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is big bluestem, western wheatgrass, and green needlegrass. Overuse results in a decrease in the extent of big bluestem and green needlegrass and an increase in the extent of western wheatgrass and Kentucky bluegrass.

This soil is well suited to all of the cultivated crops commonly grown in the county. Alfalfa, corn, and sorghum are the main crops. The main concern of management is the periodic shortage of moisture characteristic of the climate. Tilth and the level of fertility are other concerns. Stubble mulching, crop residue management, and minimum tillage conserve moisture. Including grasses and legumes in the cropping system improves fertility and tilth. The soil is well suited to irrigation because it has a deep root zone and a high available water capacity.

Tame pasture plants can be successfully seeded on this soil. Alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by applying herbicides and by cultivating.

This soil is poorly suited to building site development and septic tank absorption fields unless it is protected from flooding.

The capability subclass is IIc; Overflow range site.

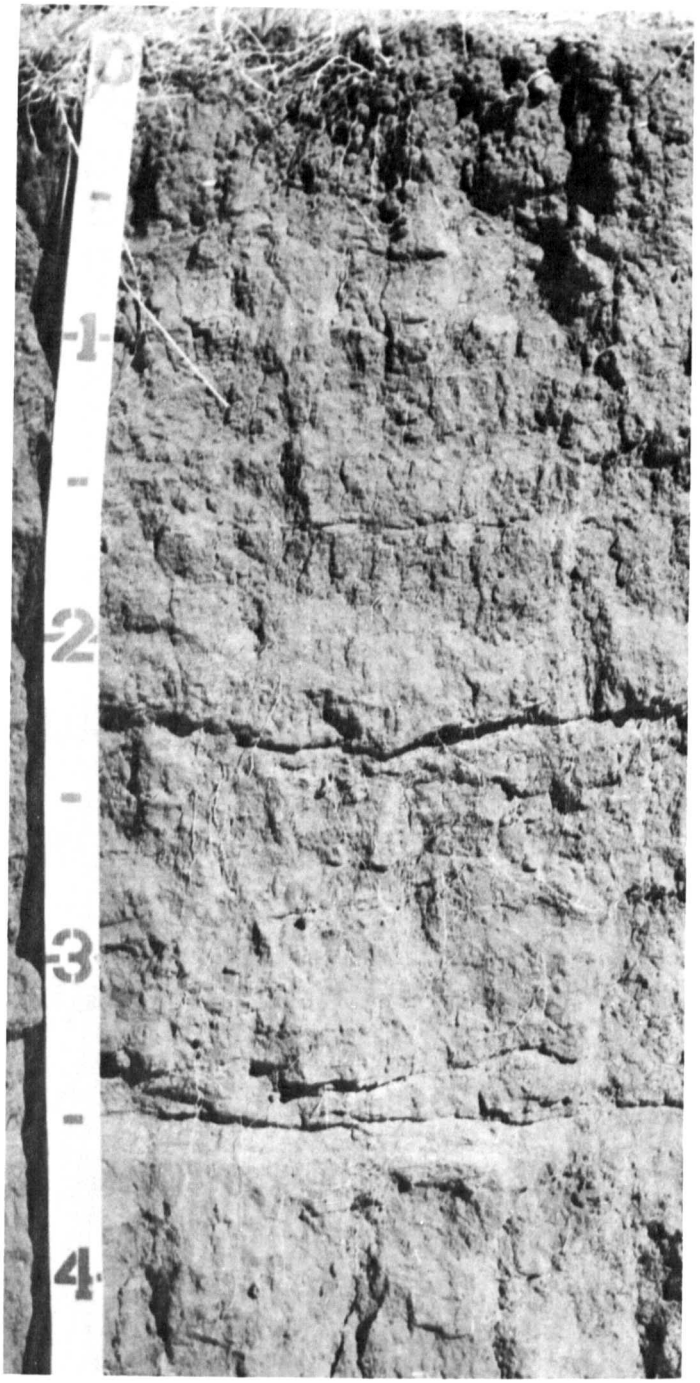


Figure 3.—Profile of Nimbro silty clay loam. The underlying material is stratified. Depth is marked in feet.

OkE—Okaton-Lakoma clays, 15 to 40 percent slopes. These shallow and moderately deep, well drained, moderately steep and steep soils are on upland ridges and along entrenched drainageways. The Okaton soil is on narrow ridges and side slopes. The moderately steep Lakoma soil is on side slopes and on broad ridgetops. Areas are irregularly shaped and range from 10 to more than 1,000 acres in size. They are about 55 to 65 percent Okaton soil and 25 to 35 percent Lakoma soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Okaton soil has a surface layer of grayish brown, calcareous clay about 3 inches thick. The next 7 inches is grayish brown, calcareous, friable clay. The underlying material is light brownish gray, calcareous shaly clay about 5 inches thick. Light brownish gray and light gray, soft shale is at a depth of about 15 inches. In places the content of clay is higher.

Typically, the Lakoma soil has a surface layer of dark grayish brown, calcareous clay about 5 inches thick. The subsoil is grayish brown and light brownish gray, firm, calcareous clay about 16 inches thick. The underlying material is light brownish gray shaly clay about 8 inches thick. Light gray, soft shale is at a depth of about 29 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is darker.

Included with these soils in mapping are small areas of Murdo, Schamber, and Swanboy soils. These included soils make up about 10 percent of the unit. Murdo and Schamber soils are on ridges. They have gravel at or near the surface. Swanboy soils are in drainageways. They are more than 60 inches deep over shale, and they are more dense and have a higher content of salts than the Okaton and Lakoma soils.

The Okaton soil is low in fertility and in content of organic matter. The Lakoma soil is medium in fertility and moderate in content of organic matter. Available water capacity is low or very low in both soils. Permeability is slow. Runoff is rapid. The shrink-swell potential is high.

Most areas support native grass and are used for grazing (fig. 4). The Okaton soil has fair potential and the Lakoma soil good potential for range. Because of the slope and a severe hazard of erosion, both soils have poor potential for cultivated crops and for windbreaks and environmental plantings and tame pasture and hay. The potential for building site development and sanitary facilities also is poor.

These soils are best suited to range. The natural plant cover mainly is little bluestem, sideoats grama, green needlegrass, and western wheatgrass. Overuse results in a decrease in the extent of little bluestem, green needlegrass, and sideoats grama and an increase in the extent of western wheatgrass and blue grama. After continued overuse, yucca and forbs are dominant and the surface of the Okaton soil commonly is bare. The topography is suitable for stock water dams, but the soils are unstable and siltation is rapid.

These soils generally are unsuitable as building sites because of the moderately steep and steep slope and the high shrink-swell potential. They also are unsuitable as septic tank absorption fields because of the slope, the restricted permeability, and the limited depth to bedrock.

The capability subclass is VIIe; Okaton soil in Shallow Clay range site, Lakoma soil in Clayey range site.

OpA—Opal clay, 0 to 3 percent slopes. This moderately deep, well drained, nearly level soil is on uplands. Areas are irregularly shaped and range from 3 to more than 100 acres in size. Slopes are smooth or slightly convex.

Typically, the surface layer is dark gray clay about 4 inches thick. The subsoil is dark grayish brown, calcareous, very firm clay about 14 inches thick. The underlying material is about 15 inches thick. It is grayish brown, calcareous clay over light brownish gray, calcareous shaly clay. Soft shale is at a depth of about 33 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is lighter in color.

Included with this soil in mapping are small areas of the moderately well drained Witten soils in swales. These soils make up less than 5 percent of any one mapped area.

This Opal soil is medium in fertility and moderate in content of organic matter. Tilth is poor. Available water capacity is low. Permeability usually is very slow. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. Runoff is slow. The shrink-swell potential is very high.

Most areas are cultivated. A few areas support native grass and are used for grazing and hay. This soil has

Figure 4.—Native grass on Okaton-Lakoma clays, 15 to 40 percent slopes.

good potential for cultivated crops and for tame pasture and hay and range. It has fair potential for windbreaks and environmental plantings and poor potential for building site development and most sanitary facilities.

This soil is suited to small grain and sorghum. Conserving moisture, controlling soil blowing, and improving water intake, fertility, and tilth are the main concerns in managing cultivated areas. Stubble mulching, crop residue management, minimum tillage, and stripcropping conserve moisture and help to control soil blowing. Grasses and legumes in the cropping system, chiseling or subsoiling, and timely tillage improve water intake, tilth, and fertility.

Seeding this soil to suitable tame pasture plants is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and blue grama. If the range is overused, the green needlegrass is replaced by western wheatgrass, blue grama, and buffalograss. If overuse continues, the western wheatgrass is replaced by blue grama and buffalograss.

This soil is suited to windbreaks and environmental plantings, but optimum growth is unlikely. Fallowing a year before planting conserves moisture and controls weeds.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The soil generally is not suitable as a septic tank absorption field because it is very slowly permeable and moderately deep over bedrock. It is a poor site for sewage lagoons because of the moderate depth to bedrock.

The capability subclass is IIIs; Clayey range site.

OpB—Opal clay, 3 to 6 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. Areas are irregularly shaped and range from 3 to more than 500 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray clay about 4 inches thick. The subsoil is dark grayish brown and grayish brown, calcareous, very firm clay about 14 inches thick. The underlying material is about 15 inches thick. It is grayish brown, calcareous clay over light brownish gray, calcareous shaly clay. Soft shale is at a depth of about 33 inches (fig. 5). In places the depth to shale is more than 40 inches. In some areas the surface layer is lighter in color.

Included with this soil in mapping are small areas of McClure, Sansarc, and Witten soils. These soils make less than 5 percent of any one mapped area. McClure soils contain less clay than the Opal soil. They are on the broader ridgetops. The shallow Sansarc soils are along drainageways. The moderately well drained Witten soils are in swales.

This Opal soil is medium in fertility and moderate in content of organic matter. Tilth is poor. Available water capacity is low. Permeability usually is very slow. It is more rapid, however, during dry periods when the water

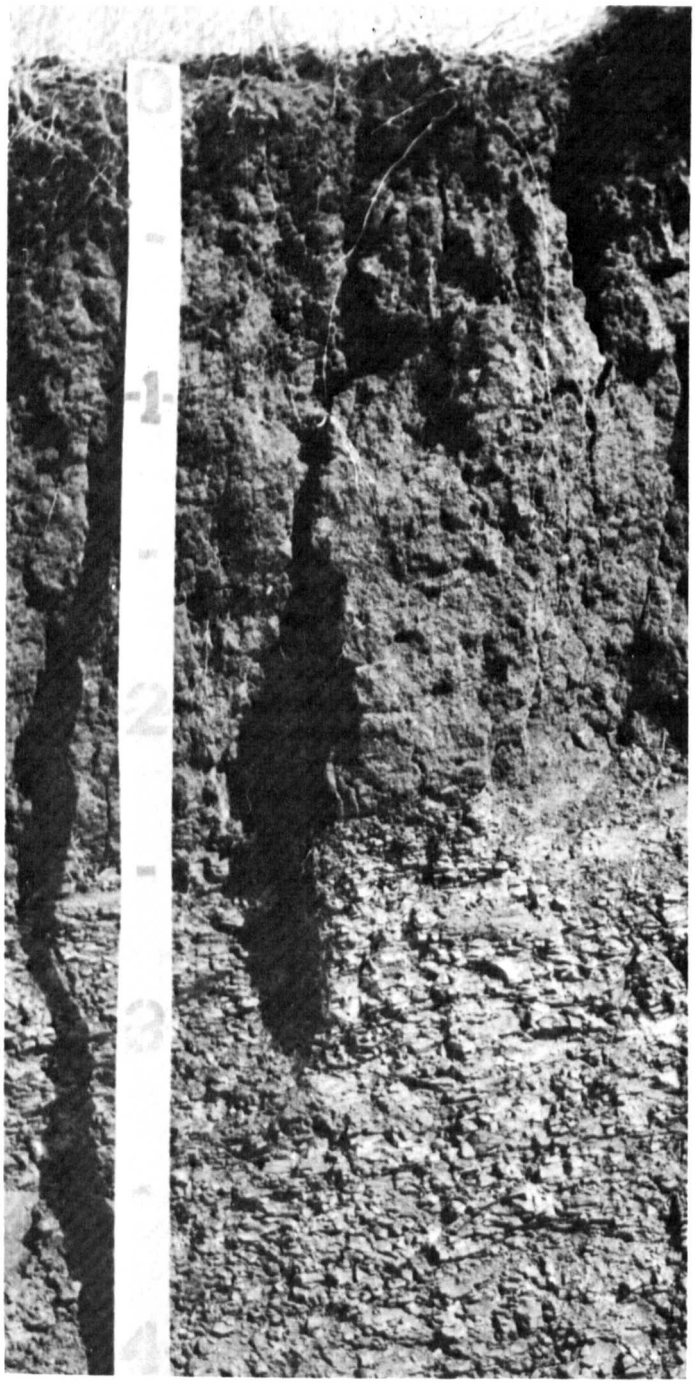


Figure 5.—Profile of Opal clay, 3 to 6 percent slopes. This soil is moderately deep over soft shale. Depth is marked in feet.

intake rate is rapid because of cracks in the soil. Runoff is medium. The shrink-swell potential is very high.

Most areas are cultivated. A few areas support native grass and are used for grazing and hay. This soil has good potential for cultivated crops and for tame pasture and hay and range. It has fair potential for windbreaks and environmental plantings and poor potential for building site development and most sanitary facilities.

This soil is suited to small grain and sorghum. Controlling erosion and soil blowing is the main concern in managing cultivated areas. Increasing the rate of water intake and improving fertility and tilth are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing. Grasses and legumes in the cropping system, chiseling or subsoiling, and timely tillage improve water intake, fertility, and tilth.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and blue grama. If the range is overused, the green needlegrass is replaced by western wheatgrass, blue grama, and buffalograss. If overuse continues, the western wheatgrass is replaced by blue grama and buffalograss.

This soil is suited to windbreaks and environmental plantings, but optimum growth is unlikely. Fallowing a year before planting conserves moisture and controls weeds. Planting the trees on the contour helps to control erosion and conserves moisture.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling and by the unstable nature of the underlying shale. The soil generally is unsuitable as a septic tank absorption field because it is very slowly permeable and moderately deep over bedrock. It is a poor site for sewage lagoons because of the moderate depth to bedrock.

The capability subclass is IIIe; Clayey range site.

OpC—Opal clay, 6 to 9 percent slopes. This moderately deep, well drained, moderately sloping soil is on uplands. Areas are irregularly shaped and range from 5 to more than 100 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray clay about 4 inches thick. The subsoil is dark grayish brown, calcareous, very firm clay about 14 inches thick. The underlying material is about 15 inches thick. It is grayish brown, calcareous clay over light brownish gray, calcareous shaly clay. Soft shale is at a depth of about 33 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is lighter in color.

Included with this soil in mapping are small areas of McClure and Sansarc soils. These soils make up less than 10 percent of any one mapped area. McClure soils contain less clay than the Opal soil. They are on the broader ridgetops. The shallow Sansarc soils are on narrow ridgetops and along drainageways.

This Opal soil is medium in fertility and moderate in content of organic matter. Tilth is poor. Available water capacity is low. Permeability usually is very slow. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. Runoff is medium. The shrink-swell potential is very high.

Most areas support native grass and are used for grazing or hay. A few areas are cultivated. This soil has good potential for range and tame pasture and hay and fair potential for cultivated crops and for windbreaks and environmental plantings. It has poor potential for building site development and most sanitary facilities.

This soil is best suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and blue grama. If the range is overused, the green needlegrass is replaced by western wheatgrass, blue grama, and buffalograss. If overuse continues, the western wheatgrass is replaced by blue grama and buffalograss. Many areas in the entrenched drainageways are potential pond sites, but the soil is unstable and siltation is rapid.

Controlling erosion and soil blowing, conserving moisture, and improving fertility and tilth are concerns in managing this soil for cultivated crops. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing. Timely tillage improves tilth, and chiseling or subsoiling improves water intake. Including grasses and legumes in the cropping system improves fertility and tilth.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Bunch grasses should not be planted alone because of the erosion hazard. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

This soil is suited to windbreaks and environmental plantings, but optimum growth is unlikely. Fallowing a year before planting conserves moisture. Planting the trees on the contour also conserves moisture and helps to control erosion.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling and by the unstable nature of the underlying shale. The soil generally is unsuitable as a septic tank absorption field

because it is very slowly permeable and moderately deep over bedrock. It is a poor site for sewage lagoons because of the moderate depth over bedrock.

The capability subclass is IVe; Clayey range site.

OtB—Opal-Chantier clays, 2 to 6 percent slopes. These moderately deep and shallow, well drained, gently sloping soils are on uplands. The Opal soil generally is higher on the landscape than the Chantier soil. Areas are irregularly shaped and range from 3 to more than 1,000 acres in size. They are about 55 to 70 percent Opal soil and 20 to 45 percent Chantier soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Opal soil has a surface layer of dark gray clay about 4 inches thick. The subsoil is dark grayish brown, calcareous, very firm clay about 14 inches thick. The underlying material is about 33 inches thick. It is grayish brown, calcareous clay over light brownish gray, calcareous shaly clay. Soft shale is at a depth of about 33 inches. In places the depth to shale is more than 40 inches.

Typically, the Chantier soil has a surface layer of grayish brown clay about 2 inches thick. The subsoil is grayish brown, extremely firm clay about 5 inches thick. The underlying material is about 11 inches thick. It is grayish brown and light brownish gray clay or shaly clay that has many streaks and spots of gypsum and other salts. Olive gray shale is at a depth of about 18 inches. In places the depth to shale is more than 20 inches.

Included with these soils in mapping are areas of Hurley and Sansarc soils. These included soils make up less than 10 percent of any one mapped area. Hurley soils have a claypan subsoil. Sansarc soils are on ridgetops and along drainageways.

The Opal and Chantier soils are medium or low in fertility and moderate or low in content of organic matter. Tilth is very poor. Available water capacity is low in the Opal soil and very low in the Chantier soil. Permeability usually is very slow in both soils. It is more rapid, however, when the water intake rate is rapid because of cracks in the soil. Runoff is medium. The shrink-swell potential is very high.

Most areas support native grass and are used for grazing. The Opal soil has good potential for cultivated crops and for range and tame pasture and hay. It has fair potential for windbreaks and environmental plantings. The Chantier soil has poor potential for cultivated crops and for range, tame pasture and hay, and windbreaks and environmental plantings. Both soils have poor potential for building site development and sanitary facilities.

These soils are best suited to range. The natural plant cover mainly is western wheatgrass and green needlegrass. The western wheatgrass is more dominant on the Chantier soil. If the range is overused, the green needlegrass on the Opal soil is replaced by western wheatgrass and blue grama and the stand of western wheatgrass on the Chantier soil thins out. Under these conditions, much of the surface of the Chantier soil is bare.

The Chantier soil is poorly suited to cultivated crops and to tame pasture and hay. Only the larger areas of the Opal soil can be successfully cropped and pastured. The other areas are too closely intermingled with areas of the Chantier soil. Small grain and sorghum are the best suited crops. The main concern of management is controlling erosion and soil blowing. Tilth and fertility are other concerns. Stubble mulching, crop residue management, minimum tillage, grasses and legumes in the cropping system, and chiseling or subsoiling help to control erosion and soil blowing, conserve moisture, and improve water intake, fertility, and tilth.

Seeding the Opal soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Intermediate wheatgrass and pubescent wheatgrass are suitable. Forage production is limited on the Chantier soil.

The Opal soil is suited to windbreaks and environmental plantings, but the Chantier soil is not suited. Windbreaks generally cannot be established because the Opal soil occurs as areas that are closely intermingled with areas of the Chantier soil. Trees or shrubs can be planted on the Opal soil, but optimum growth is unlikely. Fallowing a year prior to planting conserves moisture and controls weeds.

These soils are poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling and by the unstable nature of the underlying shale. The soils generally are unsuitable as septic tank absorption fields because they are very slowly permeable and are moderately deep or shallow over bedrock. They are poor sites for sewage lagoons because of the limited depth to bedrock.

The Opal soil is in capability subclass IIIe, Clayey range site; the Chantier soil is in capability subclass VIs, Dense Clay range site.

OtC—Opal-Chantier clays, 6 to 9 percent slopes. These moderately deep and shallow, well drained, moderately sloping soils are on uplands. The Opal soil generally is higher on the landscape than the Chantier soil. Areas are irregularly shaped and range from 10 to more than 500 acres in size. They are about 50 to 65 percent Opal soil and 25 to 50 percent Chantier soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Opal soil has a surface layer of dark gray clay about 4 inches thick. The subsoil is dark grayish brown, calcareous, very firm clay about 14 inches thick. The underlying material is about 15 inches thick. It is grayish brown, calcareous clay over light brownish gray, calcareous shaly clay. Soft shale is at a depth of about 33 inches. In places the depth to shale is more than 40 inches.

Typically, the Chantier soil has a surface layer of grayish brown clay about 2 inches thick. The subsoil is grayish brown, extremely firm clay about 5 inches thick. The underlying material is about 11 inches thick. It is grayish brown and light brownish gray clay or shaly clay that has many streaks and spots of gypsum and other salts. Olive gray shale is at a depth of about 18 inches. In places the depth to shale is more than 20 inches.

Included with these soils in mapping are small areas of Sansarc soils on ridgetops and along drainageways. These included soils make up less than 10 percent of any one mapped area.

The Opal and Chantier soils are medium or low in fertility and moderate or low in content of organic matter. Tilth is very poor. Available water capacity is low in the Opal soil and very low in the Chantier soil. Permeability usually is very slow in both soils. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. Runoff is medium. The shrink-swell potential is very high.

Most areas support native grass and are used for grazing. The Opal soil has good potential for range and tame pasture and hay. It has fair potential for cultivated crops and for windbreaks and environmental plantings. The Chantier soil has poor potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Both soils have poor potential for building site development and sanitary facilities.

These soils are best suited to range. The natural plant cover mainly is western wheatgrass and green needlegrass. The western wheatgrass is more dominant on the Chantier soil. If the range is overused, the green needlegrass on the Opal soil is replaced by western wheatgrass and blue grama and the stand of western wheatgrass on the Chantier soil thins out. Under these conditions, much of the surface of the Chantier soil is bare.

The Chantier soil is poorly suited to cultivated crops and to tame pasture and hay. Only the larger areas of the Opal soil can be successfully cropped and pastured. The other areas are too closely intermingled with areas of the Chantier soil. Small grain and sorghum are the best suited crops. The main concern of management is controlling erosion and soil blowing. Tilth and fertility are other concerns. Stubble mulching, crop residue management, minimum tillage, grasses and legumes in the cropping system, and chiseling or subsoiling help to control erosion and soil blowing, conserve moisture, and improve water intake, fertility, and tilth.

Seeding the Opal soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Bunch grasses should not be planted alone because of the erosion hazard. Intermediate wheatgrass and pubescent wheatgrass are suitable. Forage production is limited on the Chantier soil.

The Opal soil is suited to windbreaks and environmental plantings, but the Chantier soil is not suited. Windbreaks generally cannot be established because the Opal soil occurs as areas that are closely intermingled with areas of the Chantier soil. Trees or shrubs can be planted on the Opal soil, but optimum growth is unlikely. Fallowing a year prior to planting conserves moisture and controls weeds.

These soils are poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling and by the unstable nature of the underlying shale. The soils generally are unsuitable as septic tank absorption fields because they are very slowly permeable and are moderately deep or shallow over bedrock. They are poor sites for sewage lagoons because of the limited depth to bedrock and the slope.

The Opal soil is in capability subclass IVe, Clayey range site; the Chantier soil is in capability subclass VIs, Dense Clay range site.

OxB—Opal-Promise clays, 3 to 6 percent slopes. These moderately deep and deep, well drained, gently sloping soils are on uplands that generally are dissected by shallow drainageways. The Opal soil is near the drainageways, and the Promise soil is on the broader ridges. Slopes are short and convex. Areas are irregularly shaped and range from 15 to more than 100 acres in size. They are about 45 to 55 percent Opal soil and 35 to 45 percent Promise soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Opal soil has a surface layer of dark gray clay about 4 inches thick. The subsoil is grayish brown, calcareous, very firm clay about 14 inches thick. The underlying material is about 15 inches thick. It is grayish brown, calcareous clay over light brownish gray, calcareous shaly clay. Soft shale is at a depth of about 33 inches. In places the surface layer is lighter in color.

Typically, the Promise soil has a surface layer of dark gray clay about 8 inches thick. The subsoil is grayish brown and light brownish gray, calcareous, very firm clay about 17 inches thick. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, calcareous clay. It has spots and streaks of gypsum in the lower part. In places the subsoil contains less clay.

Included with these soils in mapping are small areas of the shallow Sansarc soils. These included soils make up about 10 percent of any one mapped area. They are in the steeper areas along drainageways.

The Opal and Promise soils are medium in fertility and moderate in content of organic matter. Tilth is poor. Available water capacity is low or moderate. Permeability usually is very slow in the Opal soil and slow or very slow in the Promise soil. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. Runoff is medium. The shrink-swell potential is very high.

Most areas are cultivated. A few areas support native grass and are used for grazing and hay. These soils

have good potential for cultivated crops and for range and tame pasture and hay. They have fair potential for windbreaks and environmental plantings and poor potential for building site development and most sanitary facilities.

These soils are suited to small grain and sorghum. Controlling erosion and soil blowing is the main concern in managing cultivated areas. Tilth and fertility are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing. Grasses and legumes in the cropping system, chiseling or subsoiling, and timely tillage improve water intake, fertility, and tilth.

Seeding these soils to suitable tame pasture plants is effective in controlling erosion and soil blowing. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

These soils are well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and blue grama. If the range is overused, the green needlegrass is replaced by western wheatgrass, blue grama, and buffalograss. If overuse continues, the western wheatgrass is replaced by blue grama and buffalograss.

These soils are suited to windbreaks and environmental plantings, but optimum growth is unlikely. Fallowing a year before planting conserves moisture and controls weeds. Planting the trees on the contour helps to control erosion.

These soils are poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling and by the unstable nature of the shale underlying the Opal soil. The soils generally are unsuitable as septic tank absorption fields because of the restricted permeability. The Promise soil is suitable as a site for sewage lagoons, but the Opal soil is a poorly suited site because it is moderately deep over bedrock.

The capability subclass is IIIe; Clayey range site.

Pg—Pits, gravel. This map unit consists of open excavations, 5 to 30 feet deep, from which sand and gravel has been removed. Areas generally are irregular in shape and range from 3 to 75 acres in size. Slopes are uneven and broken. They range from nearly level on the pit bottom to nearly vertical on the rims.

The material on the pit bottom typically is sand and gravel but is clay or shale in areas where all of the sand and gravel has been removed. Mounds of mixed loamy overburden are on the edges of some areas. The bottom and sides of the pits support little or no vegetation.

Most gravel pits can be used only as a source of sand and gravel for construction purposes. Some provide limited wildlife habitat. Abandoned gravel pits can be restored to range, tame pasture, or cropland if reclamation measures are applied. These measures include shaping the areas and using the mounds of overburden material as topdressing. Applying fertilizer as needed helps to establish the range or pasture.

The capability subclass is VIIIs; not assigned to a range site.

PrA—Promise clay, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands, colluvial fans, and terraces. The surface is uneven in areas where small ridges rise a few inches above slightly depressed troughs. Areas are irregularly shaped and range from 3 to more than 2,000 acres in size. Slopes are slightly concave or slightly convex.

Typically, the surface layer is dark gray clay about 8 inches thick. The subsoil is grayish brown and light brownish gray, calcareous, very firm clay about 17 inches thick. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, calcareous clay that has spots and streaks of gypsum. In places shale is within a depth of 40 inches. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of Hurley and Kolls soils. These soils make up less than 10 percent of any one mapped area. The moderately well drained Hurley soils are in concave areas and on foot slopes. They have a claypan subsoil. The poorly drained Kolls soils are in small, circular depressions.

This Promise soil is medium in fertility and moderate in content of organic matter. Tilth is poor. Available water capacity is low or moderate. Permeability usually is very slow or slow. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. Runoff is slow. The shrink-swell potential is very high.

Many areas are cultivated. A few areas support native grass and are used for grazing and hay. This soil has good potential for cultivated crops and for tame pasture and hay and range. It has fair potential for windbreaks and environmental plantings and poor potential for building site development and most sanitary facilities.

This soil is suited to small grain and sorghum. Controlling soil blowing and conserving moisture are the main concerns of management. The water intake rate, fertility, and tilth are other concerns. Stubble mulching, crop residue management, minimum tillage, and stripcropping conserve moisture and help to control soil blowing. Grasses and legumes in the cropping system, chiseling or subsoiling, and timely tillage improve water intake, tilth, and fertility.

Seeding this soil to suitable tame pasture plants is effective in controlling soil blowing. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass,

and blue grama. If the range is overused, the green needlegrass is replaced by western wheatgrass, blue grama, and buffalograss. If overuse continues, the western wheatgrass is replaced by blue grama and buffalograss.

This soil is suited to windbreaks and environmental plantings, but optimum growth is unlikely. Fallowing a year before planting conserves moisture and controls weeds.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The soil generally is unsuitable as a septic tank absorption field because of the restricted permeability. It is suitable, however, as a site for other waste disposal systems, such as sewage lagoons.

The capability subclass is IIIs; Clayey range site.

PrB—Promise clay, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregularly shaped and range from 3 to several thousand acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray clay about 8 inches thick. The subsoil is grayish brown and light brownish gray, calcareous, very firm clay about 17 inches thick. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, calcareous clay that has spots and streaks of gypsum. In places shale is within a depth of 40 inches. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of Hurley and Kolls soils. These soils make up less than 5 percent of any one mapped area. The moderately well drained Hurley soils are in concave areas. They have a claypan subsoil. The poorly drained Kolls soils are in small depressions.

This Promise soil is medium in fertility and moderate in content of organic matter. Tilth is poor. Available water capacity is low or moderate. Permeability usually is very slow or slow. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. Runoff is medium. The shrink-swell potential is very high.

Most areas are cultivated. A few areas support native grass and are used for grazing and hay. This soil has good potential for cultivated crops and for tame pasture and hay and range. It has fair potential for windbreaks and environmental plantings and poor potential for building site development and sanitary facilities.

This soil is suited to small grain and sorghum. Erosion and soil blowing are the main concerns in managing cultivated areas. Fertility and tilth are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing. Grasses and legumes in the cropping system, chiseling or subsoiling, and timely tillage improve water intake, fertility, and tilth.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and blue grama. If the range is overused, the green needlegrass is replaced by western wheatgrass, blue grama, and buffalograss. If overuse continues, the western wheatgrass is replaced by blue grama and buffalograss.

This soil is suited to windbreaks and environmental plantings, but optimum growth is unlikely. Fallowing a year before planting conserves moisture and controls weeds. Planting the trees on the contour conserves moisture and helps to control erosion.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The soil generally is unsuitable as a septic tank absorption field because of the restricted permeability. It is suitable, however, as a site for other waste disposal systems, such as sewage lagoons.

The capability subclass is IIIe; Clayey range site.

PrC—Promise clay, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands. Areas are irregularly shaped and range from 3 to more than 150 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark gray clay about 8 inches thick. The subsoil is grayish brown and light brownish gray, calcareous, very firm clay about 17 inches thick. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, calcareous clay that has spots and streaks of gypsum. In places shale is within a depth of 40 inches. In some areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the moderately well drained Hurley soils. These soils make up less than 5 percent of any one mapped area. They have a claypan subsoil. They are in concave areas.

This Promise soil is medium in fertility and moderate in content of organic matter. Tilth is poor. Available water capacity is low or moderate. Permeability usually is very slow or slow. It is more rapid, however, during dry periods when the water intake rate is rapid because of cracks in the soil. Runoff is medium. The shrink-swell potential is very high.

Most areas are cultivated. A few areas support native grass and are used for grazing and hay. This soil has good potential for range and tame pasture and hay. It has fair potential for cultivated crops and for windbreaks and environmental plantings and poor potential for building site development and most sanitary facilities.

This soil is suited to small grain and sorghum. Controlling erosion and soil blowing is the main concern in managing cultivated areas. Conserving moisture and improving fertility and tilth are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility and tilth. Stripcropping and field windbreaks also help to control soil blowing. Timely tillage improves tilth, and chiseling or subsoiling improves water intake. Including grasses and legumes in the cropping system improves fertility and tilth.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Bunch grasses should not be planted alone because of the erosion hazard. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and blue grama. If the range is overused, the green needlegrass is replaced by western wheatgrass, blue grama, and buffalograss. If overuse continues, the western wheatgrass is replaced by blue grama and buffalograss. Many areas in the more entrenched drainageways are potential pond sites, but the soil is unstable and siltation is rapid.

This soil is suited to windbreaks and environmental plantings, but optimum growth is unlikely. Fallowing a year before planting conserves moisture and controls weeds. Planting on the contour conserves moisture and helps to control erosion.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The soil generally is unsuitable as a septic tank absorption field because of the restricted permeability. It is suitable as a site for other waste disposal systems, such as sewage lagoons, but land leveling is needed.

The capability subclass is IVe; Clayey range site.

Ps—Promise-Hurley complex. These deep, well drained and moderately well drained, nearly level soils are on uplands. The Promise soil is on the higher parts of the landscape, and the Hurley soil is in slightly concave areas and near drainageways. Areas are irregularly shaped and range from 7 to more than 150 acres in size. They are about 65 to 75 percent Promise soil and 20 to 30 percent Hurley soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Promise soil has a surface layer of dark gray clay about 8 inches thick. The subsoil is grayish brown and light brownish gray, calcareous, very firm clay about 17 inches thick. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, calcareous clay that has spots and streaks of gypsum. In places shale is within a depth of 40 inches. In some areas the subsoil contains less clay.

Typically, the Hurley soil has a surface layer of gray silt loam about 3 inches thick. The subsoil is very firm clay about 16 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The lower part has accumulations of lime and salts that extend into the underlying material. The underlying material to a depth of 60 inches is light brownish gray, olive gray, and gray clay.

The Promise soil is medium in fertility and moderate in content of organic matter. The Hurley soil is low in fertility and in content of organic matter. Tilth is poor in both soils. Crops are adversely affected by the high content of sodium and the dense claypan subsoil in the Hurley soil. Available water capacity is low or moderate in the Promise soil and low in the Hurley soil. Permeability is very slow or slow in the Promise soil and very slow in the Hurley soil. Runoff is slow on both soils. The shrink-swell potential is very high.

Most areas support native grass and are used for grazing or hay. A few of the larger areas are cultivated. The Promise soil has good potential for range, cultivated crops, and tame pasture and hay and fair potential for windbreaks and environmental plantings. The Hurley soil has poor potential for cultivated crops and for tame pasture and hay, range, and windbreaks and environmental plantings. This poor potential determines the use of both soils in most areas. Both soils have poor potential for building site development and most sanitary facilities.

These soils are best suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, and blue grama on the Promise soil and blue grama, western wheatgrass, and buffalograss on the Hurley soil. If the range is overused, green needlegrass is replaced by western wheatgrass and blue grama. If overuse continues on the Hurley soil, much of the surface is bare and pricklypear is dominant during dry cycles and weeds during wet cycles.

The Hurley soil is poorly suited to cultivated crops and to tame pasture and hay. Only the larger areas of the Promise soil can be cropped. The other areas are too closely intermingled with the Hurley soil. Small grain and sorghum are the main crops. Improving tilth, controlling soil blowing, conserving moisture, and increasing the water intake rate are the main concerns of management. Stubble mulching, crop residue management, green manure crops, grasses and legumes in the cropping system, and chiseling or subsoiling improve tilth and fertility, increase the water intake rate, conserve moisture, and help to control soil blowing.

Seeding these soils to suitable tame pasture plants or to hay is effective in controlling soil blowing and improving tilth. Alfalfa, intermediate wheatgrass, and pubescent wheatgrass are suitable.

The Hurley soil generally is not suited to windbreaks and environmental plantings because it has a claypan

subsoil and a high content of salts. The Promise soil is suited to the trees and shrubs that are planted for special purposes.

These soils are poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The soils generally are unsuitable as septic tank absorption fields because of the restricted permeability. They are suitable, however, as sites for other waste disposal systems, such as sewage lagoons.

The Promise soil is in capability subclass IIIs, Clayey range site; the Hurley soil is in capability subclass VIs, Thin Claypan range site.

ReA—Ree loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on high terraces. Areas are irregular in shape and range from 5 to more than 2,000 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is friable and firm clay loam about 22 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is light brownish gray clay loam and loam. It has spots of lime in the upper part. In places sand and gravel is 20 to 40 inches from the surface. In some areas the dark colors extend to a depth at more than 20 inches.

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

Most areas are cultivated. A few areas support native grass and are used for grazing and hay. This soil has good potential for cultivated crops and for tame pasture and hay, range, windbreaks and environmental plantings, and most kinds of building site development. It has fair potential for most sanitary facilities.

This soil is well suited to all of the crops commonly grown in the county. Corn, sorghum, and winter wheat are the main crops. The main concern of management is the periodic shortage of moisture characteristic of the climate. Fertility and tilth are other concerns. Stubble mulching, crop residue management, and minimum tillage conserve moisture. Including grasses and legumes in the cropping system improves fertility and tilth. The soil is well suited to irrigation because it is nearly level and has a deep root zone and a high available water capacity.

Tame pasture plants can be successfully seeded on this soil. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, blue grama, and needleandthread. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is well suited to building site development and septic tank absorption fields.

The capability subclass is IIc; Silty range site.

ReB—Ree loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on high terraces. Areas are irregular in shape and range from 5 to 50 acres in size. Slopes are long and smooth.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is friable and firm clay loam about 22 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is light brownish gray clay loam and loam. It has spots of lime in the upper part. In places sand and gravel is 20 to 40 inches from the surface. In some areas the dark colors extend to a depth of more than 20 inches.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is high. Permeability is moderate. Runoff is medium. The shrink-swell potential is moderate in the subsoil.

Most areas are cultivated. A few areas support native grass and are used for grazing and hay. This soil has good potential for cultivated crops and for tame pasture and hay, range, windbreaks and environmental plantings, and most kinds of building site development. It has fair potential for most sanitary facilities.

This soil is well suited to all of the crops commonly grown in the county. Corn, sorghum, and winter wheat are the main crops. The main concern of management is controlling erosion. Conserving moisture, improving tilth and fertility, and increasing the content of organic matter are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion, conserve moisture, and improve fertility. Including grasses and legumes in the cropping system increases the content of organic matter and improves fertility and tilth. The soil is well suited to irrigation.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, blue grama, and needleandthread. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is well suited to windbreaks and environmental plantings. Most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides.

This soil is well suited to most kinds of building site development and to septic tank absorption fields.

The capability subclass is IIe; Silty range site.

ReC—Ree loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on high terraces. Areas are irregular in shape and range from 5 to about 50 acres in size. Slopes are slightly convex.

Typically, the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is friable and firm clay loam about 22 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is light brownish gray clay loam and loam. It has spots of lime in the upper part. In places sand and gravel is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Murdo, Opal, and Schamber soils. These soils make up less than 15 percent of any one mapped area. Murdo and Schamber soils have sand and gravel within a depth of 20 inches. They are steeper than the Ree soil. Opal soils contain more clay than the Ree soil and are 20 to 40 inches deep over shale.

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

Most areas support native grass and are used for grazing. This soil has good potential for range, windbreaks and environmental plantings, cultivated crops, tame pasture and hay, and most kinds of building site development. It has fair potential for most sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, blue grama, and needleandthread. Overuse results in an increase in the extent of western wheatgrass, needleandthread, and blue grama.

This soil is well suited to all of the crops commonly grown in the county. Winter wheat is the main crop. The main concern of management is controlling erosion. Conserving moisture, improving tilth and fertility, and increasing the content of organic matter are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion, conserve moisture, and improve fertility. Including grasses and legumes in the cropping system increases the content of organic matter and improves fertility and tilth.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion. Bunch grasses should not be planted alone because of the erosion hazard. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Except for those species that can grow well only if the supply of moisture is high, most of the climatically suited trees and shrubs can grow well if competing plants are controlled. Plant competition can be controlled by fallowing a year prior to planting, by cultivating, and by applying herbicides. Planting the trees on the contour conserves moisture and helps to control erosion.

This soil is well suited to most kinds of building site development and to septic tank absorption fields. Leveling is needed if the more sloping areas are used as building sites.

The capability subclass is IIIe; Silty range site.

Rs—Rock outcrop-Sansarc complex. This map unit dominantly consists of Rock outcrop and a shallow, well drained, gently sloping to steep soil. It is on uplands that generally are dissected by gullies. The Rock outcrop is on knobs and steep breaks. The Sansarc soil is on ridges and along entrenched drainageways. Areas are irregularly shaped and range from 5 to more than 100 acres in size. They are 60 to 85 percent Rock outcrop and 15 to 30 percent Sansarc soil. The Rock outcrop and the Sansarc soil occur as areas so intermingled that mapping them separately is not practical.

The Rock outcrop is gray, soft shale. Manganese and iron concretions are on the surface in some areas.

Typically, the Sansarc soil has a surface layer of light brownish gray clay about 4 inches thick. The underlying material is light brownish gray, friable and very friable shaly and very shaly clay about 10 inches thick. Soft shale is at a depth of about 14 inches.

Included with the Rock outcrop and the Sansarc soil in mapping are small areas of Chantier soils on the lower side slopes. These soils make up less than 10 percent of any one mapped area. They have salts within a depth of 20 inches.

The Sansarc soil is low in fertility and in content of organic matter. Available water capacity is very low. Permeability is slow. Runoff is very rapid. The shrink-swell potential is very high.

All areas are used as range. The Sansarc soil has fair potential for range. Because it is shallow and gently sloping to steep, it has poor potential for cultivated crops and for windbreaks and environmental plantings and tame pasture and hay. The potential for building site development and sanitary facilities also is poor.

This map unit is best suited to range. The Rock outcrop supports little or no vegetation. The natural plant cover on the Sansarc soil mainly is little bluestem, western wheatgrass, sideoats grama, and green needlegrass. If the range is overused, the green needlegrass and bluestems are replaced by western wheatgrass, blue grama, and yucca.

The Rock outcrop is unsuitable as a site for buildings and sanitary facilities. The Sansarc soil is a poor site for buildings because of the very high shrink-swell potential. It is unsuitable as a septic tank absorption field because it is slowly permeable and shallow over shale.

The Rock outcrop is in capability subclass VIIIs, not assigned to a range site; the Sansarc soil is in capability subclass VIIe, Shallow Clay range site.

SaE—Sansarc clay, 6 to 40 percent slopes. This shallow, well drained, moderately sloping to steep soil is on uplands that generally are dissected by large drainageways. Areas are irregular in shape and range from 5 to several thousand acres in size. Slopes are short and convex.

Typically, the surface layer is light brownish gray clay about 4 inches thick. The underlying material is light brownish gray, friable and very friable shaly and very shaly clay about 10 inches thick. Soft shale is at a depth of about 14 inches.

Included with this soil in mapping are small areas of Chantier, Opal, Schamber, and Swanboy soils. These soils make up less than 15 percent of any one mapped area. Also included is Rock outcrop, which makes up as much as 25 percent of some mapped areas. Chantier soils are on foot slopes and in concave areas at the upper end of drainageways. They have visible accumulations of salts in the underlying material. Opal soils are on the broader ridges and on toe slopes. They are 20 and 40 inches deep over shale. Schamber soils are on the edges of high terraces. They are very shallow to sand and gravel. Swanboy soils are in drainageways. They are more than 60 inches deep over shale.

This Sansarc soil is low in fertility and in content of organic matter. Available water capacity is very low. Permeability is slow. Runoff is rapid. The root zone is shallow. The shrink-swell potential is very high.

All areas support native grass and are used for grazing. This soil has fair potential for range. Because it is shallow and moderately sloping to steep, it has poor potential for cultivated crops and for tame pasture and hay and windbreaks and environmental plantings. The potential for building site development and sanitary facilities also is poor.

This soil is best suited to range. The natural plant cover mainly is little bluestem, western wheatgrass, sideoats grama, green needlegrass, and big bluestem. If the range is overused, the green needlegrass and bluestems are replaced by western wheatgrass and blue grama. The topography is suitable for stock water dams, but the soil is unstable and siltation is rapid.

This soil is poorly suited to building site development because of the very high shrink-swell potential, the slope, and the unstable nature of the underlying shale. It is unsuitable as a septic tank absorption field because it is slowly permeable, moderately sloping to steep, and shallow over shale.

The capability subclass is VIIe; Shallow Clay range site.

ScD—Sansarc-Opal clays, 6 to 15 percent slopes. These shallow and moderately deep, well drained, moderately sloping and strongly sloping soils are on ridges and along entrenched drainageways in the uplands. The Sansarc soil is on narrow ridges, on sharp slope breaks, and along entrenched drainageways where slopes are short and convex. The Opal soil is on the smoother side slopes and the broader ridgetops. Areas are irregularly shaped and range from 3 to more than 1,000 acres in size. They are about 40 to 55 percent Sansarc soil and 45 percent Opal soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Sansarc soil has a surface layer of light brownish gray clay about 4 inches thick. The underlying material is light brownish gray, friable and very friable shaly and very shaly clay about 10 inches thick. Soft shale is at a depth of about 14 inches.

Typically, the Opal soil has a surface layer of dark gray clay about 4 inches thick. The subsoil is dark grayish brown, calcareous, very firm clay about 14 inches thick. The underlying material is about 15 inches thick. It is grayish brown, calcareous clay over light brownish gray, calcareous shaly clay. Soft shale is at a depth of about 33 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is lighter in color.

Included with these soils in mapping are small areas of Chantier, Hurley, and Swanboy soils. These included soils make up less than 15 percent of any one mapped area. They are on smooth or concave foot slopes along drainageways. Their subsoil contains more salts than that of the Opal and Sansarc soils.

The Sansarc soil is low in fertility and in content of organic matter. The Opal soil is medium in fertility and moderate in content of organic matter. Tilth is poor in both soils. Available water capacity is very low in the Sansarc soil and low in the Opal soil. Permeability is slow in the Sansarc soil and very slow in the Opal soil. Runoff is medium or rapid on both soils. The shrink-swell potential is very high.

Most areas support native grass and are used for grazing (fig. 6). The Sansarc soil has fair potential and the Opal soil good potential for range. In most areas the soils have poor potential for tame pasture and hay. They have poor potential for cultivated crops and for windbreaks and environmental plantings and building site development and sanitary facilities.

These soils are best suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, little bluestem, and blue grama. If the range is overused, the green needlegrass and bluestems are replaced by western wheatgrass and blue grama. The topography is suitable for stock water dams, but the soils are unstable and siltation is rapid.

In the moderately sloping areas, the Opal soil is suited to tame pasture and hay. It generally occurs as areas so closely intermingled with areas of the poorly suited Sansarc soil, however, that tame grasses cannot be grown. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable on the Opal soil.

These soils are not suited to the windbreaks normally planted by machinery. Selected trees and shrubs can be planted for special purposes in the less sloping areas of Opal soil. Fallowing a year prior to planting conserves

Figure 6.—Native grass on Sansarc-Opal clays, 6 to 15 percent slopes.

moisture and controls weeds. Planting the trees on the contour helps to control erosion.

These soils are poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling and by the unstable nature of the underlying shale. The soils generally are unsuitable as sites for septic tank absorption fields and sewage lagoons because they are shallow or moderately deep over shale, are moderately sloping and strongly sloping, and are slowly or very slowly permeable.

The capability subclass is VIe; Sansarc soil in Shallow Clay range site, Opal soil in Clayey range site.

ScE—Sansarc-Opal clays, 15 to 40 percent slopes. These shallow and moderately deep, well drained, moderately steep and steep soils are on ridges and along entrenched drainageways in the uplands. The Sansarc soil is on narrow ridges and the steeper side slopes. The Opal soil is on the smoother side slopes and the broader ridgetops. Areas are irregularly shaped and range from 10 to more than 1,000 acres in size. They are about 60 to 70 percent Sansarc soil and 25 to 30 percent Opal soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Sansarc soil has a surface layer of light brownish gray clay about 4 inches thick. The underlying material is light brownish gray, friable and very friable shaly and very shaly clay about 10 inches thick. Soft shale is at a depth of about 14 inches.

Typically, the Opal soil has a surface layer of dark gray clay about 4 inches thick. The subsoil is dark grayish brown, calcareous, very firm clay about 14 inches thick. The underlying material is about 15 inches thick. It is grayish brown, calcareous clay over light brownish gray, calcareous shaly clay. Soft shale is at a depth of about 33 inches. In places the depth to shale is more than 40 inches. In some areas the surface layer is lighter in color.

Included with these soils in mapping are small areas of Chantier and Swanboy soils on smooth or concave foot slopes along drainageways. These included soils make up about 10 percent of the unit. They contain more salts than the Opal and Sansarc soils.

The Sansarc soil is low in fertility and in content of organic matter. The Opal soil is medium in fertility and moderate in content of organic matter. Tilth is poor in both soils. Available water capacity is very low in the Sansarc soil and low in the Opal soil. Permeability is slow in the Sansarc soil and very slow in the Opal soil. Runoff is medium on both soils. The shrink-swell potential is very high.

Most areas support native grass and are used for grazing. The Sansarc soil has fair potential and the Opal soil good potential for range. Because they are moderately steep and steep and are highly susceptible to erosion, both soils have poor potential for cultivated crops and for tame pasture and hay and windbreaks and environmental plantings. The potential for building site development and sanitary facilities also is poor.

These soils are best suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, little bluestem, and blue grama. If the range is overused, the green needlegrass and bluestems are replaced by western wheatgrass and blue grama. After continued overuse, yucca, sedges, and weeds are dominant. The topography is suitable for stock water dams, but the soils are unstable and siltation is rapid.

These soils are poorly suited to building site development because of the very high shrink-swell potential and the moderately steep and steep slope. They generally are unsuitable as sites for septic tank absorption fields and sewage lagoons because of the slope, the restricted permeability, and the limited depth to shale.

The capability subclass is VIIe; Sansarc soil in Shallow Clay range site, Opal soil in Clayey range site.

Sd—Sansarc-Rock outcrop complex. This map unit occurs as areas of a shallow, well drained, gently sloping to steep soil that are closely intermingled with areas of Rock outcrop. It is on uplands that generally are dissected by gullies. Areas are irregularly shaped and range from 5 to more than 2,000 acres in size. They are about 45 to 65 percent Sansarc soil and 25 to 55 percent Rock outcrop. The Sansarc soil and the Rock outcrop occur as areas so intermingled that mapping them separately is not practical.

Typically, the Sansarc soil has a surface layer of light brownish gray clay about 4 inches thick. The underlying material is light brownish gray, friable and very friable shaly and very shaly clay about 10 inches thick. Soft shale is at a depth of about 14 inches.

The Rock outcrop is gray, soft shale. Manganese and iron concretions are on the surface in some areas.

Included with the Sansarc soil and the Rock outcrop in mapping are small areas of Chantier and Swanboy soils. These soils make up less than 10 percent of any one mapped area. They are on foot slopes and colluvial fans along drainageways. They contain salts within a depth of 20 inches.

The Sansarc soil is low in fertility and in content of organic matter. Available water capacity is very low. Permeability is slow. Runoff is rapid or very rapid. The root zone is shallow. The shrink-swell potential is very high.

All areas are used as range. The Sansarc soil has fair potential for range. Because it is shallow and gently sloping to steep, it has poor potential for cultivated crops and for tame pasture and hay and windbreaks and environmental plantings. The potential for building site development and sanitary facilities also is poor.

This map unit is best suited to range. The Rock outcrop supports little or no vegetation. The natural plant cover on the Sansarc soil mainly is little bluestem, western wheatgrass, sideoats grama, and green needlegrass. If the range is overused, the green needlegrass and bluestems are replaced by western wheatgrass, blue grama, and yucca.

The Rock outcrop is unsuitable as a site for buildings or sanitary facilities. The Sansarc soil is poorly suited to building site development because of the very high shrink-swell potential and the slope. It is unsuitable as a site for septic tank absorption fields and sewage lagoons because of the restricted permeability, the limited depth to shale, and the slope.

The Sansarc soil is in capability subclass VIIe, Shallow Clay range site; the Rock outcrop is in capability subclass VIIIs, not assigned to a range site.

ShE—Schamber gravelly loam, 9 to 40 percent slopes. This excessively drained, strongly sloping to steep soil is on upland ridges and knolls and on terrace escarpments. It is very shallow over sand and gravel. Areas are long and narrow and range from 5 to more than 500 acres in size. Slopes are short and convex.

Typically, the surface layer is grayish brown gravelly loam about 7 inches thick. The upper part of the underlying material is light brownish gray, calcareous gravelly sandy loam about 7 inches thick. The lower part to a depth of 60 inches is light brownish gray, calcareous sand and gravel. In places the sand and gravel is more than 20 inches from the surface. In some areas it is noncalcareous.

Included with this soil in mapping are small areas of the clayey Okaton and Sansarc soils on the lower parts of the landscape. These soils make up less than 15 percent of any one mapped area. They are less than 20 inches deep over shale.

This Schamber soil is low in fertility and in content of organic matter. Available water capacity is low. Permeability is very rapid. Runoff is rapid.

Most areas support native grass and are used for grazing. Some areas are used as a source of sand and gravel. Because it is droughty and is strongly sloping to steep, this soil has poor potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It also has poor potential for building site development and sanitary facilities.

This soil is best suited to range. The natural plant cover mainly is needleandthread, grama grasses, and

threadleaf sedge. If the range is overused, the needleandthread, blue grama, and hairy grama die out and are replaced by threadleaf sedge and unpalatable forbs.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the strongly sloping to steep slope. Also, the effluent from sanitary facilities can pollute shallow ground water.

The capability subclass is VIIs; Very Shallow range site.

SmD—Schamber-Murdo complex, 6 to 15 percent slopes. These excessively drained and well drained, moderately sloping and strongly sloping soils are on upland ridges and knolls, terrace remnants, and terrace escarpments. They are very shallow or shallow over sand and gravel. Areas are long and narrow and range from 5 to more than 400 acres in size. They are about 35 to 60 percent Schamber soil and 35 to 55 percent Murdo soil. The Schamber soil is on narrow ridges and sharp breaks where slopes are short and convex. The Murdo soil is on the broader ridgetops and the lower side slopes. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Schamber soil has a surface layer of grayish brown gravelly loam about 7 inches thick. The upper part of the underlying material is light brownish gray, calcareous gravelly sandy loam about 7 inches thick. The lower part to a depth of about 60 inches is light brownish gray, calcareous sand and gravel. In places clayey material is within a depth of 40 inches. In some areas the sand and gravel is noncalcareous.

Typically, the Murdo soil has a surface layer of dark grayish brown loam about 2 inches thick. The subsoil is about 15 inches thick. It is dark brown and brown, firm clay loam in the upper part and brown, friable sandy loam in the lower part. The underlying material to a depth of 60 inches is multicolored, calcareous sand and gravel. In places the soil contains more sand. In some areas the sand and gravel is more than 20 inches from the surface, and in other areas it is noncalcareous.

Included with these soils in mapping are small areas of the clayey Okaton and Sansarc soils on the lower parts of the landscape. These included soils make up 5 to 10 percent of any one mapped area. They are less than 20 inches deep over shale.

The Schamber soil is low in fertility and in content of organic matter. The Murdo soil is medium in fertility and moderately low in content of organic matter. Available water capacity is low in both soils. Permeability is very rapid in the Schamber soil. It is moderate or moderately rapid in the upper part of the Murdo soil and rapid in the lower part. Runoff is medium or rapid on both soils.

Most areas support native grass and are used for grazing. Because of droughtiness and a severe hazard of erosion, these soils have poor potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. They also have poor potential for most sanitary facilities. The Schamber soil has fair potential and the Murdo soil good potential for most kinds of building site development.

These soils are best suited to range. The natural plant cover mainly is needleandthread, grama grasses, and sedges. If the range is overused, needleandthread, sideoats grama, and little bluestem are replaced by blue grama, sedges, and unpalatable forbs.

These soils are suitable as building sites. Land shaping is needed in the steeper areas. Septic tank absorption fields can function well on these soils. The effluent from all kinds of sanitary facilities, however, can pollute shallow ground water.

The capability subclass is VIs; Schamber soil in Very Shallow range site, Murdo soil in Shallow to Gravel range site.

SmE—Schamber-Murdo complex, 15 to 40 percent slopes. These excessively drained and well drained, moderately steep and steep soils are on upland ridges and hills and on terrace escarpments. They are very shallow or shallow over sand and gravel. Areas are long and narrow and range from 5 to more than 500 acres in size. They are about 40 to 60 percent Schamber soil and 35 to 50 percent Murdo soil. The Schamber soil is on narrow ridges and sharp breaks where slopes are short and convex. The Murdo soil is on the broader ridgetops and the lower side slopes. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Schamber soil has a surface layer of grayish brown gravelly loam about 7 inches thick. The upper part of the underlying material is light brownish gray, calcareous gravelly sandy loam about 7 inches thick. The lower part to a depth of 60 inches is light brownish gray, calcareous sand and gravel. In places clayey material is within a depth of 40 inches. In some areas the sand and gravel is noncalcareous.

Typically, the Murdo soil has a surface layer of dark grayish brown loam about 2 inches thick. The subsoil is about 15 inches thick. It is dark brown and brown, firm clay loam in the upper part and brown, friable sandy loam in the lower part. The underlying material to a depth of 60 inches is multicolored, calcareous sand and gravel. In places the soil contains more sand. In some areas the sand and gravel is more than 20 inches from the surface, and in other areas it is noncalcareous.

Included with these soils in mapping are small areas of the clayey Okaton and Sansarc soils on the lower parts of the landscape. These included soils make up 5 to 10 percent of any one mapped area. They are less than 20 inches deep over shale.

The Schamber soil is low in fertility and in content of organic matter. The Murdo soil is medium in fertility and moderately low in content of organic matter. Available water capacity is low in both soils. Permeability is very rapid in the Schamber soil. It is moderate or moderately

rapid in the upper part of the Murdo soil and rapid in the lower part. Runoff is rapid on both soils.

Most areas support native grass and are used for grazing. Because they are droughty and moderately steep and steep, these soils have poor potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. They also have poor potential for building site development and sanitary facilities.

These soils are best suited to range. The natural plant cover mainly is needleandthread, grama grasses, and sedges. If the range is overused, needleandthread, sideoats grama, and little bluestem are replaced by blue grama, sedges, and unpalatable forbs. Much of the surface is bare on severely overgrazed pastures.

These soils are unsuitable as sites for buildings and sanitary facilities because of the moderately steep and steep slope.

The capability subclass is VIIs; Schamber soil in Very Shallow range site, Murdo soil in Shallow to Gravel range site.

SuC—Sully silt loam, 3 to 9 percent slopes. This deep, well drained, gently sloping and moderately sloping soil is on uplands and terraces. Areas are narrow and range from 5 to 35 acres in size. Slopes are long and smooth.

Typically, the surface layer is grayish brown silt loam about 4 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places clayey material or shale is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of Dorna and Lowry soils. These soils make up less than 10 percent of any one mapped area. They are on the lower parts of the landscape. Their surface layer is more than 4 inches thick. Also, Dorna soils are underlain by clay at a depth of 20 to 40 inches.

This Sully soil is low in fertility and moderately low in content of organic matter. Available water capacity is high. Permeability is moderate. Runoff is medium.

Most areas support native grass and are used for grazing. This soil has fair potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has good potential for most kinds of building site development and sanitary facilities.

This soil is best suited to range. The natural plant cover mainly is little bluestem, sideoats grama, needleandthread, blue grama, and western wheatgrass. If the range is overgrazed, the mid grasses are replaced by blue grama and sedges.

This soil is suited to all of the crops commonly grown in the county. Winter wheat is the main crop. The main concern of management is controlling erosion and soil blowing. Conserving moisture, improving fertility, and increasing the content of organic matter are other concerns. Stubble mulching, crop residue management, minimum tillage, contour farming, terraces, and grassed waterways help to control erosion and soil blowing, conserve moisture, and improve fertility. Stripcropping and field windbreaks also help to control soil blowing. Including grasses and legumes in the cropping system increases the content of organic matter and improves fertility.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Bunch grasses should not be planted alone because of the erosion hazard. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

This soil is suited to windbreaks and environmental plantings, but optimum growth and survival rates are unlikely. Fallowing a year before planting conserves moisture and controls weeds. Planting the trees on the contour helps to control erosion.

This soil is well suited to building site development and septic tank absorption fields. Some leveling is needed if the more sloping areas are used as building sites.

The capability subclass is IVe; Thin Upland range site.

SuE—Sully silt loam, 9 to 25 percent slopes. This deep, well drained, strongly sloping and moderately steep soil is on uplands and terraces. Areas are narrow and range from 5 to 80 acres in size. Slopes are short and convex.

Typically, the surface layer is grayish brown silt loam about 4 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places the soil is dark and is not so silty. In some areas clayey material or shale is 20 to 40 inches from the surface.

Included with this soil in mapping are small areas of the clayey Sansarc soils. These soils make up less than 10 percent of any one mapped area. They are along drainageways on the lower parts of the landscape.

This Sully soil is low in fertility and moderately low in content of organic matter. Available water capacity is high. Permeability is moderate. Runoff is rapid.

All areas support native grass and are used for grazing. This soil has fair potential for range. Because of the slope and a severe hazard of erosion, it has poor potential for cultivated crops and for tame pasture and hay and windbreaks and environmental plantings. The potential for building site development and most sanitary facilities also is poor.

This soil is best suited to range. The natural plant cover mainly is little bluestem, sideoats grama, needleandthread, blue grama, and western wheatgrass. If the range is overused, the mid grasses are replaced by blue grama and sedges. Gullies have formed along livestock paths or trails in overgrazed areas.

This soil is too steep for most kinds of building site development and most sanitary facilities.

The capability subclass is VIe; Thin Upland range site.

SvE—Sully-Sansarc complex, 9 to 25 percent slopes. These deep and shallow, well drained, strongly

sloping and moderately steep soils are on uplands. The Sully soil is on the narrow ridges and in downslope areas, and the Sansarc soil is along drainageways. Areas are irregularly shaped and range from 5 to 80 acres in size. They are about 50 to 60 percent Sully soil and 35 to 45 percent Sansarc soil. The two soils occur as areas so intermingled that mapping them separately is not practical.

Typically, the Sully soil has a surface layer of grayish brown silt loam about 4 inches thick. The underlying material to a depth of 60 inches is light brownish gray, calcareous silt loam. In places clayey material or shale is 20 to 40 inches from the surface.

Typically, the Sansarc soil has a surface layer of light brownish gray clay about 4 inches thick. The underlying material is light brownish gray, friable and very friable shaly and very shaly clay about 10 inches thick. Soft shale is at a depth of about 14 inches. In places a thin mantle of silty material overlies the clayey material or the shale.

Included with these soils in mapping are small areas of Swanboy and Wendte soils in drainageways. These included soils make up about 5 percent of any one mapped area. They are deep and clayey.

The Sully and Sansarc soils are low in fertility and moderately low or low in content of organic matter. Available water capacity is high in the Sully soil and very low in the Sansarc soil. Permeability is moderate in the Sully soil and slow in the Sansarc soil. Runoff is rapid on both soils. The root zone is limited by the shale within a depth of 20 inches in the Sansarc soil. The shrink-swell potential is very high in that soil.

All areas support native grass and are used for grazing. These soils have fair potential for range. Because of the slope and a severe hazard of erosion, they have poor potential for cultivated crops and for tame pasture and hay and windbreaks and environmental plantings. The potential for building site development and most sanitary facilities also is poor.

These soils are best suited to range. The natural plant cover mainly is little bluestem, sideoats grama, needlegrasses, and western wheatgrass. If the range is overused, bluestems and green needlegrass are replaced by western wheatgrass and blue grama. If overuse continues, yucca and weeds replace the more productive grasses. Gullies have formed along livestock paths or trails in the overgrazed areas.

These soils are poorly suited to building site development because both are strongly sloping to moderately steep and because the Sansarc soil has a very high shrink-swell potential and is less than 20 inches deep over shale. They generally are unsuitable as septic tank absorption fields because of the slope.

The capability subclass is VIe; Sully soil in Thin Upland range site, Sansarc soil in Shallow Clay range site.

Sw—Swanboy clay. This deep, well drained, nearly level and gently sloping soil is in upland valleys, on alluvial fans, and on stream terraces. The landscape generally is dissected by small drainageways and gullies (fig. 7). Areas are long and narrow and range from 4 to several hundred acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is grayish brown clay about 1 inch thick. It is porous and tends to crust. The subsoil is grayish brown, extremely firm and very firm clay about 9 inches thick. The underlying material to a depth of 60 inches is grayish brown and olive gray, calcareous clay that has specks of gypsum and other salts. In places shale is 10 to 40 inches from the surface.

Included with this soil in mapping are small areas of Opal, Promise, Sansarc, and Wendte soils and Slickspots. These soils make up less than 15 percent of any one mapped area. Opal and Promise soils are on the higher convex parts of the landscape. They have no accumulations of salts within a depth of 15 inches. The shallow Sansarc soils are along drainageways. Wendte soils are on the lower parts of the landscape. They contain less clay than the Swanboy soil, are stratified, and have no accumulations of salts within a depth of 15 inches. Slickspots occur as bare spots where salts are at or near the surface.

This Swanboy soil is low in fertility and in content of organic matter. Tilth is very poor. Available water capacity is low. Permeability is very slow. Runoff is medium or rapid. The shrink-swell potential is very high.

Most areas support native grass and are used for grazing. Because of the very poor tilth and the high content of salts in the subsoil, this soil has poor potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It also has poor potential for most kinds of building site development and sanitary facilities.

This soil is best suited to range. The natural plant cover mainly is a sparse stand of western wheatgrass and lesser amounts of green needlegrass. If the range is overused, the green needlegrass dies out. If overuse continues, the western wheatgrass thins out and is replaced by annual weeds and pricklypear. In dry years much of the surface is bare. Flexible stocking rates are needed because the extent of the plant cover varies widely between wet and dry years.

This soil is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. This soil generally is unsuitable as a septic tank absorption field because of the restricted permeability. It is suitable, however, as a site for other waste disposal systems, such as sewage lagoons.

The capability subclass is VIs; Dense Clay range site.

Figure 7.—A dissected area of Swanboy clay. Sansarc clay, 6 to 40 percent slopes, is in the background.

Sx—Swanboy-Slickspots complex. This map unit dominantly consists of Slickspots and a deep, well drained, nearly level and gently sloping Swanboy soil in upland valleys, on alluvial fans, and on stream terraces. The Slickspots are in scattered slight depressions. The landscape generally is dissected by small drainageways and gullies. Slopes are smooth or slightly concave. Areas are dominantly long and narrow and range from 5 to several hundred acres in size. They are about 55 to 75 percent Swanboy soil and 20 to 35 percent Slickspots. The Swanboy soil and the Slickspots occur as areas so intermingled that mapping them separately is not practical.

Typically, the surface layer of the Swanboy soil is grayish brown clay about 1 inch thick. It is porous and tends to crust. The subsoil is grayish brown, very firm and extremely firm clay about 9 inches thick. The underlying material to a depth of 60 inches is grayish brown and olive gray, calcareous clay that has specks of gypsum and other salts. In places shale is 10 to 40 inches from the surface.

Typically, the Slickspots occur as small areas of a massive clay that has a crust at the surface and is nearly impervious to water. Visible accumulations of salts are within a depth of 4 inches. The surface generally is bare.

Included with the Swanboy soil and the Slickspots in mapping are small areas of Opal, Promise, and Wendte soils. These included soils make up 5 to 10 percent of any one mapped area. Opal and Promise soils are in convex areas on the higher parts of the landscape. They have no accumulations of salts within a depth of 15 inches. Also, Opal soils are 20 to 40 inches deep over shale. Wendte soils are on the lower parts of the landscape. They contain less clay than the Swanboy soil, are stratified, and have no accumulations of salts within a depth of 15 inches.

This map unit is low in fertility and in content of organic matter. Tilth is very poor. Available water capacity is low. Permeability is very slow. Runoff is medium. The shrink-swell potential is very high.

Most areas support native grass and are used for grazing. Because of the very poor tilth and the high content of salts, this map unit has poor potential for range, cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It also has poor potential for most kinds of building site development and sanitary facilities.

This map unit is best suited to range. The natural plant cover on the Swanboy soil mainly is a sparse stand of western wheatgrass and lesser amounts of green needlegrass. The Slickspots support a sparse stand of annual weeds and cacti during wet periods. They do not support sod-forming short grasses. If the range is overused, the green needlegrass dies out. If overuse

continues, the western wheatgrass thins out and is replaced by annual weeds and pricklypear. Flexible stocking rates are needed because the extent of the plant cover varies widely between wet and dry years.

This map unit is poorly suited to building site development because of the very high shrink-swell potential. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The map unit generally is unsuitable as a site for septic tank absorption fields because of the restricted permeability. It is suitable, however, as a site for other waste disposal systems, such as sewage lagoons.

The Swanboy soil is in capability subclass VIs, Dense Clay range site; the Slickspots are in capability subclass VIIIs, not assigned to a range site.

Wc—Wendte clay. This deep, moderately well drained, nearly level soil is on flood plains and low terraces. It is subject to rare flooding. Areas are long and narrow and range from 4 to more than 200 acres in size.

Typically, the surface layer is gray clay about 6 inches thick. The underlying material to a depth of 60 inches is gray, grayish brown, olive, and olive gray, stratified silty clay, clay, and silty clay loam. In places the surface layer is more than 6 inches thick and contains less clay.

Included with this soil in mapping are small areas of Nimbro, Promise, and Swanboy soils. These soils make up less than 15 percent of any one mapped area. Nimbro soils contain less clay than the Wendte soil. They are on flood plains. Promise and Swanboy soils contain more clay than the Wendte soil and are not stratified. They are on the higher foot slopes and fans.

This Wendte soil is medium in fertility and moderate in content of organic matter. Tilth is poor. Available water capacity is moderate. Permeability is slow. Runoff also is slow. The shrink-swell potential is high.

Most areas support native grass and are used for grazing or hay. This soil has good potential for range, cultivated crops, and tame pasture and hay. It has fair potential for windbreaks and environmental plantings and poor potential for most kinds of building site development and sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, blue grama, and sedges. Overuse results in a decrease in the extent of green needlegrass and an increase in the extent of western wheatgrass, Kentucky bluegrass, and sedges.

This soil is suited to most of the cultivated crops commonly grown in the county. It is better suited to small grain and alfalfa than to corn. Conserving moisture, controlling soil blowing, and improving fertility and tilth are the main concerns in managing cultivated areas. Stubble mulching, crop residue management, minimum tillage, and stripcropping conserve moisture and help to control soil blowing. Grasses and legumes in the cropping system, chiseling or subsoiling, and timely tillage improve water intake, tilth, and fertility.

Seeding this soil to suitable tame pasture plants is effective in controlling soil blowing and improving tilth. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is suited to windbreaks and environmental plantings, but optimum growth is unlikely. A year of fallow prior to planting helps to control weeds and conserves moisture.

This soil is poorly suited to building site development because of the hazard of flooding and the high shrink-swell potential. Measures that protect building sites from floodwater are needed. Specially designing foundations and footings helps to prevent the structure damage caused by shrinking and swelling. The soil generally is unsuitable as a septic tank absorption field because of the restricted permeability and the flooding.

The capability subclass is IIIs; Overflow range site.

Wd—Wendte clay, channeled. This deep, moderately well drained, nearly level soil is on flood plains along drainageways. It is frequently flooded. Areas are narrow and as much as several miles long. They are dissected into small parcels by the meandering channels. Slopes generally are less than 2 percent, but in areas adjacent to the channels, they are short and are steeper.

Typically, the surface layer is gray clay about 6 inches thick. The underlying material to a depth of 60 inches is gray, grayish brown, olive, and olive gray, stratified silty clay, clay, and silty clay loam. In places the underlying material has spots of lime and salts.

Included with this soil in mapping are small areas of Nimbro and Sansarc soils. These soils make up less than 10 percent of any one mapped area. Nimbro soils contain less clay than the Wendte soil. They are on the flood plains. Sansarc soils are less than 20 inches deep over shale. They are steeper than the Wendte soil.

This Wendte soil is medium in fertility and moderate in content of organic matter. Tilth is poor. Available water capacity is moderate. Permeability is slow. Runoff also is slow. The shrink-swell potential is high.

Most areas support native grass and are used for grazing. Deciduous trees and shrubs grow along some channels. This soil has good potential for range. It has poor potential for cultivated crops and for tame pasture and hay, windbreaks and environmental plantings, and building site development and sanitary facilities.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass, green needlegrass, blue grama, and sedges. Overuse results in a decrease in the extent of green needlegrass and an increase in the extent of western wheatgrass, Kentucky bluegrass, and sedges.

This soil generally is unsuited to cultivated crops and to tame pasture and hay and windbreaks and environmental plantings because of the flooding. The meandering stream channels have dissected the areas into such small parcels that farming is not practical. Selected trees and shrubs can be hand planted for special purposes.

This soil is unsuitable as a building site because of the flooding and the high shrink-swell potential. It is unsuitable as a septic tank absorption field because of the restricted permeability and the flooding.

The capability subclass is VIw; Overflow range site.

Wf—Wendte clay, frequently flooded. This deep, moderately well drained, nearly level soil is along streams, drainageways, and old stream channels on low lying flood plains. Areas are long and narrow and range from 3 to 80 acres in size.

Typically, the surface layer is gray clay about 6 inches thick. The underlying material to a depth of 60 inches is gray, grayish brown, olive, and olive gray, stratified silty clay, clay, and silty clay loam. In places the soil is stratified with coarser material.

Included with this soil in mapping are small marshes, which make up about 10 percent of any one mapped area.

This soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability is slow. Runoff is very slow, or the soil is ponded. The shrink-swell potential is high.

Most areas support native trees, shrubs, and grasses and are used for grazing. This soil has good potential for range. It has poor potential for cultivated crops and for tame pasture and hay, windbreaks and environmental plantings, and building site development and sanitary facilities.

This soil is well suited to range. The natural grass cover mainly is western wheatgrass, green needlegrass, and big bluestem. Overuse results in a decrease in the extent of green needlegrass and big bluestem and an increase in the extent of western wheatgrass, Kentucky bluegrass, and sedges.

This soil generally is unsuited to cultivated crops and to tame pasture and hay and the windbreaks and environmental plantings normally planted by machinery because it is frequently flooded and is only moderately well drained. Artificial drainage is not feasible in most areas.

This soil is poorly suited to building site development because of the flooding and the high shrink-swell potential. It generally is unsuitable as a septic tank absorption field because of the restricted permeability and the flooding.

The capability subclass is VIw; Overflow range site.

WsE—Westover loam, 15 to 40 percent slopes. This well drained, moderately steep and steep soil is on terrace escarpments. It is moderately deep over sand and gravel. Areas are long and narrow and range from 5 to more than 100 acres in size. Slopes are short and convex.

Typically, the surface layer is brown loam about 5 inches thick. The next 7 inches is pale brown, very friable loam. The upper part of the underlying material, to a depth of about 36 inches, is pale brown loam and gravelly loam. The lower part to a depth of 60 inches is brown and pale brown sand and gravel. In places the depth to sand and gravel is 10 to 20 inches.

Included with this soil in mapping are small areas of Lowry, Sansarc, and Sully soils. These soils make up less than 15 percent of any one mapped area. Lowry and Sully soils do not have sand and gravel within a depth of 40 inches. Lowry soils are nearly level to moderately sloping. Sully soils are in landscape positions similar to those of the Westover soil. The clayey Sansarc soils are along drainageways on the lower parts of the landscape.

This Westover soil is low in fertility and in content of organic matter. Available water capacity is moderate. Permeability is moderate in the upper part of the soil and rapid in the underlying sand and gravel. Runoff is rapid.

All areas support native grass and are used for grazing. This soil has fair potential for range. Because of the slope and a severe hazard of erosion, it has poor potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The potential for building site development and sanitary facilities also is poor.

This soil is best suited to range. The natural plant cover mainly is little bluestem, needleandthread, western wheatgrass, sideoats grama, and blue grama. If the range is overused, the mid grasses are replaced by blue grama and sedges.

This soil generally is unsuitable as a site for buildings and sanitary facilities because of the slope. Also, the effluent from sanitary facilities can pollute shallow ground water.

The capability subclass is VIIe; Thin Upland range site.

Wt—Witten silty clay. This deep, moderately well drained, nearly level soil is in swales on uplands. It is occasionally flooded. Areas are long and narrow and range from 3 to more than 200 acres in size. Slopes are slightly concave.

Typically, the surface layer is dark gray silty clay about 5 inches thick. The subsurface layer is dark gray clay about 3 inches thick. The subsoil is very firm clay about 24 inches thick. It is dark gray in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is grayish brown clay. It has nests of gypsum in the lower part. In some areas the dark colors do not extend to so great a depth.

Included with this soil in mapping are small areas of Hoven, Hurley, and Kolls soils. These soils make up less than 10 percent of any one mapped area. The poorly drained Hoven and Kolls soils are in depressions. Hurley soils have a claypan subsoil. They are on the outer edges of the mapped areas.

This Witten soil is medium in fertility and moderate in content of organic matter. Available water capacity is moderate. Permeability is slow. Runoff also is slow. The shrink-swell potential is very high.

Most areas are cultivated. This soil has good potential for cultivated crops and for range and tame pasture and

hay. It has fair potential for windbreaks and environmental plantings and poor potential for building site development and most sanitary facilities.

This soil is well suited to most of the cultivated crops commonly grown in the county. Sorghum and winter wheat are the main crops. Conserving moisture and controlling soil blowing are the main concerns in managing cultivated areas. Improving tilth also is a concern. Stubble mulching, crop residue management, minimum tillage, and stripcropping conserve moisture and help to control soil blowing. Grasses and legumes in the cropping system, chiseling or subsoiling, and timely tillage improve water intake, tilth, and fertility. Grassed waterways help to keep gullies from forming near the center of the swales, where water concentrates.

This soil is well suited to range. The natural plant cover mainly is western wheatgrass and green needlegrass. If the range is overused, the green needlegrass is replaced by western wheatgrass. If overuse continues, the western wheatgrass is replaced by blue grama, buffalograss, and forbs.

Seeding this soil to suitable tame pasture plants is effective in controlling erosion and soil blowing. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is suited to windbreaks and environmental plantings, but optimum growth is unlikely. Fallowing a year prior to planting conserves moisture and controls competing plants.

This soil is poorly suited to building site development because of the flooding and the very high shrink-swell potential. It generally is unsuitable as a septic tank absorption field because of the flooding and the restricted permeability. It is suitable, however, as a site for sewage lagoons.

The capability subclass is IIIs; Clayey range site.

Use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

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

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

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

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

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

Crops and pasture

Ralph W. Stensland, conservation agronomist, Soil Conservation Service, helped prepare this section.

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

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

About 22 percent of the acreage in Stanley County is used for cultivated crops or for tame pasture and hay. The major crops are alfalfa, oats, sorghum, and winter wheat. Alfalfa is harvested mainly for hay, oats is grown as a cash crop and as livestock feed, sorghum is harvested mainly for grain, and winter wheat is the main cash crop. The sorghum grown in some areas is used as supplemental livestock feed.

Food production could be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Soil erosion and *soil blowing* are the major problems on more than half of the cultivated areas in Stanley County. If the slope is more than 2 percent, erosion is a hazard on Agar, Lakoma, Millboro, Opal, Promise, Ree, and other soils.

Erosion reduces productivity and results in sedimentation. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is

incorporated into a plow layer. Loss of the surface layer is especially damaging on clayey soils, such as Opal and Promise, on soils having a claypan subsoil, such as Carter, and on soils that have a thin surface layer, such as Sully. Erosion also reduces productivity on soils that tend to be droughty, such as Canning soils. When erosion occurs, sediment rich in nutrients enters streams and lakes. Measures that control erosion minimize the pollution of streams and lakes by sediment and preserve water quality for fish and wildlife, recreation, and municipal use. They also reduce the amount of fertilizer needed in cropped areas because they prevent the removal of plant nutrients.

A cropping system that keeps a plant cover on the surface for extended periods holds soil losses to an amount that does not reduce the productive capacity of the soils. If a plant cover cannot protect the soil, careful management of crop residue is essential. Minimizing tillage and leaving crop residue on the surface increase the infiltration rate, reduce the runoff rate, and help to control erosion. Together with grassed waterways, minimum tillage and crop residue management are suitable on most of the soils in the survey area.

Terraces and diversions reduce the length of slopes and the runoff rate and help to control erosion. They are most practical on deep, well drained soils that have long, smooth slopes, such as Millboro and Promise soils. Contour farming and contour stripcropping also are well suited to these soils. Many of the soils are less suitable for terraces and diversions because of short, irregular slopes or an unfavorable subsoil, which would be exposed in terrace channels.

Soil blowing is a slight to severe hazard on many of the soils in the county. The hazard is especially severe on the clayey Lakoma, Opal, and Promise soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and are not protected by a plant cover or surface mulch. An adequate plant cover, a cover of crop residue, and a rough surface help to control soil blowing. Windbreaks of suitable trees and shrubs also are effective in controlling soil blowing.

Information about the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil fertility helps to determine the yields that can be obtained. It can be improved by applying fertilizer and by including grasses and legumes in the cropping system. The kinds and amounts of fertilizer needed on soils that have a high content of lime in the surface layer, such as Lakoma soils, generally differ from the kinds and amounts needed on soils that have no lime in the surface layer. On all soils additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts needed.

Soil tilth is an important factor in the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. In clayey soils, such as Opal and Promise, tilth generally is poor. These soils dry out slowly in the spring and are difficult to till when dry. If worked when wet, they tend to be very cloddy when dry. As a result of the cloddiness, preparing a good seedbed is difficult. Timely tillage, grasses and legumes in the cropping system, crop residue management, and incorporation of crop residue into the soil improve tilth and water intake.

Field crops suited to the soils and climate of the survey area include close-grown crops and row crops. Winter wheat and oats are the main close-grown crops. Sorghum is the main row crop. Cane and corn are grown for silage on a small acreage. The deep, well drained Agar, Kirley, Lowry, and Ree soils are suited to all of the crops commonly grown in the county.

Canning and other droughty soils are better suited to early maturing small grain than to deeper rooted corn and alfalfa. The porous underlying material in these soils restricts the root zone and the available water capacity. Inavale, Lakoma, Munjor, and other soils that are susceptible to soil blowing are better suited to close-grown crops than to other crops. Opal, Promise, and other clayey soils are better suited to alfalfa, sorghum, and winter wheat than to other crops.

Pasture plants best suited to the climate and most of the soils in the survey area are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Canning and other droughty soils are well suited to crested wheatgrass. Because of the hazard of erosion, bunch grasses, such as crested wheatgrass and Russian wildrye, should not be planted in areas where the slope is more than 6 percent. On the poorly drained Hoven and Kolls soils, the choice of pasture plants is limited to water-tolerant species, such as Garrison creeping foxtail and reed canarygrass.

If the pasture is overgrazed, the more productive grasses lose vigor and are replaced by annual grasses and by weeds. Proper stocking rates, timely deferment of grazing, and applications of fertilizer help to keep the pasture in good condition.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

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

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting

and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*8*). Only class and subclass are used in this survey.

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

Class I soils have slight limitations that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Soil maps for detailed planning."

Rangeland

About 75 percent of the acreage in Stanley County is rangeland (*3*). Most of the farm income is derived from livestock, principally cattle. Cow-calf-steer enterprises are dominant throughout the county. The average ranch is about 5,625 acres. Many large tracts of the Opal and Sansarc soils on breaks to Lake Oahe, Lake Sharpe, and the Bad River are used as rangeland. The soils in these areas are too steep and too shallow for cultivation. In nearly all of the areas where grain is grown, rangeland is interspersed with cropland.

On some ranches the forage produced on rangeland is supplemented with crop aftermath. In winter the forage commonly is supplemented with protein concentrate.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for many soils in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was

ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The native vegetation in this survey area commonly has been greatly depleted by continued excessive use. Management that is effective on specific kinds of soil and on specific range sites can improve the productivity.

Erosion is the major concern in managing most of the rangeland in the county. It can be controlled by managing grazing so that the kinds and amounts of plants that make up the potential plant community are maintained or reestablished. Proper distribution of grazing and deferred grazing help to keep the range in good condition.

Native woods and windbreaks

David L. Hintz, forester, Soil Conservation Service, helped prepare this section.

Native trees and shrubs grow on about 3,100 acres in Stanley County. Most are on the flood plains along the Bad River and along the part of the Missouri River below Oahe Dam. The soils that support native trees and shrubs are not classified as woodland soils.

American elm, American plum, bur oak, common chokecherry, common hackberry, false indigo, green ash, peachleaf willow, plains cottonwood, poison ivy, riverbank grape, sandbar willow, skunkbush sumac, Virginia creeper, western snowberry, and several species of wild rose are common on the Inavale, Munjor, Nimbro, and Wendte soils adjacent to the Missouri River and the Bad River. Many of these species also grow in the draws on breaks to Lake Oahe, Lake Sharpe, the Missouri River, and the Bad River.

The early settlers used the native trees and shrubs primarily as a source of fuel and food. The flood plain along the Missouri River was an excellent source before it was inundated by Lake Oahe and Lake Sharpe. Currently, the trees and shrubs protect livestock, provide habitat and food for wildlife, enhance recreation areas, and protect watersheds.

Windbreaks have been planted since the days of the early settlers. They were planted by the settlers mainly to protect farmsteads and livestock. Such windbreaks are still needed. In recent years field windbreaks have been planted to help control soil blowing. They are still needed on thousands of acres in the county.

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

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

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and

screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Wildlife habitat

John B. Farley, biologist, Soil Conservation Service, helped prepare this section.

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

In table 8, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

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

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

Hardwood trees are planted trees and shrubs that produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are bur oak, cottonwood, currant, chokecherry, eastern redcedar, American plum, hackberry, hawthorn, green ash, boxelder, and silver buffaloberry. Examples of fruit-producing shrubs and small trees that are suitable for planting on soils rated *good* are Russian-olive, honeysuckle, and crabapple.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cattails, cordgrass, rushes, sedges, and reeds.

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

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

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and trees. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous and woody plants. The wildlife attracted to these areas include ring-necked pheasant, meadowlark, gray partridge, mourning dove, cottontail, raccoon, and red fox.

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

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include pronghorn antelope, jackrabbit, deer, sharptailed grouse, coyote, western meadowlark, and lark bunting.

Engineering

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

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

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

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

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

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

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

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

Building site development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of

the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary facilities

Table 10 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons (aerobic) are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

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

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

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

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 5 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 feet.

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

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

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

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

Soil properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 16.

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

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

Engineering index properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

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

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

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

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

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 16.

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

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

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

Physical and chemical properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity

of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

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

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

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

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K in this survey area range from 0.10 to 0.43. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

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

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

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

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

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a

layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

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

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

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

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

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

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

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

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

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

Engineering index test data

Table 16 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series. The soil samples were tested by the South Dakota Department of Transportation, Division of Highways.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Soil series and morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*7*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*9*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Agar series

The Agar series consists of deep, well drained soils formed in silty loess. Permeability is moderate. These soils are on uplands. Slopes range from 0 to 6 percent.

Agar soils are similar to McClure soils and commonly are near Lowry, McClure, and Sully soils. Lowry soils lack an argillic horizon. McClure soils have a subsoil that is finer textured than that of Agar soils. Lowry and McClure soils are in positions on the landscape similar to those of Agar soils. Sully soils are calcareous at the surface and lack a mollic epipedon. They are steeper than Agar soils and are in convex areas.

Typical pedon of Agar silt loam, 0 to 3 percent slopes, 2,115 feet west and 100 feet south of the northeast corner of sec. 33, T. 100 N., R. 77 W.

Ap—0 to 6 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; neutral; abrupt smooth boundary.

B1—6 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

B2t—8 to 16 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to weak medium and fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B3ca—16 to 26 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C1ca—26 to 36 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—36 to 44 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—44 to 60 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 21 to 40 inches and the depth to free carbonates from 12 to 26 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral and is 4 to 8 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is silty clay loam or silt loam; it ranges from 24 to 30 percent clay. It is neutral or mildly alkaline. The B3 and C horizons have chroma of 2 or 3. They are mildly alkaline or moderately alkaline. In some pedons the C horizon is silty clay or clay below a depth of 30 inches.

Canning series

The Canning series consists of well drained soils that are moderately deep over sand and gravel. Permeability is moderate in the loamy sediments and rapid in the

underlying material. These soils are on high terraces. Slopes range from 0 to 9 percent.

Canning soils are similar to Ree soils and are near Kirley, Murdo, Ree, and Schamber soils. Kirley soils have a subsoil that is finer textured than that of Canning soils. Their position on the landscape is similar to that of Canning soils. Murdo and Schamber soils have sand and gravel within a depth of 20 inches. They generally are steeper than Canning soils and are on terrace escarpments. Ree soils do not have sand and gravel within a depth of 40 inches.

Typical pedon of Canning loam, 0 to 3 percent slopes, 2,500 feet south and 40 feet west of the northeast corner of sec. 1, T. 8 N., R. 27 E.

Ap—0 to 5 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; moderate fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

B21—5 to 11 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky; neutral; gradual wavy boundary.

B22t—11 to 18 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate coarse and medium prismatic structure parting to moderate coarse and medium subangular blocky; hard, friable, slightly sticky; shiny films on faces of peds; neutral; gradual wavy boundary.

B23t—18 to 23 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate coarse and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; shiny films on faces of peds; mildly alkaline; clear wavy boundary.

C1ca—23 to 32 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common medium and fine accumulations of carbonate; strong effervescence; moderately alkaline; abrupt smooth boundary.

IIC2—32 to 60 inches; multicolored sand and gravel; single grained; loose; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 13 to 25 inches and the depth to free carbonates from 12 to 25 inches. The depth to sand and gravel typically is about 32 inches but ranges from 20 to 40 inches. The mollic epipedon ranges from 8 to 15 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral and is 4 to 7 inches thick. The B2t horizon has value of 4 or 5 (2 to 4 moist) and chroma of 2 or 3. It is clay loam or sandy clay loam; it averages as low as 30 percent clay in some pedons and as high as 35 percent clay in others. The C1 horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is clay loam or sandy clay loam and is mildly alkaline or moderately alkaline.

Carter series

The Carter series consists of deep, moderately well drained, very slowly permeable soils formed in clayey material weathered from shale. These soils are in swales and flat areas on uplands. Slopes range from 0 to 3 percent.

Carter soils are near Hurley, McClure, Millboro, Promise, and Witten soils. Hurley soils have a natric horizon. McClure, Millboro, and Witten soils contain less clay in the subsoil than Carter soils. Promise soils do not have an abrupt textural change between the A and B horizons. McClure, Millboro, and Promise soils are in the slightly higher areas adjacent to Carter soils. Hurley and Witten soils are in positions on the landscape similar to those of Carter soils.

Typical pedon of Carter silt loam, in an area of Carter-Hurley silt loams, 455 feet south and 39 feet east of the northwest corner of sec. 11, T. 109 N., R. 79 W.

A11—0 to 2 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure parting to weak thin platy; slightly hard, friable; slightly acid; clear smooth boundary.

A12—2 to 8 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium platy structure parting to weak fine granular; hard, friable, slightly sticky; slightly acid; abrupt smooth boundary.

B21t—8 to 11 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium columnar structure; extremely hard, extremely firm, very sticky and very plastic; neutral; clear wavy boundary.

B22t—11 to 14 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium blocky; extremely hard, extremely firm, very sticky and very plastic; neutral; clear wavy boundary.

B3—14 to 23 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; extremely hard, extremely firm, very sticky and very plastic; strong effervescence; moderately alkaline; clear wavy boundary.

C1—23 to 33 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, extremely firm, very sticky and very plastic; strong effervescence; moderately alkaline; clear wavy boundary.

C2cs—33 to 49 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive;

extremely hard, extremely firm, very sticky and very plastic; common fine and medium accumulations of gypsum crystals; strong effervescence; moderately alkaline; clear wavy boundary.

C3—49 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; massive; hard, firm, sticky and plastic; few fine accumulations of gypsum crystals; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 19 to 33 inches. The depth to free carbonates ranges from 12 to 21 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral and is 6 to 10 inches thick. Some pedons have an A2 horizon. The B2t horizon has hue of 10YR or 2.5Y and value of 4 or 5 (3 or 4 moist). It is neutral to moderately alkaline. The C horizon has hue of 5Y or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline.

Chantier series

The Chantier series consists of shallow, well drained, very slowly permeable soils formed in residuum of shale. These soils are on uplands. They have visible accumulations of salts within a depth of 20 inches. Slopes range from 2 to 15 percent.

Chantier soils are near Okaton, Opal, Promise, Sansarc, and Swanboy soils. Okaton and Sansarc soils do not have visible accumulations of salts in the C horizon. They generally are steeper than Chantier soils and are in convex areas. Opal, Promise, and Swanboy soils are more than 20 inches deep over shale. Swanboy soils are on alluvial fans.

Typical pedon of Chantier clay, 2 to 9 percent slopes, 850 feet west and 50 feet north of a fence extending from the southeast corner of sec. 8, T. 5 N., R. 30 E.

A1—0 to 2 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky and moderate medium and fine granular structure; hard, firm, very sticky and plastic; slight effervescence; moderately alkaline; clear wavy boundary.

B2—2 to 7 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; extremely hard, extremely firm, very sticky and plastic; slight effervescence; moderately alkaline; clear wavy boundary.

C1cssa—7 to 13 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and coarse subangular blocky structure; extremely hard, extremely firm, sticky and plastic; shiny pressure faces; many fine accumulations of salt and gypsum crystals; slight effervescence; strongly alkaline; clear wavy boundary.

C2—13 to 18 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) shaly clay, grayish brown (2.5Y 5/2) moist; massive; very hard, very firm, sticky and plastic; 25 to 40 percent shale fragments; common yellowish brown (10YR 5/6) iron stains; few fine accumulations of salt and gypsum crystals; slight effervescence; moderately alkaline; clear wavy boundary.

Cr—18 to 60 inches; light olive gray (5Y 6/2) soft shale, dark gray (5Y 4/1) and grayish brown (2.5Y 5/2) moist; brittle when dry; few brownish yellow (10YR 6/6) and yellowish brown (10YR 5/6) iron stains on shale plates; few fine accumulations of salt and gypsum crystals in seams.

The thickness of the solum ranges from 5 to 15 inches. The depth to shale ranges from 10 to 20 inches.

The A and B horizons have hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 or 2. They range from mildly alkaline to strongly alkaline. The A horizon is 1 inch to 3 inches thick. The C horizon has hue of 2.5Y or 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 or 2. Seams of white to pale olive bentonite are in the Cr horizon in some pedons. They are 1 inch to 6 inches thick.

Dorna series

The Dorna series consists of deep, well drained soils formed in silty material over clayey sediments. Permeability is moderate in the solum and slow in the underlying material. These soils are on terraces. Slopes range from 0 to 2 percent.

Dorna soils are similar to Lowry soils and are near Agar, Lowry, and Sully soils. None of the nearby soils have a clayey C horizon between depths of 20 and 40 inches. Agar and Lowry soils are in positions on the landscape similar to those of Dorna soils. Sully soils are steeper than Dorna soils and are in convex areas.

Typical pedon of Dorna silt loam, 1,780 feet west and 120 feet south of the northeast corner of sec. 35, T. 110 N., R. 77 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; abrupt smooth boundary.

A12—5 to 9 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure; slightly hard, very friable; mildly alkaline; abrupt smooth boundary.

A13—9 to 15 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure; slightly hard, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—15 to 24 inches; brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse

prismatic structure; slightly hard, very friable; few fine striations of carbonate; strong effervescence; moderately alkaline; abrupt smooth boundary.

IIC2ca—24 to 31 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) and dark grayish brown (10YR 4/2) moist; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; many medium accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

IIC3—31 to 42 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; massive; very hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

IIC4—42 to 48 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; massive; very hard, firm, sticky and plastic; few fine accumulations of carbonate and salt crystals; strong effervescence; moderately alkaline; clear wavy boundary.

IIC5—48 to 60 inches; grayish brown (10YR 5/2) clay, dark brown (10YR 4/3) moist; massive; hard, firm, sticky and plastic; few fine accumulations of salt crystals; strong effervescence; moderately alkaline.

The depth to the clayey IIC horizon typically is about 24 inches but ranges from 20 to 40 inches. Some pedons have a buried A horizon. The depth to free carbonates ranges from 4 to 10 inches.

The A horizon has value of 3 to 5 (2 or 3 moist). It is neutral or mildly alkaline and is 10 to 18 inches thick. The C horizon has value of 5 or 6 (4 or 5 moist). It is mildly alkaline or moderately alkaline. The IIC horizon has hue of 10YR or 2.5Y and value of 5 or 6 (4 or 5 moist). It is clay or silty clay.

Hoven series

The Hoven series consists of deep, poorly drained soils formed in local alluvium. Permeability is very slow. These soils are in closed depressions in the uplands. Slopes are less than 1 percent.

Hoven soils are near Agar, Hurley, Kolls, McClure, and Promise soils on uplands. Agar, Kolls, McClure, and Promise soils do not have a natric horizon. Also, the Agar, McClure, and Promise soils are well drained. Hurley soils are moderately well drained.

Typical pedon of Hoven silt loam, 50 feet west and 2,600 feet north of the southeast corner of sec. 21, T. 109 N., R. 79 W.

A2—0 to 2 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak thin platy and weak fine granular structure; soft, very friable; neutral; abrupt wavy boundary.

B21t—2 to 5 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium columnar structure parting to strong medium blocky; extremely hard, very firm, sticky and plastic; thin continuous gray (10YR 5/1) coatings on tops of columns and thin patchy coatings on vertical faces of peds; mildly alkaline; gradual wavy boundary.

B22t—5 to 10 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to moderate fine blocky; extremely hard, very firm, sticky and plastic; moderately alkaline; clear wavy boundary.

B3g—10 to 15 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; weak coarse subangular blocky structure; very hard, very firm, sticky and plastic; slight effervescence; moderately alkaline; gradual wavy boundary.

C1g—15 to 32 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; massive; very hard, very firm, sticky and plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

C2g—32 to 60 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; massive; hard, firm, sticky and plastic; few fine accumulations of carbonate and gypsum crystals; strong effervescence; moderately alkaline.

The solum is 15 to 30 inches thick. Some pedons have a thin A1 horizon. The A2 horizon has value of 5 to 7 (3 or 4 moist). It dominantly is silt loam but in some pedons is silty clay loam. It is slightly acid or neutral and is 2 to 6 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 or 2. It is clay or silty clay. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 to 3. It is clay or silty clay and is moderately alkaline or strongly alkaline.

Hurley series

The Hurley series consists of deep, moderately well drained soils formed in material weathered from shale. Permeability is very slow. These soils are on uplands. Slopes range from 0 to 3 percent.

Hurley soils are near Carter, McClure, Opal, Promise, and Sansarc soils on uplands and Swanboy soils on alluvial fans. None of these nearby soils have a natric horizon. Also, Sansarc soils have shale within a depth of 20 inches.

Typical pedon of Hurley silt loam, 0 to 3 percent slopes, 225 feet north and 2,465 feet west of the southeast corner of sec. 16, T. 5 N., R. 30 E.

A2—0 to 3 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak and moderate very thin and thin platy structure parting to weak fine granular; soft, very friable; neutral; abrupt smooth boundary.

B21t—3 to 7 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium columnar structure parting to strong medium blocky; extremely hard, very firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

B22t—7 to 11 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; strong medium and fine blocky structure; extremely hard, very firm, sticky and plastic; moderately alkaline; clear wavy boundary.

B3ca—11 to 19 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium and fine blocky structure; very hard, very firm, sticky and plastic; few fine crystals of gypsum; common fine accumulations of carbonate; slight effervescence; moderately alkaline; gradual wavy boundary.

C1cacs—19 to 29 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; few fine accumulations of gypsum crystals; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C2cs—29 to 39 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; massive; very hard, very firm, sticky and plastic; common fine distinct iron stains, yellowish brown (10YR 5/6) moist; common fine accumulations of gypsum crystals; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C3—39 to 60 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; massive; very hard, firm, sticky and plastic; common fine distinct iron stains, yellowish brown (10YR 5/6) moist; few fine accumulations of gypsum crystals; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 13 to 30 inches, and the depth to free carbonates ranges from 4 to 12 inches. Accumulations of salts are above or in the horizons having accumulated carbonates.

Some pedons have a thin A1 horizon. The A2 horizon has value of 4 to 6 (3 or 4 moist) and chroma of 1 or 2. It dominantly is silt loam but in some pedons is silty clay loam. It is 1 inch to 4 inches thick. The B2t horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 or 2. It is mildly alkaline to strongly alkaline.

Inavale series

The Inavale series consists of deep, somewhat excessively drained, rapidly permeable soils formed in stratified sandy alluvium. These soils are on flood plains. Slopes range from 0 to 2 percent.

Inavale soils are near Munjor and Nimbro soils. Munjor soils are coarse-loamy. Nimbro soils are fine-loamy and have a mollic epipedon.

Typical pedon of Inavale fine sand, 1,150 feet west and 1,890 feet north of the southeast corner of sec. 32, T. 6 N., R. 31 E.

A1—0 to 7 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; weak medium granular structure; loose; partly decomposed organic matter in the upper 1/2 to 1 inch; slight effervescence; neutral; clear smooth boundary.

C—7 to 60 inches; pale brown (10YR 6/3) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; slight effervescence; mildly alkaline.

The A horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It dominantly is fine sand but in some pedons is loamy fine sand or sand. It is neutral or mildly alkaline and is 5 to 9 inches thick. The C horizon has value of 6 or 7 (4 or 5 moist). It dominantly is fine sand, but in some pedons it is sand or loamy sand and in some it has thin lenses of silty and gravelly material. It is neutral to moderately alkaline.

Kirley series

The Kirley series consists of deep, well drained soils formed in alluvium. Permeability is moderately slow. These soils are on high terraces. Slopes range from 0 to 6 percent.

Kirley soils are near Okaton, Ree, Sansarc, and Schamber soils. Okaton and Sansarc soils are shallow to shale. Ree soils are fine-loamy. Their position on the landscape is similar to that of Kirley soils. Schamber soils are very shallow to sand and gravel. They are steeper than Kirley soils and are on terrace escarpments and on the higher ridges. Okaton and Sansarc soils generally are steeper than Kirley soils and are in drainageways.

Typical pedon of Kirley loam, 0 to 3 percent slopes, 25 feet east and 175 feet north of the southwest corner of sec. 19, T. 9 N., R. 25 E.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable; neutral; abrupt smooth boundary.

A12—5 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable; neutral; clear smooth boundary.

B21t—8 to 14 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; shiny films on faces of peds; neutral; clear smooth boundary.

B22t—14 to 17 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; shiny films on faces of peds; slight effervescence; moderately alkaline; clear smooth boundary.

B3ca—17 to 31 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; shiny films on faces of peds; common fine soft accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C1ca—31 to 52 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, slightly sticky and slightly plastic; common fine soft accumulations of carbonate; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—52 to 60 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; massive; soft, friable; few fine soft accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum typically is about 31 inches but ranges from 20 to 40 inches. The mollic epipedon ranges from 7 to 18 inches in thickness. The depth to free carbonates ranges from 12 to 24 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral and is 4 to 8 inches thick. The B2t horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is clay, clay loam, or sandy clay; it averages as low as 35 percent clay in some pedons and as high as 50 percent clay in others. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It typically is clay loam or loam, but in some pedons it is clay and in some is stratified with coarser material. It is mildly alkaline or moderately alkaline.

Kolls series

The Kolls series consists of deep, poorly drained soils formed in local alluvium. Permeability is very slow. These soils are in closed depressions in the uplands. Slopes are less than 1 percent.

Kolls soils are near Hoven, Hurley, McClure, Promise, and Witten soils on uplands. Hoven and Hurley soils have a natric horizon. McClure and Promise soils are well drained. Witten soils have an argillic horizon. They are moderately well drained. Hoven soils are in the same position on the landscape as Kolls soils. Hurley and Witten soils are in swales and flat areas.

Typical pedon of Kolls clay, 300 feet north and 150 feet west of the southeast corner of sec. 21, T. 109 N., R. 79 W.

A1—0 to 4 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine granular and moderate medium blocky structure; hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.

B2—4 to 12 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to moderate medium blocky; extremely hard, firm, very sticky and very plastic; strong effervescence; moderately alkaline; clear wavy boundary.

B3g—12 to 20 inches; dark gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; weak coarse blocky structure; extremely hard, very firm, very sticky and very plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

C1g—20 to 28 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak coarse blocky structure; very hard, very firm, sticky and plastic; few fine hard accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C2gca—28 to 42 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; massive; very hard, very firm, sticky and plastic; few fine concretions and few medium soft accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C3gca—42 to 60 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; few fine faint light yellowish brown (10YR 6/4) mottles; massive; very hard, very firm, sticky and plastic; few fine concretions and few medium accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 18 to 40 inches. Free carbonates are within 5 inches of the surface.

The A horizon is neutral in hue or has hue of 10YR or 2.5Y and value of 4 or 5 (2 or 3 moist). It dominantly is clay but in some pedons is silty clay. It is mildly alkaline or moderately alkaline and is 2 to 5 inches thick. The B2 horizon is neutral or has hue of 10YR or 2.5Y and value of 4 or 5 (2 to 4 moist). It is mildly alkaline or moderately alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. It is mildly alkaline or moderately alkaline. In some pedons shale is 40 to 60 inches from the surface.

Lakoma series

The Lakoma series consists of moderately deep, well drained, slowly permeable soils formed in residuum of shale. These soils are on uplands. Slopes range from 3 to 25 percent.

Lakoma soils are near Okaton, Opal, Promise, and Swanboy soils. Okaton soils have shale within a depth of 20 inches. They commonly are steeper than Lakoma soils. Opal soils have a mollic epipedon and contain more clay than Lakoma soils. Promise and Swanboy soils do not have shale within a depth of 40 inches. Swanboy soils are on alluvial fans.

Typical pedon of Lakoma clay, 3 to 6 percent slopes, 2,335 feet east and 220 feet north of the southwest corner of sec. 16, T. 4 N., R. 25 E.

A1—0 to 5 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; crushing

to grayish brown (2.5Y 5/2) dry and dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; slight effervescence; mildly alkaline; clear smooth boundary.

B2—5 to 13 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; crushing to light brownish gray (2.5Y 6/2) dry and grayish brown (2.5Y 5/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; hard, firm but crumbly, sticky and plastic; strong effervescence; mildly alkaline; clear smooth boundary.

B3—13 to 21 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few medium accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C1—21 to 29 inches; light brownish gray (2.5Y 6/2) shaly clay, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky and plastic; few medium accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

Cr1cs—29 to 45 inches; light gray (2.5Y 7/2) soft shale, grayish brown (2.5Y 5/2) moist; strong medium and thick platy structure; common gypsum crystals between shale plates; strong effervescence; mildly alkaline; gradual smooth boundary.

Cr2—45 to 60 inches; light gray (2.5Y 7/2) soft shale, grayish brown (2.5Y 5/2) moist; strong thick platy structure; few gypsum crystals between shale plates; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 16 to 26 inches. The depth to shale ranges from 20 to 40 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It dominantly is clay but is silty clay in some pedons. It is mildly alkaline or moderately alkaline and is 4 to 6 inches thick. The B horizon has hue of 10YR or 2.5Y and chroma of 2 or 3. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

Lowry series

The Lowry series consists of deep, well drained, moderately permeable soils formed in silty loess. These soils are on uplands and terraces. Slopes range from 0 to 9 percent.

Lowry soils are similar to Dorna soils and are near Agar, Dorna, and Sully soils. Agar soils have an argillic horizon and are fine-silty. Dorna soils have a clayey C horizon between depths of 20 and 40 inches. Sully soils lack a mollic epipedon and have free carbonates near the surface. They generally are steeper than Lowry soils and are in convex areas.

Typical pedon of Lowry silt loam, 0 to 3 percent slopes, 136 feet north and 57 feet west of the southeast corner of sec. 14, T. 109 N., R. 76 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

B2—7 to 14 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure; slightly hard, very friable; slight effervescence in spots only; mildly alkaline; clear smooth boundary.

B3—14 to 20 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; slight effervescence; moderately alkaline; clear smooth boundary.

C1ca—20 to 36 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few fine striations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C2—36 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 18 to 30 inches and the depth to free carbonates from 8 to 20 inches. The mollic epipedon is 8 to 20 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is neutral or mildly alkaline and is 6 to 10 inches thick. The B horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. In some pedons the lower part of this horizon is loam.

McClure series

The McClure series consists of deep, well drained soils formed in silty material and in the underlying clayey sediments. Permeability is moderately slow through the subsoil and slow in the underlying material. These soils are on uplands. Slopes range from 0 to 6 percent.

McClure soils are similar to Agar soils and are near Agar, Carter, Hoven, Hurley, and Millboro soils. Agar soils are fine-silty. The subsoil of Carter and Millboro soils is finer textured than that of McClure soils. Also, Carter soils have an abrupt textural change between the A and B horizons. Hoven and Hurley soils have a natric horizon. Carter and Hurley soils are nearly level and are on the lower parts of the landscape. Hoven soils are in depressions.

Typical pedon of McClure silt loam, 3 to 6 percent slopes, 1,590 feet west and 90 feet north of the southeast corner of sec. 33, T. 109 N., R. 77 W.

A11—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak thin platy structure parting to weak fine granular; slightly hard, friable; slightly acid; clear smooth boundary.

A12—5 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure; slightly hard, friable; slightly acid; clear smooth boundary.

B21t—9 to 14 inches; brown (l0YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; neutral; clear wavy boundary.

B22t—14 to 19 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.

B31ca—19 to 24 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; strong effervescence; moderately alkaline; clear wavy boundary.

IIB32ca—24 to 34 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm, sticky and plastic; common medium soft accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

IIC1ca—34 to 46 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, sticky and plastic; common fine soft accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC2—46 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky and plastic; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 18 to 38 inches and the depth to free carbonates from 16 to 30 inches. The thickness of the mollic epipedon ranges from 7 to 18 inches. The depth to contrasting clayey sediments ranges from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is 5 to 10 inches thick and is slightly acid or neutral. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 2 or 3. It is silty clay loam or silty clay; it averages as low as 35 percent clay in some pedons and as high as 45 percent clay in others. It is neutral or mildly alkaline. The IIC horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is silty clay or clay and is mildly alkaline or moderately alkaline.

Millboro series

The Millboro series consists of deep, well drained soils formed in clayey material weathered from shale. Permeability is slow. These soils are on uplands. Slopes range from 0 to 6 percent.

Millboro soils are similar to Witten soils and are near Carter, Hurley, McClure, Opal, Promise, and Witten soils. Carter soils have an abrupt textural change between the A and B horizons. Hurley soils have a natric horizon. McClure soils contain less clay in the B2t horizon than Millboro soils. Opal and Promise soils lack an argillic horizon. Witten soils have a mollic epipedon that is more than 20 inches thick. Carter, Hurley, and Witten soils are in swales and are nearly level. Opal and Promise soils are on positions on the landscape similar to those of Millboro soils.

Typical pedon of Millboro silty clay loam, 3 to 6 percent slopes, 1,710 feet east and 75 feet north of the center of sec. 4, T. 109 N., R. 79 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; neutral; abrupt smooth boundary.

A12—5 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; neutral; clear smooth boundary.

B21t—8 to 14 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; mildly alkaline; clear smooth boundary.

B22t—14 to 18 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; few dark grayish brown (10YR 4/2) tongues, very dark grayish brown (10YR 3/2) moist; strong effervescence; mildly alkaline; clear smooth boundary.

B3ca—18 to 36 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate medium blocky structure; very hard, firm, sticky and plastic; common pressure faces and slickensides; common medium accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

C1—36 to 45 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, very sticky and very plastic; strong

effervescence; moderately alkaline; gradual wavy boundary.
C2—45 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, sticky and plastic; few fine accumulations of salt and gypsum crystals; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 18 to 42 inches. The depth to free carbonates generally ranges from 7 to 20 inches, but in some cultivated areas free carbonates are at the surface.

The A horizon has hue of 10YR or 2.5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silty clay loam but in some pedons is silty clay or clay. It is 4 to 8 inches thick. The B2t horizon has hue of 10YR or 2.5Y. It is clay or silty clay and is neutral or mildly alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is silty clay or clay and is mildly alkaline or moderately alkaline.

Munjor series

The Munjor series consists of deep, well drained and moderately well drained soils formed in loamy and sandy alluvium. Permeability is moderately rapid. These soils are on flood plains. Slopes range from 0 to 2 percent.

Munjor soils are near Inavale, Nimbro, and Wendte soils on flood plains. Inavale soils are sandy, Nimbro soils are fine-loamy, and Wendte soils have a fine textured control section.

Typical pedon of Munjor fine sandy loam, in an area of Munjor-Inavale complex, 700 feet west of the northeast corner of sec. 5, T. 5 N., R. 31 E.

A1—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.
C1—6 to 15 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; strong effervescence; moderately alkaline; clear smooth boundary.
C2—15 to 38 inches; light brownish gray (10YR 6/2) fine sandy loam stratified with thin lenses of clay loam or clay, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline; clear smooth boundary.
C3—38 to 45 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; massive; loose; strong effervescence; moderately alkaline; clear smooth boundary.
C4—45 to 60 inches; light brownish gray (10YR 6/2) 1oam, grayish brown (l0YR 5/2) moist; massive; soft, very friable; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 3 to 15 inches. The depth to free carbonates is less than 10 inches.

The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It dominantly is fine sandy loam but in some pedons is loamy sand, loam, or sandy loam. It is mildly alkaline or moderately alkaline and is 4 to 10 inches thick. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It has strata that range from loam to loamy sand or has thin layers of silt or clay.

Murdo series

The Murdo series consists of well drained soils formed in loamy material that is shallow over sand and gravel. These soils are on high terraces. Permeability is moderate or moderately rapid through the solum and rapid in the underlying sand and gravel. Slopes range from 6 to 30 percent.

Murdo soils are near Canning, Okaton, Opal, Sansarc, and Schamber soils. Canning soils do not have sand and gravel within a depth of 20 inches. They generally are less sloping than Murdo soils. Okaton, Opal, and Sansarc soils are clayey and are underlain by shale. Schamber soils lack a mollic epipedon and an argillic horizon.

Typical pedon of Murdo loam, in an area of Schamber-Murdo complex, 6 to 15 percent slopes, 1,200 feet west and 180 feet south of northeast corner of sec. 19, T. 9 N., R. 27 E.

A1—0 to 2 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; soft, friable; neutral; abrupt smooth boundary.
B21t—2 to 8 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, firm, sticky; neutral; clear smooth boundary.
B22t—8 to 15 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, firm, sticky; neutral; gradual smooth boundary.
B3ca—15 to 17 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.
IIC1ca—17 to 27 inches; brown (10YR 5/3) sand and gravel, brown (10YR 4/3) moist; single grained; loose; thick lime crusts on gravel; violent effervescence; moderately alkaline; gradual wavy boundary.
IIC2—27 to 45 inches; pale brown (10YR 6/3) sand and gravel, brown (10YR 5/3) moist; single grained;

loose; strong effervescence; moderately alkaline; gradual wavy boundary.

IIC3—45 to 60 inches; yellowish brown (10YR 5/6) sand and gravel, yellowish brown (10YR 5/6) moist; single grained; loose; strong effervescence; moderately alkaline.

The thickness of the solum, which is the same as the depth to sand and gravel, ranges from 12 to 20 inches. The mollic epipedon is 7 to 12 inches thick. Lime crusts are on the undersides of pebbles.

The A horizon has value of 4 or 5 (2 or 3 moist). It dominantly is loam but is gravelly loam in some pedons. It is slightly acid or neutral and is 2 to 4 inches thick. The B2t horizon has chroma of 2 or 3. It typically is clay loam but is loam, gravelly loam, or gravelly clay loam in some pedons. It is neutral or mildly alkaline. The IIC horizon commonly is stratified and crossbedded. It is mildly alkaline or moderately alkaline.

Nimbro series

The Nimbro series consists of deep, well drained and moderately well drained soils formed in loamy alluvium. Permeability is moderate. These soils are on flood plains. Slopes are less than 2 percent.

Nimbro soils are near Munjor, Promise, Swanboy, and Wendte soils. Munjor soils are coarse-loamy and lack a mollic epipedon. Promise, Swanboy, and Wendte soils have a finer textured control section than Nimbro soils. Munjor and Wendte soils are on flood plains. Promise and Swanboy soils are on uplands, alluvial fans, and terraces.

Typical pedon of Nimbro silty clay loam, 1,056 feet north and 1,424 feet east of the southwest corner of sec. 3, T. 4 N., R. 31 E.

Ap—0 to 8 inches; gray (10YR 5/1) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky and moderate fine granular structure; hard, friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline; clear smooth boundary.

C1—8 to 16 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) moist; weak very thick platy and weak medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very thin light brownish gray (2.5Y 6/2) layers; strong effervescence; mildly alkaline; clear wavy boundary.

C2—16 to 60 inches; light brownish gray (2.5Y 6/2) clay loam stratified with thin layers of fine sand, dark grayish brown (2.5Y 4/2) moist; few fine faint and distinct reddish yellow (7.5YR 6/6) mottles; slightly hard, friable; strong effervescence; mildly alkaline.

Typically, these soils are calcareous throughout, but they have thin layers that are noncalcareous in some pedons. They are mildly alkaline or moderately alkaline throughout. A thin buried A horizon is below a depth of 20 inches in some pedons.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is silty clay loam but in some pedons is loam, silt loam, or very fine sandy loam. It is 5 to 9 inches thick. The C horizon has hue of 10YR or 2.5Y, value of 4 to 7 (3 to 5 moist), and chroma of 2 to 4. It typically is silty clay loam and clay loam stratified with thin layers of fine sand, but it is silt loam in some pedons and the strata range from fine sand to clay.

Okaton series

The Okaton series consists of shallow, well drained soils formed in residuum of shale. Permeability is slow. These soils are on uplands. Slopes range from 6 to 40 percent.

Okaton soils are similar to Sansarc soils and are near Lakoma, Opal, Promise, Sansarc, and Schamber soils. Lakoma and Opal soils have shale at a depth of 20 to 40 inches. Promise soils do not have shale within a depth of 40 inches. Sansarc soils have a lower content of carbonates and a higher content of clay than Okaton soils. Schamber soils have sand and gravel at or near the surface. Lakoma, Opal, and Promise soils generally are less sloping than Okaton soils.

Typical pedon of Okaton clay, in an area of Okaton-Lakoma clays, 15 to 40 percent slopes, 1,360 feet west and 1,680 feet south of the northeast corner of sec. 31, T. 9 N., R. 25 E.

A1—0 to 3 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; gradual smooth boundary.

AC—3 to 10 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky and weak medium granular structure; slightly hard, friable, sticky and plastic; strong effervescence; mildly alkaline; gradual wavy boundary.

C—10 to 15 inches; light brownish gray (2.5Y 6/2) shaly clay, grayish brown (2.5Y 5/2) moist; thin light yellowish brown (2.5Y 6/4) seams, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear smooth boundary.

Cr1—15 to 23 inches; light brownish gray (2.5Y 6/2) fractured shale, grayish brown (2.5Y 5/2) moist; thin light yellowish brown (2.5Y 6/4) seams, light olive brown (2.5Y 5/4) moist; moderate medium platy structure; slightly hard, firm; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

Cr2—23 to 60 inches; light gray (2.5Y 7/2) soft shale, grayish brown (2.5Y 5/2) moist; thin light yellowish brown (2.5Y 6/4) seams, light olive brown (2.5Y 5/4) moist; moderate medium and thick platy structure; few and common fine nests of gypsum crystals in seams; strong effervescence; mildly alkaline.

The depth to shale ranges from 8 to 20 inches. These soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It dominantly is clay but is silty clay in some pedons. The AC horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is clay or silty clay.

Opal series

The Opal series consists of moderately deep, well drained soils formed in residuum of shale. Permeability is very slow. These soils are on uplands. Slopes range from 0 to 25 percent.

Opal soils are similar to Promise soils and are near Chantier, Lakoma, Promise, Sansarc, Swanboy, and Witten soils. Chantier and Sansarc soils have shale within a depth of 20 inches. Chantier and Swanboy soils have a higher content of salts in the solum than Opal soils. Lakoma and Swanboy soils lack a mollic epipedon. Promise, Swanboy, and Witten soils do not have shale within a depth of 40 inches. Chantier, Lakoma, and Promise soils are in positions on the landscape similar to those of Opal soils. Sansarc soils commonly are steeper than Opal soils. Swanboy soils are on alluvial fans, and Witten soils are in swales.

Typical pedon of Opal clay, 3 to 6 percent slopes, 375 feet south and 403 feet west of the northeast corner of sec. 36, T. 7 N., R. 25 E.

A1—0 to 4 inches; dark gray (10YR 4/1) clay, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium and fine granular; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; clear smooth boundary.

B21—4 to 9 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium and coarse prismatic structure parting to weak medium subangular blocky; extremely hard, very firm, sticky and plastic; shiny pressure faces on peds; strong effervescence; mildly alkaline; gradual wavy boundary.

B22—9 to 18 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium blocky; extremely hard, very firm, very sticky and plastic; shiny pressure faces on peds; strong effervescence; moderately alkaline; gradual wavy boundary.

C1—18 to 29 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, very sticky and very plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—29 to 33 inches; light brownish gray (2.5Y 6/2) shaly clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and very plastic; common fine iron stains, yellowish brown (10YR 5/6) moist; few fine nests of gypsum crystals; strong effervescence; mildly alkaline; clear wavy boundary.

Cr—33 to 60 inches; light brownish gray (2.5Y 6/2) soft shale, dark grayish brown (2.5Y 4/2) moist; few iron stains in seams, yellowish brown (10YR 5/6) moist; slight effervescence between shale plates; mildly alkaline.

The thickness of the solum ranges from 12 to 27 inches and the depth to soft shale from 20 to 40 inches. Most pedons have free carbonates at the surface, but some are leached as deep as 9 inches.

Some pedons have a thin porous crust when dry. The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is neutral or mildly alkaline and is 4 to 8 inches thick. The B horizon has hue of 2.5Y or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3.

Promise series

The Promise series consists of deep, well drained soils formed in clayey sediments weathered from shale. Permeability is slow or very slow. These soils are on uplands. Slopes range from 0 to 9 percent.

Promise soils are similar to Millboro, Opal, and Witten soils and are near Chantier, Hurley, Lakoma, Millboro, Opal, and Witten soils. Chantier soils have shale within a depth of 20 inches. Hurley soils have a natric horizon. Lakoma and Opal soils have shale at a depth of 20 to 40 inches. Millboro and Witten soils have an argillic horizon. Chantier, Lakoma, Millboro, and Opal soils are in positions on the landscape similar to those of Promise soils. Hurley and Witten soils are on flats and in swales.

Typical pedon of Promise clay, 3 to 6 percent slopes, 960 feet north and 52 feet east of a fence extending from the southwest corner of sec. 14, T. 5 N., R. 26 E.

A11—0 to 3 inches; dark gray (2.5Y 4/1) clay, very dark gray (2.5Y 3/1) moist; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; neutral; clear wavy boundary.

A12—3 to 8 inches; dark gray (2.5Y 4/1) clay, very dark gray (2.5Y 3/1) moist; weak medium and fine subangular blocky structure parting to moderate fine granular; hard, firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

B2—8 to 16 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic structure parting to moderate medium and

coarse blocky and subangular blocky; extremely hard, very firm, very sticky and very plastic; shiny pressure faces on peds; common fine and medium tongues of the A1 horizon, very dark gray (10YR 3/1) moist; strong effervescence; moderately alkaline; gradual wavy boundary.

B3ca—16 to 25 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; shiny pressure faces on peds; few fine and medium tongues of the A1 horizon, very dark gray (10YR 3/1) moist; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C1—25 to 36 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; shiny pressure faces on peds; strong effervescence; moderately alkaline; gradual wavy boundary.

C2cs—36 to 47 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; common iron stains, light yellowish brown (l0YR 6/4) moist; common fine and medium nests and seams of gypsum crystals; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—47 to 60 inches; grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky and plastic; few fine nests of gypsum crystals; strong effervescence; moderately alkaline.

The thickness of the solum typically is 25 inches but ranges from 20 to 42 inches. The depth to free carbonates generally ranges from 4 to 8 inches, but some pedons have free carbonates at the surface. Shale typically is deeper than 60 inches, but it is as shallow as 40 inches in some pedons.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is clay but is silty clay in some pedons. It is 4 to 8 inches thick. The upper 1/2 to 1 inch typically has a thin porous crust when dry. The B horizon has hue of 2.5Y or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 or 2. It is mildly alkaline or moderately alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is moderately alkaline or strongly alkaline.

Ree series

The Ree series consists of deep, well drained, moderately permeable soils formed in loamy alluvium. These soils are on high terraces. Slopes range from 0 to 9 percent.

Ree soils are similar to Canning and Kirley soils and are adjacent to Canning, Hoven, Murdo, and Schamber soils. Canning soils have sand and gravel at a depth of 20 to 40 inches. Hoven soils have a natric horizon. They are in depressions. Kirley soils have a subsoil that is finer textured than that of Ree soils. Murdo and Schamber soils have sand and gravel within a depth of 20 inches. They generally are steeper than Ree soils.

Typical pedon of Ree loam, 0 to 3 percent slopes, 70 feet west and 65 feet north of a fence extending from the center of sec. 28, T. 9 N., R. 27 E.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky and weak fine granular structure; soft, friable; slightly acid; clear smooth boundary.

B21t—5 to 11 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

B22t—11 to 19 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; shiny coatings on vertical faces of peds; neutral; clear smooth boundary.

B3—19 to 27 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 4/3) moist; weak medium and fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; neutral; clear wavy boundary.

C1ca—27 to 38 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; common fine soft accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C2—38 to 60 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; few fine soft accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 38 inches. The depth to free carbonates ranges from 15 to 35 inches. The mollic epipedon is 7 to 20 inches thick.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It dominantly is loam but is silt loam in some pedons. It is slightly acid or neutral and is 4 to 8 inches thick. The B2t horizon has hue of 10YR or 2.5Y. It is clay loam, sandy clay loam, or silty clay loam; it averages as low as 30 percent clay in some pedons and as high as 35 percent clay in others. It is neutral or mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It generally ranges from sandy loam to clay loam, but some pedons have sand and gravel between depths of 40 and 60 inches.

Sansarc series

The Sansarc series consists of shallow, well drained soils formed in residuum of shale. Permeability is slow. These soils are on dissected uplands. Slopes range from 3 to 40 percent.

Sansarc soils are similar to Okaton soils and are near Chantier, Lakoma, Okaton, and Opal soils. Chantier soils contain more salts than Sansarc soils. Lakoma and Opal soils are more than 20 inches deep over shale. Okaton soils have a higher content of free carbonates and a lower content of clay than Sansarc soils. Chantier, Lakoma, and Opal soils generally are less sloping than Sansarc soils.

Typical pedon of Sansarc clay, 6 to 40 percent slopes, 250 feet west of the east section line and 60 feet south of a fence along Bad River Road in sec. 7, T. 4 N., R. 31 E.

A1—0 to 4 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate very fine granular structure; hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

C1—4 to 10 inches; light brownish gray (2.5Y 6/2) shaly clay, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure parting to weak very fine granular; hard, friable, sticky and plastic; common very fine shale fragments; slight effervescence; mildly alkaline; gradual wavy boundary.

C2—10 to 14 inches; light brownish gray (2.5Y 6/2) very shaly clay, dark grayish brown (2.5Y 4/2) moist; fine-earth fraction is massive; loose, very friable; more than 50 percent partly weathered shale fragments; slight effervescence; mildly alkaline; gradual wavy boundary.

Cr—14 to 60 inches; light olive gray (5Y 6/2) and olive gray (5Y 5/2) soft shale, olive gray (5Y 4/2) moist; few iron and manganese stains in seams; slight effervescence; mildly alkaline.

The depth to shale typically is 14 inches but ranges from 4 to 20 inches. These soils are mildly alkaline or moderately alkaline above the shale.

The A horizon has hue of 10YR, 2.5Y, or 5Y and value of 5 to 7 (3 to 5 moist). It is 2 to 4 inches thick. The C horizon has hue of 10YR, 2.5Y, or 5Y. The shale in the Cr horizon has a wide range of color. In some pedons this horizon has no free carbonates. It ranges from medium acid to moderately alkaline.

Schamber series

The Schamber series consists of excessively drained soils that are very shallow over sand and gravel. Permeability is very rapid. These soils are on high terraces. Slopes range from 6 to 40 percent.

Schamber soils are near Canning, Murdo, Okaton, and Sansarc soils. Canning soils have sand and gravel at a depth of 20 to 40 inches. They generally are less sloping than Schamber soils. Murdo soils have a mollic epipedon and an argillic horizon. Okaton and Sansarc soils are clayey and have shale within a depth of 20 inches.

Typical pedon of Schamber gravelly loam, in an area of Schamber-Murdo complex, 15 to 40 percent slopes, 2,550 feet east of the west section line and 165 feet north of Bad River Road in sec. 7, T. 4 N., R. 31 E.

A11—0 to 2 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—2 to 7 inches; grayish brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine granular and subangular blocky structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C1ca—7 to 14 inches; light brownish gray (10YR 6/2) gravelly sandy loam, dark grayish brown (2.5Y 4/2) moist; single grained; loose; strong effervescence; moderately alkaline; gradual smooth boundary.

C2ca—14 to 60 inches; light brownish gray (10YR 6/2) sand and gravel, grayish brown (2.5Y 5/2) moist; single grained; loose; strong effervescence; mildly alkaline.

The A horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 or 3. It dominantly is gravelly loam but is loam or sandy loam in some pedons. It is neutral to moderately alkaline and is 4 to 10 inches thick. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It typically is sand and gravel, but it is gravelly sandy loam, loamy sand, or sand in some pedons.

Sully series

The Sully series consists of deep, well drained, moderately permeable soils formed in calcareous silty loess. These soils are on uplands and terraces. Slopes range from 3 to 25 percent.

Sully soils are near Agar, Dorna, Lowry, Opal, Sansarc, and Westover soils. Agar soils have a mollic epipedon and an argillic horizon. Dorna soils are coarse-silty in the upper part and clayey in the lower part. Lowry soils have a mollic epipedon. Opal soils have a subsoil that is finer textured than that of Sully soils. They are moderately deep to shale. Sansarc soils are clayey and are shallow to shale. Westover soils are coarse-loamy. Agar, Dorna, Lowry, and Opal soils generally are less sloping than Sully soils.

Typical pedon of Sully silt loam, 3 to 9 percent slopes, 492 feet north and 25 feet west of the northwest corner of an old church and cemetery lot in sec. 15, T. 109 N., R. 76 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; clear wavy boundary.
C1—4 to 10 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak very coarse prismatic structure; soft, very friable; strong effervescence; mildly alkaline; gradual wavy boundary.
C2ca—10 to 30 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable; common fine striations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.
C3—30 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

The depth to free carbonates is less than 5 inches. A buried horizon is in the lower part of the profile in some pedons.

The A horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It dominantly is silt loam but is very fine sandy loam in some pedons. It is 2 to 5 inches thick. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 to 4. It is silt loam or very fine sandy loam.

Swanboy series

The Swanboy series consists of deep, well drained soils formed in clayey alluvium. Permeability is very slow. These soils are in valleys, on alluvial fans, and on stream terraces. Visible accumulations of salts are within a depth of 15 inches. Slopes range from 0 to 6 percent.

Swanboy soils are near Chantier, Hurley, Opal, Promise, and Sansarc soils on uplands and Wendte soils on flood plains. Chantier and Sansarc soils have shale within a depth of 20 inches. Hurley soils have a natric horizon. Opal, Promise, and Wendte soils have a mollic epipedon. Also, Opal soils have shale at a depth of 20 and 40 inches.

Typical pedon of Swanboy clay, .25 mile northeast of a bridge over Powell Creek along Bad River Road and 30 feet from a fence, northward and perpendicular to the road, sec. 14, T. 4 N., R. 30 E.

A1—0 to 1 inch; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate very fine and fine granular structure; very hard, firm, sticky and plastic; few roots; moderately alkaline; abrupt smooth boundary.
B21—1 to 5 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak coarse subangular blocky structure parting to moderate medium and fine blocky; extremely hard, extremely firm, sticky and plastic; few roots; moderately alkaline; gradual wavy boundary.
B22—5 to 10 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak medium and coarse blocky structure; extremely hard, very firm, sticky and plastic; few roots; moderately alkaline; gradual wavy boundary.
C1cs—10 to 40 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; massive; extremely hard, extremely firm, sticky and plastic; few very fine roots; common very fine accumulations of salt and gypsum crystals; few fine accumulations of carbonate; slight effervescence; strongly alkaline; gradual wavy boundary.
C2—40 to 60 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; massive; very hard, very firm, sticky and plastic; few very fine accumulations of salt and gypsum crystals; slight effervescence; strongly alkaline.

The thickness of the solum ranges from 10 to 17 inches. The depth to free carbonates ranges from 0 to 9 inches.

The A and B horizons have hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 1 or 2. Though the B horizon in many pedons has value lower than 5.5 when dry and 3.5 when moist, the soils do not have a mollic epipedon; the B horizon is no darker than the C horizon and its content of organic matter is less than 1 percent higher than that in the C horizon. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (3 or 4 moist), and chroma of 1 to 3.

Wendte series

The Wendte series consists of deep, moderately well drained, slowly permeable soils formed in calcareous clayey and silty alluvium. These soils are on flood plains and low terraces. Slopes range from 0 to 2 percent.

Wendte soils are near Nimbro, Promise, and Swanboy soils. Nimbro soils are fine-loamy. Promise and Swanboy soils have a subsoil that is finer textured than that of Wendte soils. They are on uplands and alluvial fans.

Typical pedon of Wendte clay, 342 feet south and 270 feet east of the northwest corner of sec. 2, T. 3 N., R. 29 E.

Ap—0 to 6 inches; gray (2.5Y 5/1) clay, dark olive gray (5Y 3/2) moist; weak medium platy structure parting to weak fine granular; hard, firm, sticky and plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.
C1—6 to 12 inches; gray (5Y 5/1) silty clay, dark olive gray (5Y 3/2) moist; weak coarse subangular blocky and weak fine granular structure; hard, firm, sticky and plastic; few thin light brownish gray (2.5Y 6/2) layers; slight effervescence; mildly alkaline; clear smooth boundary.
C2—12 to 21 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few fine distinct

yellowish brown (10YR 5/6) mottles in the upper 3 inches; massive; hard, firm, sticky and plastic; common fine fragments of shale; slight effervescence; mildly alkaline; clear smooth boundary.

C3—21 to 60 inches; olive (5Y 5/3), olive gray (5Y 5/2), and grayish brown (2.5Y 5/2) stratified clay and silty clay loam, olive (5Y 4/3), olive gray (5Y 4/2), and dark grayish brown (2.5Y 4/2) moist; moderate thin and medium platy structure in some layers and massive in others; hard, firm, sticky and plastic; strong effervescence; mildly alkaline.

Typically, these soils are calcareous throughout, but in some pedons they have thin strata that are noncalcareous. They are mildly alkaline or moderately alkaline throughout. A thin buried A horizon is below a depth of 20 inches in some pedons.

The A horizon has hue of l0YR, 2.5Y, or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It dominantly is clay but in some pedons is silty clay, silty clay loam, or clay loam. It is 5 to 9 inches thick. The C horizon has hue of 10YR, 2.5Y, or 5Y and value of 4 to 7 (3 to 6 moist). It typically is stratified silty clay, silty clay loam, and clay, but the range includes clay loam. Also, some pedons have a few coarser textured layers 1/8 to 2 inches thick. These layers make up less than 20 percent of the control section. Few fine soft accumulations of carbonate and gypsum crystals are in the C horizon in some pedons.

Westover series

The Westover series consists of well drained soils formed in loamy, sandy, and gravelly material on terrace escarpments. These soils are moderately deep over sand and gravel. Permeability is moderate in the upper part of the soils and rapid in the underlying material. Slopes range from 15 to 40 percent.

Westover soils are near Dorna, Lowry, Sansarc, Schamber, and Sully soils. Dorna and Lowry soils have a mollic epipedon and are coarse-silty. They are less sloping than Westover soils. Sansarc soils are clayey and have shale within a depth of 20 inches. Schamber soils have coarse sand and gravel within a depth of 10 inches. Sully soils are coarse-silty.

Typical pedon of Westover loam, 15 to 40 percent slopes, 1,000 feet east and 850 feet south of the northwest corner of sec. 26, T. 109 N., R. 76 W.

A1—0 to 5 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

AC—5 to 12 inches; pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, very friable; strong effervescence; mildly alkaline; clear wavy boundary.

C1—12 to 28 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

C2—28 to 36 inches; pale brown (10YR 6/3) gravelly loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

IIC3—36 to 60 inches; brown (10YR 5/3) and pale brown (10YR 6/3) sand and gravel, dark brown (10YR 4/3) and brown (10YR 5/3) moist; single grained; loose; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 8 to 17 inches. Free carbonates are at or near the surface. These soils are mildly alkaline or moderately alkaline throughout.

The A horizon has value of 4 to 6 (3 or 4 moist). It dominantly is loam but in some pedons is silt loam or very fine sandy loam. It is 3 to 5 inches thick. The C horizon has hue of 10YR or 2.5Y and value of 5 to 7 (4 or 5 moist). It is loam, fine sandy loam, or gravelly loam. The IIC horizon is stratified silt, sand, and gravel.

Witten series

The Witten series consists of deep, moderately well drained, slowly permeable soils formed in local clayey alluvium. These soils are in swales on uplands. Slopes range from 0 to 3 percent.

Witten soils are similar to Millboro and Promise soils and are near Carter, Hoven, Hurley, Kolls, Millboro, Opal, and Promise soils. Carter soils have an abrupt textural change between the A and B horizons. Hoven and Kolls soils are poorly drained. Hurley soils have a natric horizon. Millboro, Opal, and Promise soils have a mollic epipedon that is less than 20 inches thick. Carter and Hurley soils are in positions on the landscape similar to those of Witten soils. Hoven and Kolls soils are in depressions. Millboro, Opal, and Promise soils are in convex areas.

Typical pedon of Witten silty clay, 1,875 feet south and 1,812 feet west of the northeast corner of sec. 32, T. 109 N., R. 79 W.

Ap—0 to 5 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate fine and medium granular structure; hard, friable, sticky and plastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—5 to 8 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and very plastic; slight effervescence; mildly alkaline; abrupt wavy boundary.

B21t—8 to 18 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak coarse prismatic

structure parting to moderate medium and coarse subangular blocky; extremely hard, very firm, very sticky and very plastic; strong effervescence; mildly alkaline; clear wavy boundary.

B22t—18 to 25 inches; dark gray (10YR 4/1) clay, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; extremely hard, very firm, very sticky and very plastic; shiny pressure faces on peds; strong effervescence; mildly alkaline; gradual wavy boundary.

B3—25 to 32 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; extremely hard, very firm, very sticky and very plastic; shiny pressure faces on peds; strong effervescence; moderately alkaline; gradual wavy boundary.

C1—32 to 37 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, very sticky and very plastic; strong effervescence; moderately alkaline; clear wavy boundary.

C2cs—37 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, very sticky and very plastic; common fine nests of gypsum crystals; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 45 inches. Free carbonates are at or near the surface in most pedons but are leached as deep as 15 inches in some pedons.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is neutral or mildly alkaline. It is 8 to 15 inches thick. The B2t horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is neutral or mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is clay or silty clay. It has few to many gypsum crystals and in some pedons has accumulations of carbonate.

Formation of the soils

Soil forms when soil-forming processes act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

In the following paragraphs, the factors of soil formation are related to the soils in Stanley County.

Climate

Climate directly affects the rate of chemical and physical weathering. Stanley County has a continental climate, which generally is characterized by cold winters and hot summers. This climate favors the growth of grasses and the resulting accumulation of organic matter in the surface layer. It also favors a moderately slow rate of weathering or soil formation. The climate generally is uniform throughout the county. Therefore, climate alone does not account for differences among the soils in the county. Detailed information about the climate is available under the heading "General nature of the county."

Plant and animal life

Plants, animals, insects, earthworms, bacteria, and fungi have an important effect on soil formation. They cause gains in organic matter, gains or losses in plant nutrients, and changes in soil structure and porosity. In Stanley County prairie grasses have had more influence than other living organisms on soil formation. The nearly level Witten soils contain more organic matter than the more sloping Sansarc soils because they have a more extensive grass cover. Bacteria and fungi convert more plant residue into organic matter. As a result, more nutrients are released for plant food. Earthworms, insects, and burrowing animals help to keep the soil open and porous.

Parent material

Parent material determines many of the chemical and physical characteristics of the soil, such as color, texture, reaction, and consistence. The rate of soil formation is more rapid in the more friable loamy and silty parent material than in other kinds of parent material. Also, more changes take place, and the horizons are more distinct.

Many of the soils in Stanley County formed in clayey material that weathered from the shale of the Pierre Formation. The only bedrock exposed is the Pierre shale of Late Cretaceous age, which is about 1,000 feet thick and consists almost entirely of shale and claystone (*4*).

Most of the shale is dark gray when dry and almost black when moist. Lakoma, Okaton, Opal, and Sansarc soils formed in clayey residuum of this shale.

Pleistocene deposits of nonglacial alluvium from areas to the west cap the Pierre shale on high terraces in the county. Canning, Ree, and Schamber soils formed in material on these terraces. Hoven and Kolls soils, which are in depressions in the uplands, formed in local alluvium that washed in from adjacent upland soils. Nimbro and Wendte soils formed in stream-deposited alluvium on flood plains.

Loess mantles the uplands in the eastern part of the county. Agar, Lowry, and Sully soils formed in this silty loess.

Relief

Relief affects soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. On the steeper soils, such as Okaton, Sansarc, and Sully soils, much of the rainfall is lost through runoff and thus does not penetrate the surface. Much of the surface soil is lost through erosion. As a result, these soils have a thin surface layer and are calcareous at or near the surface.

Runoff is less rapid on Promise, Ree, and other less sloping soils, and more moisture penetrates the surface. These soils are calcareous at a greater depth than Okaton, Sansarc, and Sully soils. Also, the horizons in which organic matter accumulates are thicker.

Witten soils are in swales that receive runoff from adjacent soils. The horizons in which organic matter accumulates are thicker than those in Promise and Ree soils. Kolls soils are in depressions where water ponds. They have the colors and mottles characteristic of poorly drained soils.

Time

The length of time that soil material has been exposed to the other four factors of soil formation is reflected in the kinds of soil that form. The degree of profile development reflects the age of a soil. The oldest soils are on parts of the landscape that have been stable for the longest time. In Stanley County these are Kirley and Ree soils on high terraces. The youngest soils either are those in which natural erosion removes nearly as much soil material as is formed through the weathering of parent material or are alluvial soils, which receive new material each time the area is flooded. Sully soils are an example of young soils that are subject to natural erosion, and Nimbro soils are an example of young alluvial soils.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*9*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 17, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

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

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

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

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

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

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Atterburg limits. The limits used in classifying soils on the basis of liquid limit and plasticity index.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

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

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

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

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing

crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Crop residue management. Use of that part of the plant or crop left in the field after harvest for protection or improvement of the soil.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.

Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.

Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil*

Survey Manual. The major horizons of mineral soil are as follows:
O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.
C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.
R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

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

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

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

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

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

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that the water can soak into the soil or flow slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature*						Precipitation*				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days**	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	25.4	4.8	15.1	59	-27	0	.41	.17	.59	1	3.8
February---	31.9	10.9	21.4	65	-22	19	.72	.25	1.08	2	7.2
March------	41.0	19.9	30.5	77	-10	97	.80	.38	1.14	2	5.5
April------	57.9	33.6	45.8	88	13	208	1.92	.82	2.83	4	2.6
May--------	70.0	44.8	57.5	94	26	543	2.92	1.67	3.92	6	.1
June-------	80.3	55.5	68.0	103	40	840	3.82	1.94	5.34	6	.0
July-------	89.0	61.3	75.1	108	46	1,088	2.03	.79	3.03	4	.0
August-----	88.0	59.9	74.0	107	44	1,054	1.86	.68	2.80	4	.0
September--	75.7	48.0	61.9	102	29	657	1.30	.30	2.07	3	.0
October----	63.7	37.3	50.5	93	19	347	1.01	.28	1.58	2	.8
November---	44.6	23.2	34.0	74	-3	53	.49	.09	.79	1	2.9
December---	31.0	11.3	21.2	64	-19	24	.62	.19	.95	2	6.3
Year-----	58.2	34.2	46.3	109	-27	4,930	17.90	14.98	20.64	37	29.2

* Recorded in the period 1951-74 at Pierre, S. Dak.

** A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature*		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 4	May 11	May 22
2 years in 10 later than--	April 28	May 5	May 17
5 years in 10 later than--	April 17	April 26	May 8
First freezing temperature in fall:			
1 year in 10 earlier than--	October 3	September 29	September 22
2 years in 10 earlier than--	October 9	October 4	September 27
5 years in 10 earlier than--	October 20	October 15	October 6

* Recorded in the period 1951-74 at Pierre, S. Dak.

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature*		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	166	152	129
8 years in 10	172	158	136
5 years in 10	186	171	150
2 years in 10	199	184	163
1 year in 10	205	191	171

* Recorded in the period 1951-74 at Pierre, S. Dak.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AgA	Agar silt loam, 0 to 3 percent slopes	475	0.1
AgB	Agar silt loam, 3 to 6 percent slopes	330	*
AkA	Agar silt loam, clay substratum, 0 to 3 percent slopes	1,775	0.2
AkB	Agar silt loam, clay substratum, 3 to 6 percent slopes	1,895	0.2
CaA	Canning loam, 0 to 3 percent slopes	2,435	0.3
CaB	Canning loam, 3 to 6 percent slopes	750	0.1
CaC	Canning loam, 6 to 9 percent slopes	405	*
Cc	Carter-Hurley silt loams	7,580	0.8
ChB	Chantier clay, 2 to 9 percent slopes	24,490	2.7
CsC	Chantier-Sansarc clays, 3 to 15 percent slopes	24,140	2.7
CwB	Chantier-Swanboy clays, 2 to 9 percent slopes	3,770	0.4
Do	Dorna silt loam	660	0.1
Ho	Hoven silt loam	2,200	0.2
HrA	Hurley silt loam, 0 to 3 percent slopes	13,215	1.5
Hs	Hurley-Slickspots complex	3,640	0.4
In	Inavale fine sand	255	*
KeA	Kirley loam, 0 to 3 percent slopes	1,945	0.2
KeB	Kirley loam, 3 to 6 percent slopes	1,715	0.2
Ko	Kolls clay	2,395	0.3
LaB	Lakoma clay, 3 to 6 percent slopes	7,050	0.8
LaC	Lakoma clay, 6 to 9 percent slopes	7,360	0.8
LkD	Lakoma-Okaton clays, 6 to 15 percent slopes	27,425	3.0
LoA	Lowry silt loam, 0 to 3 percent slopes	2,730	0.3
LoB	Lowry silt loam, 3 to 6 percent slopes	1,120	0.1
LoC	Lowry silt loam, 6 to 9 percent slopes	265	*
McA	McClure silt loam, 0 to 3 percent slopes	2,015	0.2
McB	McClure silt loam, 3 to 6 percent slopes	4,660	0.5
MoA	Millboro silty clay loam, 0 to 3 percent slopes	3,055	0.3
MoB	Millboro silty clay loam, 3 to 6 percent slopes	5,210	0.6
Mu	Munjor-Inavale complex	390	*
Nb	Nimbro silty clay loam	4,115	0.5
OkE	Okaton-Lakoma clays, 15 to 40 percent slopes	19,530	2.2
OpA	Opal clay, 0 to 3 percent slopes	2,865	0.3
OpB	Opal clay, 3 to 6 percent slopes	42,670	4.7
OpC	Opal clay, 6 to 9 percent slopes	40,870	4.5
OtB	Opal-Chantier clays, 2 to 6 percent slopes	13,815	1.5
OtC	Opal-Chantier clays, 6 to 9 percent slopes	8,680	1.0
OxB	Opal-Promise clays, 3 to 6 percent slopes	930	0.1
Pg	Pits, gravel	440	*
PrA	Promise clay, 0 to 3 percent slopes	61,200	6.8
PrB	Promise clay, 3 to 6 percent slopes	83,750	9.3
PrC	Promise clay, 6 to 9 percent slopes	9,505	1.1
Ps	Promise-Hurley complex	4,880	0.5
ReA	Ree loam, 0 to 3 percent slopes	6,720	0.7
ReB	Ree loam, 3 to 6 percent slopes	800	0.1
ReC	Ree loam, 6 to 9 percent slopes	345	*
Rs	Rock outcrop-Sansarc complex	6,840	0.8
SaE	Sansarc clay, 6 to 40 percent slopes	195,030	21.6
ScD	Sansarc-Opal clays, 6 to 15 percent slopes	85,610	9.5
ScE	Sansarc-Opal clays, 15 to 40 percent slopes	30,940	3.4
Sd	Sansarc-Rock outcrop complex	50,255	5.6
ShE	Schamber gravelly loam, 9 to 40 percent slopes	7,380	0.8
SmD	Schamber-Murdo complex, 6 to 15 percent slopes	4,095	0.5
SmE	Schamber-Murdo complex, 15 to 40 percent slopes	5,605	0.6
SuC	Sully silt loam, 3 to 9 percent slopes	430	*
SuE	Sully silt loam, 9 to 25 percent slopes	500	0.1
SvE	Sully-Sansarc complex, 9 to 25 percent slopes	975	0.1
Sw	Swanboy clay	27,110	3.0
Sx	Swanboy-Slickspots complex	12,585	1.4
Wc	Wendte clay	3,640	0.4
Wd	Wendte clay, channeled	6,520	0.7
Wf	Wendte clay, frequently flooded	1,825	0.2
WsE	Westover loam, 15 to 40 percent slopes	1,190	0.1
Wt	Witten silty clay	4,090	0.5
	Oahe Dam	375	*
	Water (less than 40 acres)	3,500	0.4
	Total	904,960	100.0
	Water (more than 40 acres)	64,000	
	Total area	968,960	

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Only arable soils are listed. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Oats	Winter wheat	Grain sorghum	Alfalfa hay	Cool season grass
	Bu	Bu	Bu	Bu	Ton	AUM*
AgA---------- Agar	39	54	35	49	1.9	3.2
AgB---------- Agar	37	50	33	47	1.9	3.2
AkA---------- Agar	39	54	35	49	1.9	3.2
AkB---------- Agar	37	50	33	47	1.9	3.2
CaA---------- Canning	26	45	27	35	1.4	2.3
CaB---------- Canning	24	42	26	33	1.3	2.2
CaC---------- Canning	---	---	---	26	1.1	1.8
Cc---------- Carter-Hurley	21	33	24	29	0.9	1.4
Do---------- Dorna	32	45	26	40	1.7	2.8
KeA---------- Kirley	37	50	34	41	1.8	3.0
KeB---------- Kirley	34	48	33	39	1.7	2.8
LaB---------- Lakoma	18	35	25	32	1.1	1.8
LaC---------- Lakoma	16	27	21	24	0.9	1.5
LoA---------- Lowry	36	49	33	41	1.8	3.0
LoB---------- Lowry	33	46	31	37	1.7	2.8
LoC---------- Lowry	30	41	24	27	1.5	2.4
McA---------- McClure	38	50	39	52	2.0	3.3
McB---------- McClure	36	48	37	49	1.9	3.2
MoA---------- Millboro	34	48	37	46	1.7	2.8
MoB---------- Millboro	32	46	35	43	1.6	2.6

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Winter wheat	Grain sorghum	Alfalfa hay	Cool season grass
	Bu	Bu	Bu	Bu	Ton	AUM*
Mu---------- Munjor-Inavale	28	32	---	30	2.0	3.2
Nb---------- Nimbro	45	48	32	45	2.0	3.3
OpA---------- Opal	26	44	34	36	1.4	2.3
OpB---------- Opal	25	41	31	34	1.4	2.3
OpC---------- Opal	21	33	26	25	1.3	2.2
OtB---------- Opal-Chantier	17	29	20	23	0.8	1.3
OtC---------- Opal-Chantier	13	23	15	18	0.7	1.1
OxB---------- Opal-Promise	25	45	32	37	1.4	2.3
PrA---------- Promise	28	50	36	44	1.5	2.4
PrB---------- Promise	26	48	34	42	1.5	2.4
PrC---------- Promise	23	40	29	33	1.3	2.2
Ps---------- Promise-Hurley	21	36	27	33	1.2	1.9
ReA---------- Ree	36	51	35	47	1.8	3.0
ReB---------- Ree	33	49	33	45	1.7	2.5
ReC---------- Ree	30	44	29	38	1.5	2.4
SuC---------- Sully	20	30	16	28	1.2	2.0
Wc---------- Wendte	30	50	32	38	1.8	3.0
Wd---------- Wendte	---	---	---	---	---	2.5
Wt---------- Witten	40	55	42	55	2.1	3.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
AgA, AgB---------- Agar	Silty----------	Favorable	3,100	Western wheatgrass----------	30
		Normal	2,600	Green needlegrass----------	20
		Unfavorable	1,800	Little bluestem----------	10
				Needleandthread----------	10
				Sideoats grama----------	10
				Big bluestem----------	5
				Blue grama----------	5
				Sedge----------	5
AkA, AkB---------- Agar	Silty----------	Favorable	3,100	Western wheatgrass----------	30
		Normal	2,600	Green needlegrass----------	20
		Unfavorable	1,800	Little bluestem----------	10
				Needleandthread----------	10
				Sideoats grama----------	10
				Big bluestem----------	5
				Blue grama----------	5
				Sedge----------	5
CaA, CaB, CaC------ Canning	Silty----------	Favorable	2,800	Western wheatgrass----------	30
		Normal	2,300	Green needlegrass----------	20
		Unfavorable	1,600	Needleandthread----------	10
				Sideoats grama----------	10
				Blue grama----------	10
				Sedge----------	5
				Big bluestem----------	5
				Little bluestem----------	5
Cc*:					
Carter----------	Claypan----------	Favorable	2,200	Western wheatgrass----------	55
		Normal	1,800	Green needlegrass----------	20
		Unfavorable	1,200	Blue grama----------	10
				Buffalograss----------	5
				Sedge----------	5
Hurley----------	Thin Claypan----------	Favorable	1,300	Blue grama----------	40
		Normal	1,100	Western wheatgrass----------	15
		Unfavorable	700	Buffalograss----------	15
				Needleandthread----------	10
				Sedge----------	10
ChB---------- Chantier	Dense Clay----------	Favorable	1,800	Western wheatgrass----------	60
		Normal	1,500	Green needlegrass----------	20
		Unfavorable	1,000		
CsC*:					
Chantier----------	Dense Clay----------	Favorable	1,800	Western wheatgrass----------	60
		Normal	1,500	Green needlegrass----------	20
		Unfavorable	1,000		
Sansarc----------	Shallow Clay----------	Favorable	1,600	Little bluestem----------	35
		Normal	1,400	Western wheatgrass----------	20
		Unfavorable	1,000	Sideoats grama----------	15
				Green needlegrass----------	10
				Blue grama----------	5
				Sedge----------	5
				Big bluestem----------	5
CwB*:					
Chantier----------	Dense Clay----------	Favorable	1,800	Western wheatgrass----------	60
		Normal	1,500	Green needlegrass----------	20
		Unfavorable	1,000		
Swanboy----------	Dense Clay----------	Favorable	1,800	Western wheatgrass----------	60
		Normal	1,500	Green needlegrass----------	25
		Unfavorable	1,000		

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Do Dorna	Silty	Favorable Normal Unfavorable	2,900 2,400 1,700	Western wheatgrass Green needlegrass Little bluestem Needleandthread Sideoats grama Big bluestem Blue grama Sedge	30 20 10 10 10 5 5 5
Ho Hoven	Closed Depression	Favorable Normal Unfavorable	3,300 3,000 2,100	Western wheatgrass Sedge	85 10
HrA Hurley	Thin Claypan	Favorable Normal Unfavorable	1,300 1,100 700	Blue grama Western wheatgrass Buffalograss Needleandthread Sedge	40 15 15 10 10
Hs*: Hurley	Thin Claypan	Favorable Normal Unfavorable	1,300 1,100 700	Blue grama Western wheatgrass Buffalograss Needleandthread Sedge	40 15 15 10 10
Slickspots.					
In Inavale	Sands	Favorable Normal Unfavorable	3,300 2,800 2,000	Sand bluestem Prairie sandreed Little bluestem Needleandthread Switchgrass Porcupinegrass Sedge	30 20 15 15 5 5 5
KeA, KeB Kirley	Clayey	Favorable Normal Unfavorable	2,500 2,100 1,500	Western wheatgrass Green needlegrass Sideoats grama Blue grama Sedge	45 30 10 5 5
Ko Kolls	Closed Depression	Favorable Normal Unfavorable	3,300 3,000 2,100	Western wheatgrass Sedge Blue grama Buffalograss	65 15 10 5
LaB, LaC Lakoma	Clayey	Favorable Normal Unfavorable	2,600 2,200 1,500	Western wheatgrass Green needlegrass Little bluestem Blue grama Sideoats grama Buffalograss	35 25 15 10 5 5
LkD*: Lakoma	Clayey	Favorable Normal Unfavorable	2,600 2,200 1,500	Western wheatgrass Green needlegrass Little bluestem Blue grama Sideoats grama Buffalograss	35 25 15 10 5 5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
LkD*:					
Okaton	Shallow Clay	Favorable	2,200	Little bluestem	35
		Normal	1,800	Sideoats grama	25
		Unfavorable	1,300	Western wheatgrass	10
				Big bluestem	5
				Blue grama	5
				Sedge	5
				Small soapweed	5
LoA, LoB, LoC	Silty	Favorable	2,800	Western wheatgrass	30
Lowry		Normal	2,300	Green needlegrass	20
		Unfavorable	1,600	Needleandthread	15
				Blue grama	15
				Sideoats grama	10
				Sedge	5
McA, McB	Silty	Favorable	2,800	Western wheatgrass	35
McClure		Normal	2,300	Green needlegrass	20
		Unfavorable	1,600	Needleandthread	15
				Sideoats grama	10
				Blue grama	10
				Sedge	5
MoA, MoB	Clayey	Favorable	2,500	Western wheatgrass	50
Millboro		Normal	2,100	Green needlegrass	25
		Unfavorable	1,500	Blue grama	10
				Sideoats grama	5
				Buffalograss	5
Mu*:					
Munjor	Overflow	Favorable	3,800	Big bluestem	20
		Normal	3,200	Western wheatgrass	15
		Unfavorable	2,300	Green needlegrass	10
				Switchgrass	10
				Blue grama	10
				Prairie sandreed	10
Inavale	Sands	Favorable	3,300	Sand bluestem	30
		Normal	2,800	Prairie sandreed	20
		Unfavorable	2,000	Little bluestem	15
				Needleandthread	15
				Switchgrass	5
				Porcupinegrass	5
				Sedge	5
Nb	Overflow	Favorable	3,300	Big bluestem	30
Nimbro		Normal	3,000	Western wheatgrass	20
		Unfavorable	2,100	Green needlegrass	15
				Blue grama	5
				Sedge	5
OkE*:					
Okaton	Shallow Clay	Favorable	1,900	Little bluestem	30
		Normal	1,600	Sideoats grama	30
		Unfavorable	1,100	Western wheatgrass	10
				Big bluestem	5
				Blue grama	5
				Sedge	5
				Small soapweed	5
Lakoma	Clayey	Favorable	2,600	Western wheatgrass	35
		Normal	2,200	Green needlegrass	25
		Unfavorable	1,500	Little bluestem	15
				Blue grama	10
				Sideoats grama	5
				Buffalograss	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
OpA, OpB, OpC---- Opal	Clayey----------	Favorable	2,500	Western wheatgrass----------	50
		Normal	2,100	Green needlegrass----------	30
		Unfavorable	1,500	Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
OtB*, OtC*:					
Opal----------	Clayey----------	Favorable	2,500	Western wheatgrass----------	50
		Normal	2,100	Green needlegrass----------	30
		Unfavorable	1,500	Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
Chantier----------	Dense Clay----------	Favorable	1,800	Western wheatgrass----------	60
		Normal	1,500	Green needlegrass----------	20
		Unfavorable	1,000		
OxB*:					
Opal----------	Clayey----------	Favorable	2,500	Western wheatgrass----------	50
		Normal	2,100	Green needlegrass----------	30
		Unfavorable	1,500	Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
Promise----------	Clayey----------	Favorable	2,500	Western wheatgrass----------	50
		Normal	2,100	Green needlegrass----------	30
		Unfavorable	1,500	Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
PrA, PrB---------- Promise	Clayey----------	Favorable	2,500	Western wheatgrass----------	50
		Normal	2,100	Green needlegrass----------	30
		Unfavorable	1,500	Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
PrC---------- Promise	Clayey----------	Favorable	2,300	Western wheatgrass----------	45
		Normal	1,900	Green needlegrass----------	25
		Unfavorable	1,300	Blue grama----------	10
				Sideoats grama----------	5
				Little bluestem----------	5
				Sedge----------	5
Ps*:					
Promise----------	Clayey----------	Favorable	2,500	Western wheatgrass----------	50
		Normal	2,100	Green needlegrass----------	30
		Unfavorable	1,500	Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
Hurley----------	Thin Claypan----------	Favorable	1,300	Blue grama----------	40
		Normal	1,100	Western wheatgrass----------	15
		Unfavorable	700	Buffalograss----------	15
				Needleandthread----------	10
				Sedge----------	10
ReA, ReB, ReC---- Ree	Silty----------	Favorable	3,000	Western wheatgrass----------	40
		Normal	2,500	Green needlegrass----------	20
		Unfavorable	1,700	Blue grama----------	15
				Needleandthread----------	10
				Sideoats grama----------	10
Rs*: Rock outcrop.					

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Rs*:					
Sansarc	Shallow Clay	Favorable	1,600	Little bluestem	35
		Normal	1,400	Western wheatgrass	20
		Unfavorable	1,000	Sideoats grama	15
				Green needlegrass	10
				Blue grama	5
				Sedge	5
				Big bluestem	5
SaE	Shallow Clay	Favorable	1,600	Little bluestem	35
Sansarc		Normal	1,400	Western wheatgrass	20
		Unfavorable	1,000	Sideoats grama	15
				Green needlegrass	10
				Blue grama	5
				Sedge	5
				Big bluestem	5
ScD*:					
Sansarc	Shallow Clay	Favorable	1,600	Little bluestem	35
		Normal	1,400	Western wheatgrass	20
		Unfavorable	1,000	Sideoats grama	15
				Green needlegrass	10
				Blue grama	5
				Sedge	5
				Big bluestem	5
Opal	Clayey	Favorable	2,500	Western wheatgrass	50
		Normal	2,100	Green needlegrass	30
		Unfavorable	1,500	Sideoats grama	5
				Blue grama	5
				Sedge	5
ScE*:					
Sansarc	Shallow Clay	Favorable	1,600	Little bluestem	35
		Normal	1,400	Western wheatgrass	20
		Unfavorable	1,000	Sideoats grama	15
				Green needlegrass	10
				Blue grama	5
				Sedge	5
				Big bluestem	5
Opal	Clayey	Favorable	2,300	Western wheatgrass	50
		Normal	1,900	Green needlegrass	20
		Unfavorable	1,300	Blue grama	10
				Sideoats grama	5
				Little bluestem	5
				Sedge	5
Sd*:					
Sansarc	Shallow Clay	Favorable	1,600	Little bluestem	35
		Normal	1,400	Western wheatgrass	20
		Unfavorable	1,000	Sideoats grama	15
				Green needlegrass	10
				Blue grama	5
				Sedge	5
				Big bluestem	5
Rock outcrop.					
ShE	Very Shallow	Favorable	1,400	Needleandthread	30
Schamber		Normal	1,200	Blue grama	30
		Unfavorable	700	Sedge	20
				Buffalograss	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
SmD*, SmE*:					
Schamber	Very Shallow	Favorable	1,400	Needleandthread	30
		Normal	1,200	Blue grama	30
		Unfavorable	700	Sedge	20
				Buffalograss	5
Murdo	Shallow to Gravel	Favorable	1,800	Needleandthread	25
		Normal	1,500	Blue grama	25
		Unfavorable	900	Sedge	20
				Sideoats grama	5
				Plains muhly	5
SuC, SuE	Thin Upland	Favorable	2,300	Little bluestem	30
Sully		Normal	1,900	Sideoats grama	15
		Unfavorable	1,300	Needleandthread	15
				Western wheatgrass	10
				Blue grama	10
				Sedge	5
SvE*:					
Sully	Thin Upland	Favorable	2,300	Little bluestem	30
		Normal	1,900	Sideoats grama	15
		Unfavorable	1,300	Needleandthread	15
				Western wheatgrass	10
				Blue grama	10
				Sedge	5
Sansarc	Shallow Clay	Favorable	1,600	Little bluestem	35
		Normal	1,400	Western wheatgrass	20
		Unfavorable	1,000	Sideoats grama	15
				Green needlegrass	10
				Blue grama	5
				Sedge	5
				Big bluestem	5
Sw	Dense Clay	Favorable	1,800	Western wheatgrass	60
Swanboy		Normal	1,500	Green needlegrass	25
		Unfavorable	1,000		
Sx*:					
Swanboy	Dense Clay	Favorable	1,800	Western wheatgrass	60
		Normal	1,500	Green needlegrass	25
		Unfavorable	1,000		
Slickspots.					
Wc	Overflow	Favorable	3,400	Western wheatgrass	40
Wendte		Normal	2,800	Green needlegrass	15
		Unfavorable	2,000	Blue grama	15
				Big bluestem	5
				Sedge	5
Wd	Overflow	Favorable	3,400	Western wheatgrass	40
Wendte		Normal	2,800	Blue grama	20
		Unfavorable	2,000	Green needlegrass	15
				Big bluestem	5
				Sedge	5
Wf	Overflow	Favorable	3,600	Western wheatgrass	30
Wendte		Normal	3,000	Big bluestem	15
		Unfavorable	2,100	Green needlegrass	15
				Blue grama	10
				Sedge	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
WsE---------- Westover	Thin Upland----------	Favorable	2,200	Little bluestem----------	20
		Normal	1,800	Needleandthread----------	20
		Unfavorable	1,300	Western wheatgrass----------	20
				Sideoats grama----------	15
				Blue grama----------	10
				Sedge----------	5
Wt---------- Witten	Clayey----------	Favorable	2,900	Western wheatgrass----------	40
		Normal	2,400	Green needlegrass----------	30
		Unfavorable	1,700	Sideoats grama----------	10
				Buffalograss----------	10
				Sedge----------	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	<8	8-15	16-25	26-35
AgA, AgB---------- Agar	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
AkA, AkB---------- Agar	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, common chokecherry, American plum.	Siberian elm, ponderosa pine, blue spruce, Russian-olive.	---
CaA, CaB, CaC----- Canning	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, Peking cotoneaster, lilac.	Ponderosa pine, green ash, Siberian crabapple, common hackberry, Russian-olive, eastern redcedar.	Siberian elm----------	---
Cc*: Carter---------- Hurley.	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---
ChB. Chantier				
CsC*: Chantier. Sansarc.				
CwB*: Chantier. Swanboy.				
Do---------- Dorna	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
Ho. Hoven				
HrA. Hurley				
Hs*: Hurley. Slickspots.				

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	<8	8-15	16-25	26-35
In---------- Inavale	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---
KeA, KeB---------- Kirley	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
Ko. Kolls				
LaB, LaC---------- Lakoma	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
LkD*: Lakoma----------	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
Okaton.				
LoA, LoB, LoC----- Lowry	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum.	Siberian elm, ponderosa pine, blue spruce, Black Hills spruce, Russian-olive.	---
McA, McB---------- McClure	Lilac----------	Green ash, Siberian crabapple, Rocky Mountain juniper, crabapple, Rocky American plum, Siberian peashrub.	Siberian elm, ponderosa pine, blue spruce, Black Hills ponderosa pine, blue olive.	---
MoA, MoB---------- Millboro	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
Mu*: Munjor----------	Lilac----------	Russian-olive, Rocky Mountain juniper, Siberian peashrub, American plum.	Ponderosa pine, blue spruce, Black Hills spruce, green ash, common hackberry.	Plains cottonwood, golden willow.
Inavale----------	---	Ponderosa pine, eastern redcedar, Rocky Mountain juniper.	---	---
Nb---------- Nimbro	Lilac----------	Russian-olive, Rocky Mountain juniper, Siberian peashrub, American plum.	Ponderosa pine, blue spruce, Black Hills spruce, green ash, common hackberry.	Plains cottonwood, golden willow.
OkE*: Okaton.				

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	<8	8-15	16-25	26-35
OkE*: Lakoma.				
OpA, OpB, OpC----- Opal	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
OtB*, OtC*: Opal----------	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
Chantier.				
OxB*: Opal----------	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
Promise----------	American plum, silver buffaloberry, Siberian peashrub, Peking cotoneaster, lilac.	Green ash, Russian-olive, Siberian crabapple, common chokecherry, Rocky Mountain juniper.	Siberian elm, ponderosa pine.	---
Pg*. Pits				
PrA, PrB, PrC----- Promise	American plum, silver buffaloberry, Siberian peashrub, Peking cotoneaster, lilac.	Green ash, Russian-olive, Siberian crabapple, common chokecherry, Rocky Mountain juniper.	Siberian elm, ponderosa pine.	---
Ps*: Promise----------	American plum, silver buffaloberry, Siberian peashrub, Peking cotoneaster, lilac.	Green ash, Russian-olive, Siberian crabapple, common chokecherry, Rocky Mountain juniper.	Siberian elm, ponderosa pine.	---
Hurley.				
ReA, ReB, ReC----- Ree	Lilac----------	Common chokecherry, Siberian peashrub, American plum, green ash, Siberian crabapple, Rocky Mountain juniper.	Siberian elm, blue spruce, Black Hills spruce, Russian-olive, ponderosa pine.	---
Rs*: Rock outcrop.				
Sansarc.				
SaE. Sansarc				
ScD*: Sansarc.				

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--			
	<8	8-15	16-25	26-35
ScD*: Opal	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
ScE*: Sansarc.				
Opal.				
Sd*: Sansarc.				
Rock outcrop.				
ShE. Schamber				
SmD*, SmE*: Schamber.				
Murdo.				
SuC---------- Sully	Rocky Mountain juniper, eastern redcedar, Siberian peashrub, lilac, silver buffaloberry.	Ponderosa pine, Siberian elm, green ash, Russian-olive.	---	---
SuE. Sully				
SvE*: Sully.				
Sansarc.				
Sw. Swanboy				
Sx*: Swanboy.				
Slickspots.				
Wc---------- Wendte	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---
Wd, Wf. Wendte				
WsE. Westover				
Wt---------- Witten	Siberian peashrub, silver buffaloberry, American plum, Peking cotoneaster, lilac.	Green ash, Rocky Mountain juniper, Russian-olive, Siberian crabapple, common chokecherry.	Siberian elm, ponderosa pine.	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
AgA, AgB, AkA, AkB-- Agar	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
CaA, CaB---------- Canning	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
CaC---------- Canning	Poor	Fair	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
Cc*:									
Carter----------	Poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Hurley----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
ChB---------- Chantier	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
CsC*:									
Chantier----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Sansarc----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
CwB*:									
Chantier----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Swanboy----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Do---------- Dorna	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ho---------- Hoven	Very poor	Poor	Poor	Poor	Fair	Fair	Very poor	Fair	Poor.
HrA---------- Hurley	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Hs*:									
Hurley----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Slickspots.									
In---------- Inavale	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
KeA, KeB---------- Kirley	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ko---------- Kolls	Very poor	Poor	Poor	Poor	Fair	Fair	Very poor	Fair	Poor.
LaB---------- Lakoma	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
LaC---------- Lakoma	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
LkD*:									
Lakoma----------	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Okaton----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
LoA, LoB---------- Lowry	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
LoC---------- Lowry	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
McA, McB---------- McClure	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
MoA, MoB---------- Millboro	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Mu*:									
Munjor----------	Fair	Fair	Fair	Good	Very poor	Very poor	Fair	Very poor	Fair.
Inavale----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Nb---------- Nimbro	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
OkE*:									
Okaton----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Lakoma----------	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
OpA, OpB---------- Opal	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
OpC---------- Opal	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
OtB*:									
Opal----------	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Chantier----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
OtC*:									
Opal----------	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Chantier----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
OxB*:									
Opal----------	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Promise----------	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Pg*. Pits									
PrA, PrB---------- Promise	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
PrC---------- Promise	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
Ps*:									
Promise----------	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Hurley----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
ReA, ReB---------- Ree	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
ReC---------- Ree	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Rs*: Rock outcrop.									
Sansarc----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
SaE---------- Sansarc	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
ScD*:									
Sansarc----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Opal----------	Poor	Fair	Good	Fair	Very poor	Very poor	Poor	Very poor	Good.
ScE*:									
Sansarc----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Opal----------	Very poor	Very poor	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Sd*:									
Sansarc----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Rock outcrop.									
ShE---------- Schamber	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
SmD*, SmE*:									
Schamber----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Murdo----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
SuC---------- Sully	Poor	Fair	Fair	Poor	Very poor	Very poor	Poor	Very poor	Fair.
SuE---------- Sully	Very poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
SvE*:									
Sully----------	Very poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Sansarc----------	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Sw---------- Swanboy	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Sx*:									
Swanboy----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Slickspots.									
Wc---------- Wendte	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Wd---------- Wendte	Very poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Wf---------- Wendte	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
WsE---------- Westover	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
Wt---------- Witten	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
AgA--- Agar	Slight	Slight	Slight	Slight	Moderate: low strength.
AgB--- Agar	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
AkA--- Agar	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.
AkB--- Agar	Moderate: too clayey.	Moderate: shrink-swell.	Severe: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.
CaA--- Canning	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: low strength.
CaB, CaC--- Canning	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: low strength.
Cc*:					
Carter	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Hurley	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
ChB--- Chantier	Severe: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
CsC*:					
Chantier	Severe: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Sansarc	Severe: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.
CwB*:					
Chantier	Severe: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Swanboy	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Do--- Dorna	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength.
Ho--- Hoven	Severe: floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: wetness, low strength, floods.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
HrA---------- Hurley	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Hs*: Hurley----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Slickspots.					
In---------- Inavale	Severe: cutbanks cave.	Slight----------	Moderate: wetness.	Slight----------	Slight.
KeA, KeB---------- Kirley	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Ko---------- Kolls	Severe: wetness, floods.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: wetness, low strength, floods.
LaB, LaC---------- Lakoma	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
LkD*: Lakoma----------	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Okaton----------	Severe: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
LoA---------- Lowry	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: frost action, low strength.
LoB, LoC---------- Lowry	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: frost action, low strength.
McA, McB---------- McClure	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
MoA, MoB---------- Millboro	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Mu*: Munjor----------	Severe: cutbanks cave.	Slight----------	Moderate: wetness.	Slight----------	Moderate: low strength.
Inavale----------	Severe: cutbanks cave.	Slight----------	Moderate: wetness.	Slight----------	Slight.
Nb---------- Nimbro	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.
OkE*: Okaton----------	Severe: slope, depth to rock.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope, depth to rock.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
OkE*:					
Lakoma	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
OpA, OpB, OpC	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Opal					
OtB*, OtC*:					
Opal	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Chantier	Severe: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
OxB*:					
Opal	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Promise	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Pg*.					
Pits					
PrA, PrB, PrC	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Promise					
Ps*:					
Promise	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Hurley	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
ReA	Slight	Slight	Slight	Slight	Severe: low strength.
Ree					
ReB, ReC	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.
Ree					
Rs*:					
Rock outcrop.					
Sansarc	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
SaE	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Sansarc					
ScD*:					
Sansarc	Severe: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
ScD*:					
Opal	Moderate: too clayey, depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
ScE*:					
Sansarc	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Opal	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Sd*:					
Sansarc	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Rock outcrop.					
ShE--- Schamber	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SmD*:					
Schamber	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Murdo	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
SmE*:					
Schamber	Severe: slope, cutbanks cave.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Murdo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SuC--- Sully	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
SuE--- Sully	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SvE*:					
Sully	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sansarc	Severe: slope, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, depth to rock.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Sw--- Swanboy	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Sx*:					
Swanboy	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Sx*: Slickspots.					
Wc---------- Wendte	Moderate: too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: shrink-swell, low strength.
Wd, Wf---------- Wendte	Severe: floods.	Severe: shrink-swell, floods.	Severe: shrink-swell, floods.	Severe: shrink-swell, floods.	Severe: shrink-swell, low strength, floods.
WsE---------- Westover	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wt---------- Witten	Severe: floods.	Severe: shrink-swell, floods.	Severe: shrink-swell, floods.	Severe: shrink-swell, floods.	Severe: shrink-swell, floods, low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AgA---- Agar	Slight----	Moderate: seepage.	Moderate: too clayey.	Slight----	Fair: too clayey.
AgB---- Agar	Slight----	Moderate: slope, seepage.	Moderate: too clayey.	Slight----	Fair: too clayey.
AkA---- Agar	Severe: percs slowly.	Slight----	Severe: too clayey.	Slight----	Poor: too clayey.
AkB---- Agar	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----	Poor: too clayey.
CaA, CaB, CaC---- Canning	Slight----	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy.
Cc*:					
Carter----	Severe: percs slowly.	Slight----	Severe: too clayey.	Slight----	Poor: too clayey.
Hurley----	Severe: percs slowly.	Slight----	Severe: too clayey.	Slight----	Poor: too clayey, area reclaim.
ChB---- Chantier	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim.
CsC*:					
Chantier----	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim.
Sansarc----	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim.
CwB*:					
Chantier----	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim.
Swanboy----	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----	Poor: too clayey.
Do---- Dorna	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight----	Poor: too clayey.
Ho---- Hoven	Severe: percs slowly, floods, wetness.	Slight----	Severe: too clayey, floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
HrA---- Hurley	Severe: percs slowly.	Slight----	Severe: too clayey.	Slight----	Poor: too clayey, area reclaim.
Hs*:					
Hurley----	Severe: percs slowly.	Slight----	Severe: too clayey.	Slight----	Poor: too clayey, area reclaim.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Hs*: Slickspots.					
In Inavale	Moderate: wetness.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
KeA Kirley	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey.
KeB Kirley	Severe: percs slowly.	Moderate: slope, seepage.	Severe: too clayey.	Slight	Poor: too clayey.
Ko Kolls	Severe: percs slowly, floods, wetness.	Slight	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
LaB Lakoma	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
LaC Lakoma	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
LkD*:					
Lakoma	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
Okaton	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim.
LoA Lowry	Slight	Moderate: seepage.	Slight	Slight	Good.
LoB Lowry	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
LoC Lowry	Slight	Severe: slope.	Slight	Slight	Good.
McA McClure	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
McB McClure	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
MoA Millboro	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
MoB Millboro	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Mu*:					
Munjor	Moderate: wetness.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Inavale	Moderate: wetness.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Nb---------- Nimbro	Moderate: floods.	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
OkE*: Okaton----------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: too clayey, area reclaim, slope.
Lakoma----------	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Poor: slope, too clayey, area reclaim.
OpA, OpB---------- Opal	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
OpC---------- Opal	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
OtB*: Opal----------	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
Chantier----------	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim.
OtC*: Opal----------	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
Chantier----------	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim.
OxB*: Opal----------	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
Promise----------	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
Pg*. Pits					
PrA---------- Promise	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey.
PrB---------- Promise	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
PrC---------- Promise	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
Ps*: Promise----------	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey.
Hurley----------	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, area reclaim.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ReA Ree	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
ReB Ree	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
ReC Ree	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Rs*: Rock outcrop.					
Sansarc	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey, area reclaim.
SaE Sansarc	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey, area reclaim.
ScD*: Sansarc	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim.
Opal	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, area reclaim.
ScE*: Sansarc	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey, area reclaim.
Opal	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey, slope.	Severe: slope.	Poor: slope, too clayey, area reclaim.
Sd*: Sansarc	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey, area reclaim.
Rock outcrop.					
ShE Schamber	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: slope, small stones, seepage.
SmD*: Schamber	Moderate: slope.	Severe: slope, seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage.
Murdo	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SmE*:					
Schamber	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: slope, small stones, seepage.
Murdo	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
SuC	Slight	Severe: slope.	Slight	Slight	Good.
Sully					
SuE	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Sully					
SvE*:					
Sully	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Sansarc	Severe: slope, percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: slope, too clayey, depth to rock.	Severe: slope, depth to rock.	Poor: slope, too clayey, area reclaim.
Sw	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
Swanboy					
Sx*:					
Swanboy	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
Slickspots.					
Wc	Severe: percs slowly.	Severe: floods.	Severe: too clayey.	Moderate: floods.	Poor: too clayey.
Wendte					
Wd, Wf	Severe: percs slowly, floods.	Severe: floods.	Severe: too clayey, floods.	Severe: floods.	Poor: too clayey.
Wendte					
WsE	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope, seepage.	Poor: slope, too sandy, seepage.
Westover					
Wt	Severe: percs slowly, floods.	Slight	Severe: too clayey, floods.	Severe: floods.	Poor: too clayey.
Witten					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AgA, AgB---------- Agar	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
AkA, AkB---------- Agar	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
CaA, CaB, CaC--------- Canning	Good----------	Probable----------	Probable----------	Fair: thin layer.
Cc*: Carter----------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Hurley----------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess sodium, excess salt.
ChB---------- Chantier	Poor: shrink-swell, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, area reclaim, excess salt.
CsC*: Chantier----------	Poor: shrink-swell, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, area reclaim, excess salt.
Sansarc----------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, area reclaim.
CwB*: Chantier----------	Poor: shrink-swell, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
Swanboy----------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
Do---------- Dorna	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ho---------- Hoven	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness, excess salt.
HrA---------- Hurley	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess sodium, excess salt.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Hs*:				
Hurley	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess sodium, excess salt.
Slickspots.				
In	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Inavale				
KeA, KeB	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Kirley				
Ko	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Kolls				
LaB, LaC	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Lakoma				
LkD*:				
Lakoma	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Okaton	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, area reclaim.
LoA, LoB, LoC	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Lowry				
McA, McB	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
McClure				
MoA, MoB	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Millboro				
Mu*:				
Munjor	Fair: low strength.	Probable	Improbable: too sandy.	Good.
Inavale	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Nb	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Nimbro				
OkE*:				
Okaton	Poor: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope, area reclaim.
Lakoma	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
OpA, OpB, OpC	Poor: shrink-swell, low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Opal				

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
OtB*, OtC*:				
Opal	Poor: shrink-swell, low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Chantier	Poor: shrink-swell, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, area reclaim, excess salt.
OxB*:				
Opal	Poor: shrink-swell, low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Promise	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Pg*.				
Pits				
PrA, PrB, PrC	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Promise				
Ps*:				
Promise	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Hurley	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, excess sodium, excess salt.
ReA, ReB, ReC	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Ree				
Rs*:				
Rock outcrop.				
Sansarc	Poor: slope, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, area reclaim.
SaE	Poor: slope, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, area reclaim.
Sansarc				
ScD*:				
Sansarc	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, area reclaim.
Opal	Poor: shrink-swell, low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
ScE*:				
Sansarc	Poor: slope, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, area reclaim.
Opal	Poor: shrink-swell, low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
Sd*:				
Sansarc	Poor: slope, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, area reclaim.
Rock outcrop.				
ShE Schamber	Fair: slope.	Probable	Probable	Poor: slope, small stones, area reclaim.
SmD*:				
Schamber	Good	Probable	Probable	Poor: small stones, area reclaim.
Murdo	Good	Probable	Probable	Poor: small stones.
SmE*:				
Schamber	Poor: slope.	Probable	Probable	Poor: slope, small stones, area reclaim.
Murdo	Fair: slope.	Probable	Probable	Poor: small stones, slope.
SuC Sully	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
SuE Sully	Fair: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
SvE*:				
Sully	Fair: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Sansarc	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, area reclaim.
Sw Swanboy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
Sx*:				
Swanboy	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Sx*: Slickspots.				
Wc, Wd, Wf---------- Wendte	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
WsE---------- Westover	Fair: slope.	Probable----------	Probable----------	Poor: slope.
Wt---------- Witten	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AgA--- Agar	Moderate: seepage.	Severe: piping.	Not needed	Favorable	Not needed	Erodes easily.
AgB--- Agar	Moderate: seepage, slope.	Severe: piping.	Not needed	Slope	Erodes easily	Erodes easily.
AkA--- Agar	Moderate: seepage.	Severe: hard to pack.	Not needed	Percs slowly	Not needed	Favorable.
AkB--- Agar	Moderate: seepage, slope.	Severe: hard to pack.	Not needed	Percs slowly, slope.	Percs slowly	Favorable.
CaA--- Canning	Severe: seepage.	Severe: seepage.	Not needed	Favorable	Not needed	Favorable.
CaB--- Canning	Severe: seepage.	Severe: seepage.	Not needed	Slope	Too sandy	Favorable.
CaC--- Canning	Severe: seepage.	Severe: seepage.	Not needed	Slope	Too sandy	Favorable.
Cc*: Carter	Slight	Severe: hard to pack.	Not needed	Percs slowly, erodes easily.	Percs slowly	Percs slowly, erodes easily.
Hurley	Slight	Severe: hard to pack, excess sodium.	Not needed	Percs slowly, excess sodium, droughty.	Percs slowly, depth to rock, erodes easily.	Excess salt, excess sodium.
ChB--- Chantier	Severe: depth to rock.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, excess salt.	Depth to rock, percs slowly.	Excess salt, depth to rock.
CsC*: Chantier	Severe: depth to rock.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, excess salt.	Depth to rock, percs slowly.	Excess salt, depth to rock.
Sansarc	Severe: depth to rock, slope.	Severe: thin layer, hard to pack.	Not needed	Slope, slow intake, rooting depth.	Slope, depth to rock, percs slowly.	Slope, rooting depth.
CwB*: Chantier	Severe: depth to rock.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, excess salt.	Depth to rock, percs slowly.	Excess salt, depth to rock.
Swanboy	Moderate: slope.	Severe: hard to pack.	Not needed	Slow intake, percs slowly.	Percs slowly, erodes easily.	Excess salt, percs slowly.
Do--- Dorna	Moderate: seepage.	Severe: hard to pack.	Not needed	Percs slowly	Not needed	Percs slowly.
Ho--- Hoven	Slight	Severe: hard to pack, ponding, excess sodium.	Percs slowly, ponding, excess salt.	Wetness, percs slowly, excess sodium.	Wetness, percs slowly, erodes easily.	Excess salt, wetness, excess sodium.
HrA--- Hurley	Slight	Severe: hard to pack, excess sodium.	Not needed	Percs slowly, excess sodium, droughty.	Percs slowly, depth to rock, erodes easily.	Excess salt, excess sodium.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Hs*:						
Hurley	Slight	Severe: hard to pack, excess sodium.	Not needed	Percs slowly, excess sodium, droughty.	Percs slowly, depth to rock, erodes easily.	Excess salt, excess sodium.
Slickspots.						
In Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
KeA Kirley	Moderate: seepage.	Moderate: thin layer, hard to pack.	Not needed	Percs slowly	Not needed	Percs slowly.
KeB Kirley	Moderate: seepage, slope.	Moderate: thin layer, hard to pack.	Not needed	Percs slowly	Percs slowly	Percs slowly.
Ko Kolls	Slight	Severe: hard to pack, ponding.	Percs slowly, ponding.	Slow intake, wetness, percs slowly.	Not needed	Percs slowly, wetness.
LaB, LaC Lakoma	Moderate: depth to rock, slope.	Severe: hard to pack.	Not needed	Slow intake, droughty, percs slowly.	Depth to rock, percs slowly.	Depth to rock, droughty, erodes easily.
LkD*:						
Lakoma	Moderate: depth to rock, slope.	Severe: hard to pack.	Not needed	Slow intake, droughty, percs slowly.	Depth to rock, percs slowly.	Depth to rock, droughty, erodes easily.
Okaton	Severe: depth to rock, slope.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, rooting depth.	Slope, depth to rock, percs slowly.	Slope, rooting depth, droughty.
LoA Lowry	Moderate: seepage.	Severe: piping.	Not needed	Favorable	Favorable	Erodes easily.
LoB Lowry	Moderate: seepage, slope.	Severe: piping.	Not needed	Slope	Favorable	Erodes easily.
LoC Lowry	Moderate: seepage, slope.	Severe: piping.	Not needed	Slope	Favorable	Erodes easily.
McA McClure	Slight	Severe: hard to pack.	Not needed	Percs slowly	Not needed	Percs slowly.
McB McClure	Moderate: slope.	Severe: hard to pack.	Not needed	Percs slowly	Percs slowly	Percs slowly.
MoA Millboro	Slight	Severe: hard to pack.	Not needed	Slow intake, percs slowly.	Percs slowly	Percs slowly.
MoB Millboro	Moderate: slope.	Severe: hard to pack.	Not needed	Slow intake, percs slowly.	Percs slowly	Percs slowly.
Mu*:						
Munjor	Severe: seepage.	Severe: piping.	Not needed	Soil blowing	Too sandy, soil blowing.	Favorable.
Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Nb Nimbro	Moderate: seepage.	Moderate: piping.	Not needed	Favorable	Not needed	Favorable.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
OkE*:						
Okaton	Severe: depth to rock, slope.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, rooting depth.	Slope, depth to rock, percs slowly.	Slope, rooting depth, droughty.
Lakoma	Severe: slope.	Severe: hard to pack.	Not needed	Slow intake, droughty, percs slowly.	Slope, depth to rock, percs slowly.	Slope, erodes easily, depth to rock.
OpA	Moderate: depth to rock.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, rooting depth.	Percs slowly, depth to rock.	Percs slowly, depth to rock.
OpB, OpC Opal	Moderate: depth to rock, slope.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, rooting depth.	Percs slowly, depth to rock.	Percs slowly, depth to rock.
OtB*, OtC*:						
Opal	Moderate: depth to rock, slope.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, rooting depth.	Percs slowly, depth to rock.	Percs slowly, depth to rock.
Chantier	Severe: depth to rock.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, excess salt.	Depth to rock, percs slowly.	Excess salt, depth to rock.
OxB*:						
Opal	Moderate: depth to rock, slope.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, rooting depth.	Percs slowly, depth to rock.	Percs slowly, depth to rock.
Promise	Moderate: slope.	Severe: hard to pack.	Not needed	Slope, slow intake, percs slowly.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Pg*. Pits						
PrA Promise	Slight	Severe: hard to pack.	Not needed	Slow intake, percs slowly.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
PrB, PrC Promise	Moderate: slope.	Severe: hard to pack.	Not needed	Slope, slow intake, percs slowly.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Ps*:						
Promise	Slight	Severe: hard to pack.	Not needed	Slow intake, percs slowly.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Hurley	Slight	Severe: hard to pack, excess sodium.	Not needed	Percs slowly, excess sodium, droughty.	Percs slowly, depth to rock, erodes easily.	Excess salt, excess sodium.
ReA Ree	Moderate: seepage.	Severe: piping.	Not needed	Favorable	Favorable	Favorable.
ReB, ReC Ree	Moderate: seepage, slope.	Severe: piping.	Not needed	Slope	Favorable	Favorable.
Rs*:						
Rock outcrop.						
Sansarc	Severe: depth to rock, slope.	Severe: thin layer, hard to pack.	Not needed	Slope, slow intake, rooting depth.	Slope, depth to rock, percs slowly.	Slope, rooting depth, droughty.
SaE Sansarc	Severe: depth to rock, slope.	Severe: thin layer, hard to pack.	Not needed	Slope, slow intake, rooting depth.	Slope, depth to rock, percs slowly.	Slope, rooting depth, droughty.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
ScD*:						
Sansarc	Severe: depth to rock, slope.	Severe: thin layer, hard to pack.	Not needed	Slope, slow intake, rooting depth.	Slope, depth to rock, percs slowly.	Slope, rooting depth, droughty.
Opal	Moderate: depth to rock, slope.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, rooting depth.	Percs slowly, depth to rock.	Percs slowly, depth to rock.
ScE*:						
Sansarc	Severe: depth to rock, slope.	Severe: thin layer, hard to pack.	Not needed	Slope, slow intake, rooting depth.	Slope, depth to rock, percs slowly.	Slope, rooting depth, droughty.
Opal	Severe: slope.	Severe: hard to pack.	Not needed	Slow intake, percs slowly, rooting depth.	Slope, percs slowly, depth to rock.	Slope, percs slowly, depth to rock.
Sd*:						
Sansarc	Severe: depth to rock, slope.	Severe: thin layer, hard to pack.	Not needed	Slope, slow intake, rooting depth.	Slope, depth to rock, percs slowly.	Slope, rooting depth, droughty.
Rock outcrop.						
ShE--- Schamber	Severe: slope, seepage.	Severe: seepage.	Not needed	Droughty, slope.	Slope, too sandy.	Slope, droughty.
SmD*:						
Schamber	Severe: slope, seepage.	Severe: seepage.	Not needed	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Murdo	Severe: seepage, slope.	Severe: seepage.	Not needed	Droughty, slope.	Too sandy	Droughty.
SmE*:						
Schamber	Severe: slope, seepage.	Severe: seepage.	Not needed	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Murdo	Severe: seepage, slope.	Severe: seepage.	Not needed	Droughty, slope.	Slope, too sandy.	Droughty, slope.
SuC--- Sully	Moderate: seepage, slope.	Severe: piping.	Not needed	Slope, erodes easily.	Erodes easily	Erodes easily.
SuE--- Sully	Severe: slope.	Severe: piping.	Not needed	Slope, erodes easily.	Erodes easily, slope.	Slope, erodes easily.
SvE*:						
Sully	Severe: slope.	Severe: piping.	Not needed	Slope, erodes easily.	Erodes easily, slope.	Slope, erodes easily.
Sansarc	Severe: depth to rock, slope.	Severe: thin layer, hard to pack.	Not needed	Slope, slow intake, rooting depth.	Slope, depth to rock, percs slowly.	Slope, rooting depth, droughty.
Sw--- Swanboy	Slight	Severe: hard to pack.	Not needed	Slow intake, percs slowly.	Percs slowly, erodes easily.	Excess salt, percs slowly.
Sx*:						
Swanboy	Slight	Severe: hard to pack.	Not needed	Slow intake, percs slowly.	Percs slowly, erodes easily.	Excess salt, percs slowly.
Slickspots.						

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Wc---------- Wendte	Slight---------	Severe: hard to pack.	Not needed-----	Percs slowly, slow intake.	Not needed-----	Percs slowly.
Wd, Wf---------- Wendte	Slight---------	Severe: hard to pack.	Not needed-----	Floods, percs slowly, slow intake.	Not needed-----	Percs slowly.
WsE---------- Westover	Severe: seepage, slope.	Severe: seepage.	Not needed-----	Slope----------	Slope, too sandy.	Slope.
Wt---------- Witten	Slight---------	Severe: hard to pack.	Not needed-----	Slow intake, percs slowly, erodes easily.	Percs slowly---	Percs slowly, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AgA, AgB---------- Agar	0-8	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
	8-26	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	26-44	Silty clay loam, silt loam.	CL, ML	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
	44-60	Silt loam, silty clay loam, clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
AkA, AkB---------- Agar	0-6	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	100	95-100	90-100	30-45	5-20
	6-21	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	10-20
	21-33	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	10-20
	33-60	Silty clay, clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-50
CaA, CaB, CaC------ Canning	0-5	Loam------------	CL	A-4, A-6	0	100	100	85-100	50-90	30-40	8-15
	5-32	Clay loam, sandy clay loam.	ML, CL, SC	A-6, A-7	0	95-100	85-100	60-90	35-80	30-45	10-20
	32-60	Sand and gravel	SM, SM-SC, GM, GM-GC	A-1, A-2, A-3	0	40-100	30-80	15-70	5-30	<25	NP-5
Cc*: Carter------------	0-8	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	90-100	25-40	10-20
	8-23	Clay------------	CH, MH	A-7	0	100	100	90-100	90-100	60-90	25-50
	23-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	90-100	55-80	25-50
Hurley------------	0-3	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	3-60	Clay, shaly clay	CH, MH	A-7	0	100	100	95-100	80-100	50-90	20-55
ChB---------- Chantier	0-18	Clay, shaly clay	CH, MH	A-7	0	100	100	95-100	85-100	65-85	30-50
	18-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	65-105	40-80
CsC*: Chantier----------	0-18	Clay, shaly clay	CH, MH	A-7	0	100	100	95-100	85-100	65-85	30-50
	18-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	65-105	40-80
Sansarc----------	0-4	Clay------------	CH, MH	A-7	0	100	95-100	90-100	75-100	50-90	20-55
	4-14	Shaly clay, very shaly clay, clay.	CH, MH	A-7	0	80-100	75-100	75-100	75-100	50-90	20-55
	14-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
CwB*: Chantier----------	0-18	Clay, shaly clay	CH, MH	A-7	0	100	100	95-100	85-100	65-85	30-50
	18-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	65-105	40-80
Swanboy----------	0-10	Clay------------	CH, MH	A-7	0	100	100	90-100	80-100	50-100	20-60
	10-60	Clay------------	CH, MH	A-7	0	100	100	90-100	80-100	50-100	20-60

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Do---------- Dorna	0-15	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	15-24	Silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	24-60	Silty clay, clay, silty clay loam.	CH, MH, CL, ML	A-7	0	100	100	90-100	80-100	40-75	15-40
Ho---------- Hoven	0-2	Silt loam-------	ML, CL	A-4, A-6, A-7	0	100	100	90-100	75-95	27-45	5-20
	2-32	Silty clay, clay, clay loam.	CH, MH, CL	A-7	0	100	95-100	95-100	80-100	45-80	20-45
	32-60	Silty clay, clay, clay loam.	CL, CH	A-6, A-7	0	95-100	90-100	80-100	60-100	35-75	11-45
HrA---------- Hurley	0-3	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	3-60	Clay, shaly clay	CH, MH	A-7	0	100	100	95-100	80-100	50-90	20-55
Hs*: Hurley----------	0-3	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	3-60	Clay, shaly clay	CH, MH	A-7	0	100	100	95-100	80-100	50-90	20-55
Slickspots.											
In---------- Inavale	0-7	Fine sand-------	SM, SP-SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	7-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	100	70-90	5-30	<25	NP-5
KeA, KeB---------- Kirley	0-8	Loam----------	CL	A-4, A-6	0	100	95-100	85-100	65-80	25-40	8-15
	8-31	Clay, clay loam, sandy clay.	CL, CH	A-6, A-7	0	100	90-100	85-100	60-80	35-60	15-35
	31-52	Clay loam, clay	CL, CH, ML, MH	A-6, A-7	0	100	90-100	85-100	55-85	35-55	10-30
	52-60	Loam, clay loam	CL, ML	A-4, A-6, A-7	0	100	90-100	85-100	50-75	30-45	8-15
Ko---------- Kolls	0-12	Clay----------	CH, MH	A-7	0	100	100	95-100	85-100	50-90	25-50
	12-60	Clay----------	CH, MH	A-7	0	100	100	95-100	85-100	50-90	25-60
LaB, LaC---------- Lakoma	0-29	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	29-60	Weathered bedrock.	CH, MH	A-7	0	95-100	85-100	85-100	85-100	50-100	25-65
LkD*: Lakoma----------	0-29	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	29-60	Weathered bedrock.	CH, MH	A-7	0	95-100	85-100	85-100	85-100	50-100	25-65
Okaton----------	0-15	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	15-60	Weathered bedrock.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-100	20-65
LoA, LoB, LoC------ Lowry	0-14	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	80-100	25-40	5-15
	14-60	Silt loam, loam, very fine sandy loam.	ML, CL	A-4	0	100	100	95-100	70-100	25-40	NP-10
McA, McB---------- McClure	0-9	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-100	25-40	5-15
	9-24	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-60	15-35
	24-60	Silty clay, clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-50

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MoA, MoB---------- Millboro	0-8	Silty clay loam	CL, CH	A-7	0	100	100	90-100	75-100	40-60	15-35
	8-18	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-80	20-50
	18-60	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-80	20-50
Mu*:											
Munjor----------	0-6	Fine sandy loam	SM, SC, ML, CL	A-2-4, A-4	0	100	95-100	65-100	30-75	15-30	NP-10
	6-60	Fine sandy loam, loam, loamy fine sand.	SM, SC, ML, CL	A-2-4, A-4	0	100	95-100	65-100	30-65	15-30	3-10
Inavale----------	0-7	Fine sand-------	SM, SP-SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	7-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	100	70-90	5-30	<25	NP-5
Nb---------- Nimbro	0-8	Silty clay loam	ML, CL	A-6, A-7	0	100	100	95-100	85-100	30-50	11-20
	8-60	Stratified loam to silty clay loam.	CL	A-6, A-7	0	90-100	90-100	80-100	70-95	30-45	11-20
OkE*:											
Okaton----------	0-15	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	15-60	Weathered bedrock.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-100	20-65
Lakoma----------	0-29	Clay, shaly clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-85	20-50
	29-60	Weathered bedrock.	CH, MH	A-7	0	95-100	85-100	85-100	85-100	50-100	25-65
OpA, OpB, OpC------ Opal	0-4	Clay----------	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	4-18	Clay----------	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	18-33	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	80-100	50-85	25-60
	33-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
OtB*, OtC*:											
Opal----------	0-4	Clay----------	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	4-18	Clay----------	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	18-33	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	80-100	50-85	25-60
	33-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
Chantier----------	0-18	Clay, shaly clay	CH, MH	A-7	0	100	100	95-100	85-100	65-85	30-50
	18-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	65-105	40-80
OxB*:											
Opal----------	0-4	Clay----------	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	4-18	Clay----------	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	18-33	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	80-100	50-85	25-60
	33-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
Promise----------	0-8	Clay----------	CH, MH	A-7	0	100	100	90-100	80-100	50-70	20-40
	8-36	Clay----------	CH, MH	A-7	0	100	100	90-100	85-100	50-85	20-50
	36-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-85	25-55
Pg*. Pits											
PrA, PrB, PrC------ Promise	0-8	Clay----------	CH, MH	A-7	0	100	100	90-100	80-100	50-70	20-40
	8-36	Clay----------	CH, MH	A-7	0	100	100	90-100	85-100	50-85	20-50
	36-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-85	25-55

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ps*:											
Promise	0-8	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-70	20-40
	8-36	Clay	CH, MH	A-7	0	100	100	90-100	85-100	50-85	20-50
	36-60	Clay, silty clay	CH, MH	A-7	0	100	100	90-100	85-100	50-85	25-55
Hurley	0-3	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	3-60	Clay, shaly clay	CH, MH	A-7	0	100	100	95-100	80-100	50-90	20-55
ReA, ReB, ReC	0-5	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	70-95	25-40	5-15
Ree	5-27	Clay loam, sandy clay loam, silty clay loam.	CL	A-6, A-7	0	100	90-100	70-100	65-85	30-45	10-20
	27-60	Sandy loam, loam, clay loam.	CL, CL-ML, SM-SC, SC	A-4, A-6	0	100	85-100	70-100	35-85	25-40	5-20
Rs*:											
Rock outcrop.											
Sansarc	0-4	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	50-90	20-55
	4-14	Shaly clay, very shaly clay, clay.	CH, MH	A-7	0	80-100	75-100	75-100	75-100	50-90	20-55
	14-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
SaE	0-4	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	50-90	20-55
Sansarc	4-14	Shaly clay, very shaly clay, clay.	CH, MH	A-7	0	80-100	75-100	75-100	75-100	50-90	20-55
	14-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
ScD*, ScE*:											
Sansarc	0-4	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	50-90	20-55
	4-14	Shaly clay, very shaly clay, clay.	CH, MH	A-7	0	80-100	75-100	75-100	75-100	50-90	20-55
	14-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
Opal	0-4	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	4-18	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-80	20-45
	18-33	Clay, shaly clay	CH	A-7	0	100	95-100	90-100	80-100	50-85	25-60
	33-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
Sd*:											
Sansarc	0-4	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	50-90	20-55
	4-14	Shaly clay, very shaly clay, clay.	CH, MH	A-7	0	80-100	75-100	75-100	75-100	50-90	20-55
	14-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
Rock outcrop.											
ShE	0-7	Gravelly loam	SM, SW-SM, GM, GW-GM	A-2, A-1	0-5	55-90	40-75	30-60	10-35	<25	NP-5
Schamber	7-60	Gravelly sand, very gravelly sand, gravelly sandy loam.	SW, SW-SM, GW, GW-GM	A-1	0-15	30-60	15-40	5-20	0-10	<25	NP-5

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SmD*, SmE*:											
Schamber	0-7	Gravelly loam	SM, SW-SM, GM, GW-GM	A-2, A-1	0-5	55-90	40-75	30-60	10-35	<25	NP-5
	7-60	Gravelly sand, very gravelly sand, gravelly sandy loam.	SW, SW-SM, GW, GW-GM	A-1	0-15	30-60	15-40	5-20	0-10	<25	NP-5
Murdo	0-15	Loam, clay loam	CL, SC, CL-ML, SM-SC	A-2, A-4, A-6	0	90-100	60-90	50-80	30-70	25-40	5-20
	15-60	Sand and gravel	GP, GM, SP, SM	A-1, A-2	0	40-80	10-55	5-45	0-30	<25	NP-5
SuC, SuE	0-4	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	3-15
Sully	4-60	Silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	20-40	5-15
SvE*:											
Sully	0-4	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	3-15
	4-60	Silt loam, very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	20-40	5-15
Sansarc	0-4	Clay	CH, MH	A-7	0	100	95-100	90-100	75-100	50-90	20-55
	4-14	Shaly clay, very shaly clay, clay.	CH, MH	A-7	0	80-100	75-100	75-100	75-100	50-90	20-55
	14-60	Weathered bedrock.	CH	A-7	0	100	95-100	90-100	85-100	50-95	25-65
Sw	0-10	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-100	20-60
Swanboy	10-60	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-100	20-60
Sx*:											
Swanboy	0-10	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-100	20-60
	10-60	Clay	CH, MH	A-7	0	100	100	90-100	80-100	50-100	20-60
Slickspots.											
Wc, Wd, Wf	0-6	Clay	CH, MH	A-7	0	100	100	90-100	85-100	50-80	20-45
Wendte	6-60	Stratified silty clay loam to clay.	CL, CH	A-7	0	100	100	90-100	70-100	45-80	20-45
WsE	0-12	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	65-80	20-40	5-15
Westover	12-36	Loam, fine sandy loam, gravelly loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0	100	85-100	70-90	45-80	15-30	5-15
	36-60	Sand and gravel	SM, GM, GP-GM, SP-SM	A-1, A-2, A-3	0-5	40-80	25-75	15-70	5-30	<20	NP-5
Wt	0-8	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	90-100	50-80	20-50
Witten	8-25	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	90-100	50-85	20-55
	25-60	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	90-100	50-80	20-50

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
AgA, AgB--------- Agar	0-8 8-26 26-44 44-60	0.6-2.0 0.6-2.0 0.6-2.0 0.6-2.0	0.19-0.22 0.17-0.22 0.17-0.20 0.17-0.20	6.1-7.3 6.6-7.8 7.4-8.4 7.4-9.0	<2 <2 <2 <2	Moderate Moderate Low------- Low-------	0.32 0.43 0.43 0.43	5	6
AkA, AkB--------- Agar	0-6 6-21 21-33 33-60	0.6-2.0 0.6-2.0 0.2-0.6 0.06-0.2	0.19-0.22 0.17-0.22 0.17-0.22 0.08-0.16	6.1-7.3 6.6-7.8 7.4-8.4 7.4-8.4	<2 <2 <2 <2	Moderate Moderate Moderate High------	0.32 0.32 0.32 0.32	5	6
CaA, CaB, CaC---- Canning	0-5 5-32 32-60	0.6-2.0 0.6-2.0 6.0-20	0.18-0.22 0.17-0.20 0.03-0.06	6.1-7.3 6.6-8.4 7.4-8.4	<2 <2 <2	Moderate Moderate Low-------	0.28 0.28 0.10	4	6
Cc*: Carter---------- Hurley----------	0-8 8-23 23-60 0-3 3-60	0.6-2.0 <0.06 <0.2 0.6-2.0 <0.06	0.19-0.22 0.08-0.14 0.08-0.12 0.19-0.22 0.05-0.13	6.1-7.3 6.6-8.4 7.4-8.4 6.1-7.3 7.4-9.0	<2 2-8 2-8 <2 4-16	Moderate Very high Very high Moderate Very high	0.37 0.37 0.37 0.43 0.43	3 1	6 6
ChB-------------- Chantier	0-18 18-60	<0.06 ---	0.08-0.12 ---	7.4-9.0 5.6-8.4	4-16 <2	Very high Very high	0.37 ----	2	4
CsC*: Chantier-------- Sansarc---------	0-18 18-60 0-4 4-14 14-60	<0.06 --- 0.06-0.2 0.06-0.2 ---	0.08-0.12 --- 0.08-0.12 0.08-0.12 ---	7.4-9.0 5.6-8.4 6.6-8.4 7.4-8.4 5.6-8.4	4-16 <2 <2 <2 ---	Very high Very high Very high Very high Very high	0.37 ---- 0.37 0.37 ----	2 2	4 4
CwB*: Chantier-------- Swanboy---------	0-18 18-60 0-10 10-60	<0.06 --- <0.06 <0.06	0.08-0.12 --- 0.08-0.12 0.05-0.12	7.4-9.0 5.6-8.4 6.6-9.0 6.6-9.0	4-16 <2 <2 2-10	Very high Very high Very high Very high	0.37 ---- 0.37 0.37	2 5	4 4
Do--------------- Dorna	0-15 15-24 24-60	0.6-2.0 0.6-2.0 0.06-0.2	0.19-0.22 0.15-0.20 0.11-0.17	6.6-7.8 7.4-8.4 7.9-8.4	<2 <2 2-4	Low------- Low------- High------	0.32 0.32 0.32	5	5
Ho--------------- Hoven	0-2 2-32 32-60	0.6-2.0 <0.06 <0.2	0.19-0.22 0.10-0.19 0.08-0.17	5.6-7.3 6.6-8.4 6.6-9.0	<2 4-16 4-16	Moderate High------ High------	0.37 0.37 0.37	1	8
HrA-------------- Hurley	0-3 3-60	0.6-2.0 <0.06	0.19-0.22 0.05-0.13	6.1-7.3 7.4-9.0	<2 4-16	Moderate Very high	0.43 0.43	1	6
Hs*: Hurley---------- Slickspots.	0-3 3-60	0.6-2.0 <0.06	0.19-0.22 0.05-0.13	6.1-7.3 7.4-9.0	<2 4-16	Moderate Very high	0.43 0.43	1	6
In--------------- Inavale	0-7 7-60	6.0-20 6.0-20	0.07-0.09 0.05-0.10	6.6-7.8 6.6-8.4	<2 <2	Low------- Low-------	0.17 0.17	5	1

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
KeA, KeB	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Moderate	0.32	5	6
Kirley	8-31	0.06-0.6	0.11-0.19	6.6-8.4	<2	High	0.32		
	31-52	0.2-2.0	0.11-0.18	7.4-8.4	<2	High	0.32		
	52-60	0.2-2.0	0.14-0.17	7.4-8.4	<2	Moderate	0.32		
Ko	0-12	<0.06	0.10-0.14	7.4-8.4	<2	High	0.37	5	8
Kolls	12-60	<0.06	0.08-0.12	7.4-8.4	<2	High	0.37		
LaB, LaC	0-29	0.06-0.2	0.08-0.12	7.4-8.4	<2	High	0.37	4	4
Lakoma	29-60	---	---	7.4-8.4	<2	High	----		
LkD*:									
Lakoma	0-29	0.06-0.2	0.08-0.12	7.4-8.4	<2	High	0.37	4	4
	29-60	---	---	7.4-8.4	<2	High	----		
Okaton	0-15	0.06-0.2	0.11-0.16	7.4-8.4	<2	High	0.37	2	4
	15-60	---	---	7.4-8.4	<2	High	----		
LoA, LoB, LoC	0-14	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low	0.32	5	5
Lowry	14-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low	0.43		
McA, McB	0-9	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	6
McClure	9-24	0.2-0.6	0.11-0.19	6.6-8.4	<2	High	0.32		
	24-60	0.06-0.2	0.08-0.16	7.4-8.4	2-4	High	0.32		
MoA, MoB	0-8	0.06-0.2	0.13-0.19	6.6-7.8	<2	High	0.37	5	4
Millboro	8-18	0.06-0.2	0.08-0.16	6.6-7.8	<2	Very high	0.37		
	18-60	0.06-0.2	0.08-0.16	7.4-8.4	2-4	Very high	0.37		
Mu*:									
Munjor	0-6	2.0-6.0	0.14-0.20	7.4-8.4	<2	Low	0.24	5	3
	6-60	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low	0.24		
Inavale	0-7	6.0-20	0.07-0.09	6.6-7.8	<2	Low	0.17	5	1
	7-60	6.0-20	0.05-0.10	6.6-8.4	<2	Low	0.17		
Nb	0-8	0.6-2.0	0.19-0.22	7.4-8.4	<2	Moderate	0.28	5	7
Nimbro	8-60	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.28		
OkE*:									
Okaton	0-15	0.06-0.2	0.11-0.16	7.4-8.4	<2	High	0.37	2	4
	15-60	---	---	7.4-8.4	<2	High	----		
Lakoma	0-29	0.06-0.2	0.08-0.12	7.4-8.4	<2	High	0.37	4	4
	29-60	---	---	7.4-8.4	<2	High	----		
OpA, OpB, OpC	0-4	<0.06	0.10-0.14	6.6-7.8	<2	Very high	0.37	4	4
Opal	4-18	<0.06	0.08-0.14	7.4-8.4	<2	Very high	0.37		
	18-33	<0.06	0.08-0.12	7.4-8.4	2-4	Very high	0.37		
	33-60	---	---	6.6-8.4	<2	Very high	----		
OtB*, OtC*:									
Opal	0-4	<0.06	0.10-0.14	6.6-7.8	<2	Very high	0.37	4	4
	4-18	<0.06	0.08-0.14	7.4-8.4	<2	Very high	0.37		
	18-33	<0.06	0.08-0.12	7.4-8.4	2-4	Very high	0.37		
	33-60	---	---	6.6-8.4	<2	Very high	----		
Chantier	0-18	<0.06	0.08-0.12	7.4-9.0	4-16	Very high	0.37	2	4
	18-60	---	---	5.6-8.4	<2	Very high	----		
OxB*:									
Opal	0-4	<0.06	0.10-0.14	6.6-7.8	<2	Very high	0.37	4	4
	4-18	<0.06	0.08-0.14	7.4-8.4	<2	Very high	0.37		
	18-33	<0.06	0.08-0.12	7.4-8.4	2-4	Very high	0.37		
	33-60	---	---	6.6-8.4	<2	Very high	----		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
OxB*:									
Promise	0-8	<0.2	0.10-0.14	6.1-7.8	<2	Very high	0.37	5	4
	8-36	<0.2	0.08-0.14	7.4-9.0	<2	Very high	0.37		
	36-60	<0.2	0.10-0.12	7.4-9.0	2-4	Very high	0.37		
Pg*.									
Pits									
PrA, PrB, PrC	0-8	<0.2	0.10-0.14	6.1-7.8	<2	Very high	0.37	5	4
Promise	8-36	<0.2	0.08-0.14	7.4-9.0	<2	Very high	0.37		
	36-60	<0.2	0.10-0.12	7.4-9.0	2-4	Very high	0.37		
Ps*:									
Promise	0-8	<0.2	0.10-0.14	6.1-7.8	<2	Very high	0.37	5	4
	8-36	<0.2	0.08-0.14	7.4-9.0	<2	Very high	0.37		
	36-60	<0.2	0.10-0.12	7.4-9.0	2-4	Very high	0.37		
Hurley	0-3	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.43	1	6
	3-60	<0.06	0.05-0.13	7.4-9.0	4-16	Very high	0.43		
ReA, ReB, ReC	0-5	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.28	5	6
Ree	5-27	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.28		
	27-60	0.6-2.0	0.09-0.20	7.4-8.4	<2	Low	0.28		
Rs*:									
Rock outcrop.									
Sansarc	0-4	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4
	4-14	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37		
	14-60	---	---	5.6-8.4	---	Very high	----		
SaE	0-4	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4
Sansarc	4-14	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37		
	14-60	---	---	5.6-8.4	---	Very high	----		
ScD*, ScE*:									
Sansarc	0-4	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4
	4-14	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37		
	14-60	---	---	5.6-8.4	---	Very high	----		
Opal	0-4	<0.06	0.10-0.14	6.6-7.8	<2	Very high	0.37	4	4
	4-18	<0.06	0.08-0.14	7.4-8.4	<2	Very high	0.37		
	18-33	<0.06	0.08-0.12	7.4-8.4	2-4	Very high	0.37		
	33-60	---	---	6.6-8.4	<2	Very high	----		
Sd*:									
Sansarc	0-4	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4
	4-14	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37		
	14-60	---	---	5.6-8.4	---	Very high	----		
Rock outcrop.									
ShE	0-7	>6.0	0.03-0.06	6.6-8.4	<2	Low	0.17	2	6
Schamber	7-60	>6.0	0.03-0.06	7.4-8.4	<2	Low	0.10		
SmD*, SmE*:									
Schamber	0-7	>6.0	0.03-0.06	6.6-8.4	<2	Low	0.17	2	6
	7-60	>6.0	0.03-0.06	7.4-8.4	<2	Low	0.10		
Murdo	0-15	0.6-6.0	0.17-0.22	6.1-7.8	<2	Low	0.24	2	6
	15-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10		
SuC, SuE	0-3	0.6-2.0	0.17-0.22	6.6-7.8	<2	Low	0.43	5	4L
Sully	3-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low	0.43		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
SvE*:									
Sully	0-3	0.6-2.0	0.17-0.22	6.6-7.8	<2	Low	0.43	5	4L
	3-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low	0.43		
Sansarc	0-4	0.06-0.2	0.08-0.12	6.6-8.4	<2	Very high	0.37	2	4
	4-14	0.06-0.2	0.08-0.12	7.4-8.4	<2	Very high	0.37		
	14-60	---	---	5.6-8.4	---	Very high	----		
Sw	0-10	<0.06	0.08-0.12	6.6-9.0	<2	Very high	0.37	5	4
Swanboy	10-60	<0.06	0.05-0.12	6.6-9.0	2-10	Very high	0.37		
Sx*:									
Swanboy	0-10	<0.06	0.08-0.12	6.6-9.0	<2	Very high	0.37	5	4
	10-60	<0.06	0.05-0.12	6.6-9.0	2-10	Very high	0.37		
Slickspots.									
Wc, Wd, Wf	0-6	0.06-0.2	0.13-0.18	7.4-8.4	<2	High	0.28	5	4
Wendte	6-60	0.06-0.2	0.11-0.17	7.4-8.4	<2	High	0.28		
WsE	0-12	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low	0.32	4	6
Westover	12-36	0.6-2.0	0.09-0.18	7.4-8.4	<2	Low	0.32		
	36-60	6.0-20	0.03-0.10	7.4-8.4	<2	Low	0.10		
Wt	0-8	0.06-0.2	0.10-0.14	6.6-7.8	<2	Very high	0.37	5	4
Witten	8-25	0.06-0.2	0.10-0.14	6.6-7.8	<2	Very high	0.37		
	25-60	0.06-0.2	0.08-0.12	7.4-8.4	2-4	Very high	0.37		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the text explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AgA, AgB, AkA, AkB---------- Agar	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
CaA, CaB, CaC----- Canning	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
Cc*: Carter----------	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Hurley----------	D	None--------	---	---	>6.0	---	---	>40	Soft	Low------	High-----	Moderate.
ChB---------- Chantier	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Moderate.
CsC*: Chantier---------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Moderate.
Sansarc----------	D	None--------	---	---	>6.0	---	---	4-20	Soft	Low------	High-----	Moderate.
CwB*: Chantier---------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Moderate.
Swanboy----------	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.
Do---------- Dorna	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Ho**---------- Hoven	D	Frequent----	Very long	Mar-Jul	+.5-1.5	Perched	Mar-Jul	>60	---	Moderate	High-----	Moderate.
HrA---------- Hurley	D	None--------	---	---	>6.0	---	---	>40	Soft	Low------	High-----	Moderate.
Hs*: Hurley----------	D	None--------	---	---	>6.0	---	---	>40	Soft	Low------	High-----	Moderate.
Slickspots.												
In---------- Inavale	A	None--------	---	---	4.0-6.0	Aparent	Jan-Dec	>60	---	Low------	High-----	Low.
KeA, KeB---------- Kirley	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Ko**---------- Kolls	D	Frequent----	Very long	Mar-Jun	+.5-1.5	Perched	Apr-Jun	>60	---	Moderate	High-----	Moderate.
LaB, LaC---------- Lakoma	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Moderate.

See footnotes at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
LkD*:												
Lakoma	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Okaton	D	None	---	---	>6.0	---	---	8-20	Soft	Low	High	Moderate.
LoA, LoB, LoC----- Lowry	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
McA, McB---------- McClure	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
MoA, MoB---------- Millboro	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
Mu*:												
Munjor	B	None	---	---	4.0-6.0	Apparent	Jan-Dec	>60	---	Low	Low	Low.
Inavale	A	None	---	---	4.0-6.0	Apparent	Jan-Dec	>60	---	Low	High	Low.
Nb---------- Nimbro	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
OkE*:												
Okaton	D	None	---	---	>6.0	---	---	8-20	Soft	Low	High	Moderate.
Lakoma	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
OpA, OpB, OpC----- Opal	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
OtB*, OtC*:												
Opal	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Chantier	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Moderate.
OxB*:												
Opal	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Promise	D	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Pg*. Pits												
PrA, PrB, PrC----- Promise	D	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Ps*:												
Promise	D	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Hurley	D	None	---	---	>6.0	---	---	>40	Soft	Low	High	Moderate.
ReA, ReB, ReC----- Ree	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.

See footnotes at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Rs*:												
Rock outcrop.												
Sansarc	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
SaE Sansarc	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
ScD*, ScE*:												
Sansarc	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
Opal	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
Sd*:												
Sansarc	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
Rock outcrop.												
ShE Schamber	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
SmD*, SmE*:												
Schamber	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Murdo	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
SuC, SuE Sully	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
SvE*:												
Sully	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Sansarc	D	None	---	---	>6.0	---	---	4-20	Soft	Low	High	Moderate.
Sw Swanboy	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.
Sx*:												
Swanboy	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.
Slickspots.												
Wc Wendte	D	Rare	---	---	>6.0	---	---	>60	---	Low	High	Low.
Wd Wendte	D	Frequent	Brief	Apr-Oct	>6.0	---	---	>60	---	Low	High	Low.
Wf Wendte	D	Frequent	Brief	Apr-Oct	>6.0	---	---	>60	---	Low	High	Low.
WsE Westover	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.

See footnotes at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Wt---------- Witten	D	Occasional	Very brief	Apr-Jun	>6.0	---	---	>60	---	Moderate	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

** A plus sign in the column showing depth to the water table indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water is above the surface. The second numeral indicates the depth below the surface.

TABLE 16.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available]

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution							Liquid limit	Plasticity index	Moisture density	
			Percentage passing sieve				Percentage smaller than--						
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Maximum density	Optimum moisture
										Pct	Lb/ ft3		Pct
Chantier clay:[1] (S67SD-058-001)													
B2------ 2 to 7	A-7-5(44)	MH	100	100	100	97	--	74	--	72	36	91	27
Cr------ 18 to 60	A-7-5(76)	CH	100	100	99	98	--	78	--	103	62	88	29
Millboro silty clay loam:[2] (S67SD-058-022)													
B21t----- 9 to 17	A-7-5(25)	MH	100	100	100	98	--	46	--	52	20	95	22
C1-------24 to 36	A-7-6(25)	ML-MH	100	100	100	98	--	48	--	50	21	101	20
Promise clay:[3] (S67SD-058-004)													
B2------ 8 to 16	A-7-5(34)	MH	100	100	99	95	--	66	--	63	29	92	26
C2cs---- 36 to 47	A-7-5(37)	CH	100	100	100	96	--	68	--	63	32	92	27
Swanboy clay:[4] (S64SD-058-003)													
B22----- 5 to 10	A-7-5(52)	CH	100	100	99	98	--	70	--	78	43	87	28
C1cs---- 10 to 40	A-7-5(52)	CH	100	99	97	95	--	72	--	81	45	87	29

[1]Chantier clay: 850 feet west and 50 feet north of a fence extending from the southeast corner of sec. 8, T. 5 N., R. 30 E.

[2]Millboro silty clay loam: 525 feet southeast along Angling Road and 225 feet east of a road along the north section line in NE1/4 sec. 13, T. 5 N., R. 30 E.

[3]Promise clay: 960 feet north and 52 feet east of a fence extending from the southwest corner of sec. 14, T. 5 N., R. 26 E.

[4]Swanboy clay: From Powell Creek, .25 mile northeast along Bad River Road and 50 feet northwest of the road, sec. 14, T. 4 N., R. 30 E.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Agar	Fine-silty, mixed, mesic Typic Argiustolls
Canning	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiustolls
Carter	Very fine, montmorillonitic, mesic Vertic Paleustolls
Chantier	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Dorna	Coarse-silty over clayey, mixed, mesic Fluventic Haplustolls
Hoven	Fine, montmorillonitic, mesic Typic Natraquolls
Hurley	Very fine, montmorillonitic, mesic Leptic Natrustolls
Inavale	Sandy, mixed, mesic Typic Ustifluvents
Kirley	Fine, montmorillonitic, mesic Typic Argiustolls
Kolls	Very fine, montmorillonitic (calcareous), mesic Vertic Haplaquolls
Lakoma	Fine, montmorillonitic, mesic Typic Ustochrepts
Lowry	Coarse-silty, mixed, mesic Typic Haplustolls
McClure	Fine, montmorillonitic, mesic Typic Argiustolls
Millboro	Fine, montmorillonitic, mesic Vertic Argiustolls
Munjor	Coarse-loamy, mixed (calcareous), mesic Typic Ustifluvents
Murdo	Loamy-skeletal, mixed, mesic Aridic Argiustolls
Nimbro	Fine-loamy, mixed (calcareous), mesic Mollic Ustifluvents
Okaton	Clayey, montmorillonitic (calcareous), mesic, shallow Typic Ustorthents
Opal	Very fine, montmorillonitic, mesic Vertic Haplustolls
Promise	Very fine, montmorillonitic, mesic Vertic Haplustolls
Ree	Fine-loamy, mixed, mesic Typic Argiustolls
Sansarc	Clayey, montmorillonitic (calcareous), mesic, shallow Typic Ustorthents
Schamber	Sandy-skeletal, mixed, mesic Ustic Torriorthents
Sully	Coarse-silty, mixed (calcareous), mesic Typic Ustorthents
Swanboy	Very fine, montmorillonitic, mesic Ustertic Camborthids
Wendte	Fine, montmorillonitic (calcareous), mesic Vertic Ustifluvents
Westover	Coarse-loamy, mixed (calcareous), mesic Typic Ustorthents
Witten	Fine, montmorillonitic, mesic Vertic Argiustolls

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