Foreword

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

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

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

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

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

Amos I. Garrison, Jr.
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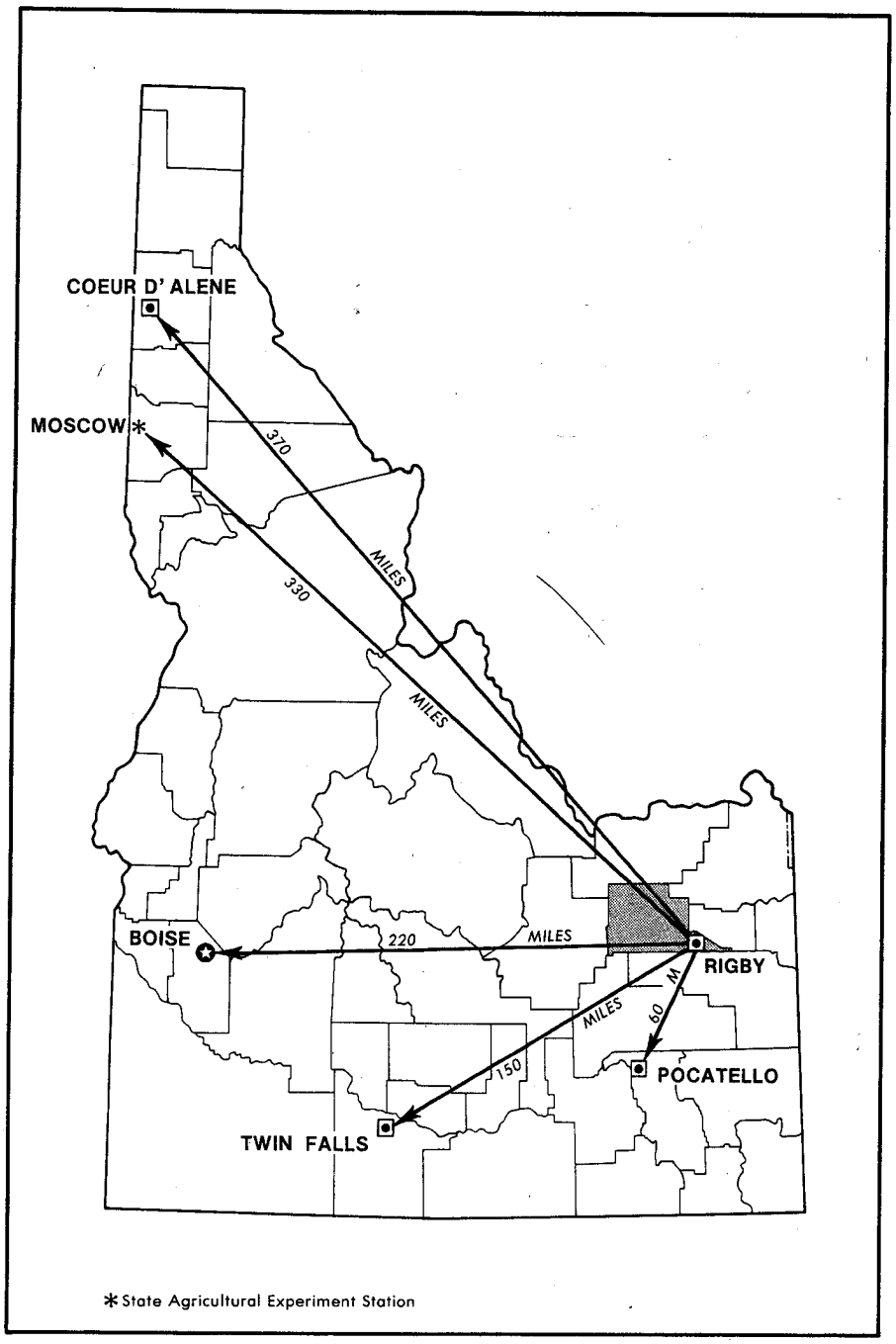

Location of Jefferson County in Idaho.

SOIL SURVEY OF JEFFERSON COUNTY, IDAHO

By Wendell Jorgensen, Soil Conservation Service

Fieldwork by Wendell Jorgensen, Harley R. Noe, and D. Max Daniels,
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United States Department of Agriculture, Soil Conservation Service,
in cooperation with University of Idaho, College of Agriculture and
Idaho Agricultural Experiment Station; Board of Commissioners,
Jefferson County; and United States Department of the Interior,
Bureau of Land Management

JEFFERSON COUNTY is in the eastern part of Idaho. Rigby, the county seat, has a population of 2,997. The county has a total area of 1,089 square miles, or 696,960 acres. About 296,000 acres is irrigated, and most of the rest of the acreage is rangeland.

Elevation of most of the county ranges from about 4,780 feet, at Mud Lake, to about 5,200 feet, in the higher lava-covered areas. A small area east of Heise is at an elevation of 6,469 feet.

About half of the county is covered by a lava flow overlain by a thin mantle of soil. Most of the rest of the county is covered by water deposited materials. The area around Mud Lake and northwest of Roberts is covered mostly by lake sediment. The area that extends from Roberts to Ririe is covered mostly by alluvium from the Snake River. The northwestern part of the county is also covered by alluvium.

General nature of the county

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

Settlement

In December 1832, Captain Bonneville and a group of trappers came through what is now Jefferson County on their way to see the Three Buttes. In 1860 Richard Leigh, a trapper famous in this area, moved into the county. In October 1868, W. J. Adams opened a stage station at Market Lake, which is now Roberts. For many years Market Lake was the hub of activity in this general area.

In 1873 Oliver Buck, who lived in what is now known as Menan, was one of the first men to attempt farming. The main railroad line to Butte was completed in the early 1880's. It was extended to Rigby in the fall of 1901. Potatoes, the first produce shipped out of Rigby by rail, were shipped in October 1901.

Farmers originally obtained their lands in the Rigby and Roberts areas through the Homestead Act. Mud Lake land was opened to settlers through the Carey Act. The first farming was by irrigation. The earliest water right was issued in 1881.

Idaho became a state in 1890. Jefferson County was organized in 1913. It was originally a part of Bannock County, then of Bingham County, and then of Fremont County. The population was 9,441 in 1920. Since that time the population has gradually increased to its present level of 12,500.

Rigby is the largest town. Other towns are Hamer, Menan, Mud Lake, Lewisville, Ririe, and Roberts. Camas was a thriving town during the early history of the county, but now it has only a few residents.

Natural resources

Soil and water are the most important natural resources in the county. Crops produced on farms and livestock that graze the grassland are marketable products that are derived from soil and water.

In most of the county, water is adequate for all farm and ranch uses. The Snake River, in the Rigby area, and Camas Creek, in the Mud Lake area, provide water for much of the canal system. Sufficient underground water exists in most areas to provide water for arable soils where there is no access to streams.

The limited amount of industry in the county is all connected with farming and ranching.

Farming

The first settlers in Jefferson County were trappers. Ranchers and farmers arrived shortly afterward. Because of the sparse rainfall, all farming required irrigation. This was done in the eastern part of the county by diverting

water from the Snake River. Originally the rise and fall of the river made diversion of water difficult. Between 1895 and 1900, the Great Feeder Canal system, a system for diverting Snake River water for farming purposes, was completed. Except in rare years, water has always been abundant and no natural disasters have interfered with farming. The Mud Lake area was developed by irrigating from Camas Creek, by pumping from Mud Lake, and by pumping from wells. In 1929, 300 wells were in production.

The completion of the railroad through Rigby in 1901 changed farming by making it possible to ship perishable produce. Because of the climate, potatoes was the only crop that was added. Before that time hay and grain were the only crops grown.

The enactment of the Soil Conservation District legislation in 1937 stirred the interest of many landowners by providing them with the opportunity to form organizations to solve their mutual problems. The three districts in the county were organized to aid the farmers in making more efficient use of irrigation water and to control soil erosion on the sandy soils.

The West Side Soil and Water Conservation District, which includes parts of both Jefferson and Bonneville Counties, was formed in August 1944. In Jefferson County it takes in the area around Roberts. The Mud Lake Soil and Water Conservation District, which covers the northern part of the county, was formed in June 1946. The Rigby area and the area in the southwestern part of the county were organized into the Jefferson Soil and Water Conservation District in April 1952.

The soils and climate in Jefferson County are suitable for many kinds of crops, including Irish potatoes, small grain, sugar beets, alfalfa, and pasture. Some corn is grown for silage.

The limitations for crop production that require special consideration are the short growing season, the hazards of soil blowing and water erosion, and the need to manage the available irrigation water.

Climate

By Kenneth A. Rice, climatologist for Idaho, National Weather Service, Department of Commerce

Jefferson County has a midlatitude, semiarid climate. Summers are warm and dry (3).

The county, which is mostly on the Snake River Plain, is one of the most uniformly level counties in Idaho. The climate therefore is relatively uniform throughout the county. The climatic data in tables 1 and 2 are based on records for Hamer and for a weather station formerly at Mud Lake. Data not recorded at Hamer or Mud Lake were extrapolated graphically using data for Idaho Falls, Dubois Experiment Station, and the Idaho National Engineering Laboratory.

Autumn is usually the most pleasant time of the year. Nights are cool, and days are warm. In summer, the days usually are hot but the nights usually are cool. The first freezing temperature often occurs by mid-September. Winters are cold, but recurring periods of sub-zero temperatures and snow accumulation are eased by the milder weather that occurs during periods when the wind blows persistently from the southwest. Occasionally during winter, an arctic airmass spills over the Continental Divide and covers all of Jefferson County. During these periods the sky clears and the wind subsides; subzero temperatures are likely at night, especially over snow-covered surfaces.

The daily range in temperature is greatest in summer. The range is considerably smaller in winter. Mean temperature ranges from 16.1 degrees F in January to 68.3 degrees in July. The growing season averages 119 days but ranges from 80 to 160 days.

Temperature extremes have ranged from -42 degrees, recorded at Mud Lake in January 1937, to 105 degrees, recorded at Hamer in July 1960. The number of days when the temperature is 90 degrees or above averages 18 per year, and the number of days when the temperature is 32 degrees or lower averages 190. Sub-zero temperatures occur on an average of 33 days per year. Frost depths of 2 to 3 feet are common in winter.

Annual precipitation averages about 8 inches. Although the greatest precipitation usually occurs in May and June, crops must be irrigated during these months and afterward. The wettest and windiest months occur in spring, when warming is gradual. Freezing temperatures at night are common through most of April. A sharp decrease in precipitation occurs in summer, when most rainfall comes in the form of local showers.

Records show that 39 percent of the total precipitation is received in spring, 22 percent in summer, 20 percent in fall, and 19 percent in winter. The wettest month is usually June, with an average of 1.35 inches, and the driest month is February, with an average of 0.41 inch. The greatest for any month was 4.22 inches at Hamer, recorded in August 1951; 8.26 inches at Dubois Experiment Station, recorded in June 1944; 4.15 inches at Idaho Falls Airport, recorded in June 1944; and 4.42 inches at the Idaho National Engineering Laboratory, recorded in May 1957. There have been several months when no precipitation was recorded.

Snowfall records for the county are sparse; however, during the 14 years that data were recorded at Hamer, seasonal snowfall ranged from 9.3 inches in 1960-61 to 56.2 inches in 1948-49. Precipitation extremes for 21 years at Hamer ranged from 4.66 inches in 1953 to 13.26 inches in 1963.

Relative humidity in summer, based on data recorded at Idaho Falls, averages only 25 to 30 percent late in the afternoon but rises to 65 to 75 percent early in the morning. In winter the average humidity is 70 to 80

percent in the afternoon and 80 to 90 percent early in the morning.

Annual evaporation from an open pan averages 40 to 55 inches, of which 80 percent or more occurs from May through October. Mean annual evaporation from lakes and reservoirs is estimated at 30 to 40 inches.

Winds at and near the surface are mainly from the south-southwest. The highest average windspeed occurs in March, April, and May; the lowest occurs in July, August, and September. A study by the Bonneville Power Administration indicates that, on the average, winds of 45 to 50 miles per hour, sustained for a period of 1 minute or longer, can be expected every other year; winds of about 60 miles per hour, 1 year in 10; and winds of 70 to 80 miles per hour, 1 year in 50.

The percentage of possible sunshine received from July to September at Idaho Falls Airport averages 80 to 85 percent of that possible. It drops to 20 to 25 percent in January. Clear days occur, on the average, 11 percent of the time in December and 51 percent of the time in September. Cloudy days are reported 65 percent of the time in December and 10 percent of the time in July.

How this survey was made

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

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories of soil classification most used in a local survey.

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

The areas shown on a soil map are called soil map units. On most maps detailed enough to be useful in planning the management of farms and fields, a map unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show. on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a named soil phase.

Some map units are made up of soils of different series, or of different phases within one series, and some have little or no soil. These kinds of map units are discussed in the section "Soil maps for detailed planning."

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

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

The soils in Jefferson County fall in narrow limits in regard to mean annual precipitation, mean annual soil temperature, and elevation. Elevations range from about 4,800 to 5,200 feet. The precipitation is about 8 inches, and the mean annual soil temperature ranges from about 41 to 46 degrees F. A very small mountainous area east of Heise rises to elevations of more than 6,400 feet and may receive an estimated precipitation of 14 inches.

General soil map for broad land use planning

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

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for gen-

eral kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

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

The general soil map at the back of this survey does not join, in all instances, with the general soil maps of adjacent counties. Differences in the maps have resulted from the differences in the occurrence of soil patterns and from recent advances in classification.

The soil map units in this survey have been grouped into three general kinds of landscape for broad interpretative purposes. Each of the broad groups and the soil map units in each group are described in the following pages. The terms for texture used in the title apply to the surface texture. For example, in describing the first map unit the words "medium textured and moderately coarse textured soils" refer to the surface texture.

Nearly level, well drained and moderately well drained soils

The soils in this group are mainly in the eastern, west-central, and northwestern parts of the county. They formed in alluvium and in lacustrine sediment. Most of the soils are mainly moderately deep and deep over sand and gravel, but some of the soils are shallow over sand and gravel and others are very deep over lacustrine sediment.

About 80 percent of the acreage is used for irrigated crops and pasture. The rest is used as range, for wildlife habitat, and for recreation. An additional 14 percent of the acreage could be cropped if water for irrigation were available.

Five map units are in this group. They make up about 40 percent of the survey area.

1. Whiteknob-Bereniceton-Lidy

Nearly level, well drained, very deep, medium textured and moderately coarse textured soils over gravel; on alluvial fans and basalt plains

The soils in this map unit formed in alluvium derived from mixed sources. This unit makes up about 5 percent of the survey area. It is about 40 percent Whiteknob soils, 25 percent Bereniceton soils, and 20 percent Lidy soils. Minor soils such as Matheson make up the remaining 15 percent.

Whiteknob soils typically have a surface layer of very pale brown gravelly loam about 5 inches thick. The upper part of the underlying material is very pale brown gravelly loam about 9 inches thick. The lower part to a depth of 60 inches or more is very pale brown very gravelly sandy loam and very gravelly sand.

Bereniceton soils typically have a surface layer of brown and pale brown loam about 7 inches thick. The underlying material to a depth of 60 inches is pale brown and very pale brown loam and clay loam.

Lidy soils typically have a surface layer of pale brown sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is light gray sandy loam 24 inches thick over sand and gravel.

About 45 percent of this unit is used for irrigated hay, small grain, potatoes, and pasture. The rest is used as range or as recreation areas. An additional 50 percent of the noncultivated part of this unit is also suitable for irrigation.

Irrigated areas of this unit have potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. The nonirrigated areas have potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

2. Annis-Blackfoot

Nearly level, moderately well drained, very deep, medium textured and moderately fine textured soils; on river terraces

The soils in this map unit formed in alluvium derived from mixed sources. The unit makes up about 6 percent of the survey area. It is about 35 percent Annis soils and 22 percent Blackfoot soils. Bannock, Heiseton, Labenzo, and Wardboro soils make up the remaining 43 percent.

Annis soils typically have a surface layer of grayish brown silty clay loam and silt loam about 12 inches thick. The subsoil is light brownish gray silt loam about 9 inches thick. The substratum to a depth of 60 inches or more is light brownish gray and gray silty clay loam 28 inches thick over light gray silt loam.

Blackfoot soils typically have a surface layer of grayish brown silt loam about 10 inches thick. The underlying material to a depth of 60 inches or more is stratified light brownish gray silty clay loam, silt loam, and sandy loam.

This unit is mostly used for irrigated crops such as hay, small grain, potatoes, sugar beets, and pasture. Some small areas along the Snake River are not cropped.

The soils in this unit are moderately or severely limited for septic tank filter fields because of wetness and slow permeability.

Irrigated areas of this unit have potential for providing habitat for ring-necked pheasant, mourning dove, and songbirds. Noncultivated areas also provide needed cover for these birds, and they also provide habitat for chipmunk, cottontail, birds of prey, and elk.

3. Bannock-Xeric Torrifluvents-Bockston

Nearly level, well drained, deep and very deep, medium textured and moderately coarse textured soils over gravel on river terraces

The soils in this map unit formed in alluvium derived from mixed sources. This unit makes up about 3 percent of the survey area. It is about 50 percent Bannock soils, 25 percent Xeric Torrifluvents, and 15 percent Bockston soils. The remaining 10 percent is Bereniceton, Paesl, and Wardboro soils.

Bannock soils typically have a surface layer of brown loam 11 inches thick. The upper part of the underlying material is light gray loam and sandy loam about 20 inches thick. The lower part to a depth of 60 inches or more is light gray very gravelly sand.

Xeric Torrifluvents are variable soils, but they commonly have a surface layer that is light brownish gray and pale brown gravelly sandy loam about 9 inches thick. The underlying material to a depth of 60 inches or more is brown gravelly sandy loam about 9 inches thick over sand and gravel.

Bockston soils typically have a surface layer of brown loam about 9 inches thick. The subsoil is pale brown silt loam about 12 inches thick. The substratum to a depth of 60 inches or more is light gray and light brownish gray silt loam and fine sandy loam about 17 inches thick over very gravelly fine sandy loam and very gravelly loamy sand.

This unit is used for irrigated crops such as hay, potatoes, small grain, sugar beets, and pasture.

This unit is suited to dwellings and for septic tank filter fields. Pollution of ground water in places is a hazard because of the very rapidly permeable, gravelly substratum. Most of the soils are a good source of gravel.

This map unit has potential for providing habitat for ring-necked pheasant, mourning dove, and songbirds.

4. Hayeston-Helseton-Blackfoot

Nearly level, moderately well drained and well drained, very deep, moderately coarse textured and medium textured soils; on river terraces and lakebeds

The soils in this map unit formed in alluvium derived from mixed sources. The unit makes up about 4 percent of the survey area. It is about 30 percent Hayeston soils, 30 percent Heiseton soils, 15 percent Blackfoot soils, and 15 percent Xeric Torrifluvents. The remaining 10 percent is Labenzo and Wardboro soils. All soils occur throughout areas of the map unit.

Hayeston soils typically have a surface layer of light brownish gray sandy loam about 7 inches thick. The upper part of the underlying material is light brownish gray sandy loam about 16 inches thick. The lower part is unconformable sand and gravel that extends to a depth of 60 inches or more. These soils are well drained.

Heiseton soils typically have a surface layer of grayish brown loam about 7 inches thick. The underlying material is light brownish gray and gray stratified sandy loam to silt loam about 43 inches thick over sand and gravel that extends to a depth of 60 inches or more. These soils are moderately well drained.

Blackfoot soils typically have a surface layer of grayish brown silt loam about 10 inches thick. The underlying material is light brownish gray stratified loam, silty clay loam, silt loam, and fine sandy loam that extends to a depth of 60 inches or more. These soils are moderately well drained.

About 80 percent of this unit is used for irrigated crops such as hay, potatoes, small grain, and pasture (fig. 1). Areas along the river are used as nonirrigated pasture.

The soils in this unit have potential for providing habitat for ring-necked pheasant, mourning dove, and songbirds. Shrubs planted along fence rows and in odd field corners provide additional protective cover.

5. Terreton

Nearly level, well drained, very deep, moderately fine textured soils; on old lakebeds

The soils in this map unit formed in lacustrine material derived from mixed sources. The unit makes up about 22 percent of the survey area. It is about 70 percent Terreton soils. The remaining 30 percent is Grassy Butte, Market, Montlid, and Zwiefel soils.

Terreton soils typically have a surface layer of light brownish gray silty clay loam 6 inches thick. The underlying material is light brownish gray and light gray clay and silty clay loam to a depth of 60 inches or more.

About 80 percent of this unit is used for irrigated crops such as hay, small grain, potatoes, and pasture. The rest is used as range or as National resource lands. An additional 15 percent of the acreage is suitable for irrigated crops.

The irrigated areas of this map unit have potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey.

The range and recreational areas have potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

Nearly level, very poorly drained soils

The soils in this group are mostly in the vicinity of Mud Lake and near the city of Roberts. The soils formed in very deep lacustrine sediment and some sandy eolian material.

About 97 percent of the acreage is used for nonirrigated pasture, and the rest is used for irrigated crops and pasture.

One map unit is in this group. It makes up about 3 percent of the survey area.

6. Levelton-Medano

Nearly level, very poorly drained, very deep, medium textured and moderately coarse textured soils; on old lakebeds

The soils in this map unit formed in lacustrine sediment derived from mixed sources and some eolian sandy material. The unit makes up about 3 percent of the survey area. It is about 65 percent Levelton soils and 15 percent Medano soils. The remaining 20 percent is Fluvaquents, Psammaquents, Grassy Butte, Terreton, and Zwiefel soils.

Levelton soils typically have a surface layer of white loam about 7 inches thick. The upper part of the underlying material is light gray silty clay about 30 inches thick. The lower part is stratified light brownish gray sandy loam to silty clay that extends to a depth of 60 inches or more.

Medano soils typically are overlain by a root mat 2 inches thick. The surface layer is grayish brown sandy loam about 6 inches thick. The upper part of the underlying material is grayish brown and dark grayish brown sandy clay loam and sandy loam about 10 inches thick. The lower part is brown and gray coarse sand and sand that extends to a depth of 60 inches or more. These soils are subject to flooding.

This unit is mostly within the boundaries of wildlife refuges. Some areas are grazed by livestock in spring and fall.

These soils are suited to waterfowl habitat. Migrating waterfowl stop to rest and feed in the refuges, and a good population of waterfowl nests here.

Nearly level to hilly, well drained and somewhat excessively drained soils

The soils in this group are generally in the northeastern and southwestern parts of the survey area. The soils formed in wind-deposited material over basalt lava flows. Most of the soils are moderately deep to very deep, but some are shallow. Areas of Rock outcrop are interspersed with the soils.

About 17 percent of the acreage is used for irrigated crops and pasture. The rest is used as range and for wildlife habitat and recreation. An additional 14 percent of the acreage could be cropped if water were available for irrigation.

Six map units are in this group. They make up about 57 percent of the survey area.

7. Grassy Butte-Matheson-Diston

Nearly level to rolling, well drained and somewhat excessively drained, very deep and moderately deep, coarse textured and moderately coarse textured soils; on basalt plains

The soils in this map unit formed in sandy eolian deposits. The topography is irregular because of the underlying basalt flows. This map unit makes up about 15 percent of the survey area. It is about 30 percent Grassy Butte soils, 20 percent Matheson soils, and 15 percent Diston soils. The remaining 35 percent is Bondfarm soils, Dune land, and Rock outcrop.

Grassy Butte soils typically have a grayish brown loamy sand surface layer about 7 inches thick. The underlying material is grayish brown and gray loamy sand to a depth of 60 inches or more. These soils are somewhat excessively drained.

Matheson soils typically have a surface layer of light brownish gray sandy loam about 10 inches thick. The underlying material is light brownish gray and light gray sandy loam to a depth of 60 inches or more. These soils are well drained.

Diston soils typically have a surface layer of grayish brown loamy sand about 5 inches thick. The upper part of the underlying material is light brownish gray and light gray loamy sand about 26 inches thick. The middle part is light gray loamy sand 18 inches thick over an indurated hardpan about 16 inches thick. The lower part is sand to a depth of 60 inches or more. These soils are somewhat excessively drained.

About 15 percent of this map unit is used for irrigated crops such as potatoes, small grain, and hay. The rest is used as range and for wildlife habitat and recreation. About 25 percent of this map unit could be cropped if water were available for irrigation.

Irrigated areas of this map unit have potential for providing habitat for ring-necked pheasant, coyote, songbirds, and birds of prey. Range areas have potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

8. Modkin-Bondranch-Rock outcrop

Nearly level to rolling, well drained, shallow and moderately deep, moderately coarse textured soils and Rock outcrop; on basalt plains

The soils in this map unit formed in a sandy eolian mantle over basalt lava flows. The unit makes up about 8 percent of the survey area. It is about 20 percent Modkin soils, 20 percent Bondranch soils, and 20 percent Rock outcrop. The remaining 40 percent is Bondfarm, Grassy Butte, Mathon, and Matheson soils.

Modkin soils typically have a surface layer of brown very stony sandy loam about 6 inches thick. The subsoil is brown and light brownish gray sandy loam 22 inches thick. The substratum is white sandy loam 4 inches thick. Basalt is at a depth of 32 inches.

Bondranch soils typically have a surface layer of light brownish gray sandy loam about 5 inches thick. The subsoil is pale brown sandy loam about 6 inches thick. The substratum is very pale brown sandy loam about 8 inches thick. Basalt is at a depth of 19 inches.

This unit is used mainly as range. The high percentage of Rock outcrop and the stones on the surface of the Modkin soils limit farming operations.

This unit has potential for producing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and various birds of prey.

9. Aecet-Bereniceton-Rock outcrop

Nearly level to gently rolling, well drained, moderately deep to very deep, medium textured and moderately coarse textured soils, and Rock outcrop; on basalt plains

The soils in this map unit formed in eolian deposits over irregular basalt lava flows. The map unit makes up about 11 percent of the survey area. It is about 25 percent Aecet soils, 20 percent Bereniceton soils, and 20 percent Rock outcrop. The remaining 35 percent is Bondfarm, Grassy Butte, Malm, Matheson, and Terreton soils.

Aecet soils typically have a surface layer of pale brown very stony sandy loam about 5 inches thick. The subsoil is pale brown clay loam about 8 inches thick. The substratum is very pale brown clay loam about 10 inches thick. Basalt is at a depth of 23 inches.

Bereniceton soils typically have a surface layer of brown and pale brown very stony sandy loam and very stony loam about 7 inches thick. The underlying material is pale brown loam and clay loam about 39 inches thick. Basalt is at a depth of 46 inches.

This unit is used as range and for wildlife habitat and recreation. The high percentage of Rock outcrop adversely affects the suitability of this map unit for farming.

This unit has potential for producing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

10. Matheson-Malm-Bereniceton

Nearly level to gently rolling, well drained, moderately deep to very deep, moderately coarse textured soils; on basalt plains

The soils in this map unit formed in eolian deposits over irregular basalt lava flows. The unit makes up about 6 percent of the survey area. It is about 40 percent Matheson soils, 20 percent Malm soils, and 15 percent Bereniceton soils. The remaining 25 percent is Aecet, Bondfarm, and Terreton soils and Rock outcrop.

Matheson soils typically have a surface layer of light brownish gray sandy loam about 10 inches thick. The underlying material is light brownish gray and light gray sandy loam to a depth of 60 inches or more.

Malm soils typically have a surface layer of brown sandy loam about 4 inches thick. The underlying material is pale brown and white sandy loam about 20 inches thick. Basalt is at a depth of 24 inches.

Bereniceton soils typically have a surface layer of brown and pale brown very stony sandy loam and very stony loam about 7 inches thick. The underlying material is pale brown and very pale brown loam and clay loam about 39 inches thick. Basalt is at a depth of 46 inches.

About 95 percent of this unit is used as range and for wildlife habitat and recreation. Some areas are used for irrigated crops, mainly hay, small grain, and pasture. An additional one-third of the unit could be cropped if water for irrigation were available.

Rangeland areas have potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

11. Malm-Rock outcrop-Bondfarm

Nearly level to gently rolling, well drained, shallow and moderately deep, moderately coarse textured soils, and Rock outcrop; on basalt plains

The soils in this map unit formed in eolian sandy deposits over irregular basalt lava flows. The unit makes up about 5 percent of the survey area. It is about 45 percent Malm soils, 30 percent Rock outcrop, and 20 percent Bondfarm soils. The remaining 5 percent is Grassy Butte and Matheson soils. The soils in the mountainous areas of this unit, in the northwest corner and in the eastern part of the county, have slopes of as much as 60 percent.

Malm soils typically have a surface layer of brown extremely stony sandy loam about 4 inches thick. The underlying material is pale brown and white sandy loam about 20 inches thick. Basalt is at a depth of 24 inches.

Bondfarm soils typically have a surface layer of light brownish gray sandy loam about 4 inches thick. The subsoil and substratum are very pale brown sandy loam 14 inches thick. Basalt is at a depth of 18 inches.

This unit is used as range and for wildlife habitat and recreation. Rock outcrop and moderate and shallow depth to bedrock limit the use of this unit for farming.

This unit has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

12. Pancheri

Nearly level to rolling, well drained, very deep, medium textured soils; on basalt plains

The soils in this map unit formed in deposits of eolian silt over irregular basalt flows. The unit makes up about 12 percent of the survey area. It is about 75 percent Pancheri soils. The remaining 25 percent is Bereniceton, Bondfarm, and Terreton soils and Rock outcrop. Rock outcrop occurs throughout the unit.

Pancheri soils typically have a surface layer of pale brown silt loam about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown, light gray, and very pale brown silt loam.

About 65 percent of this unit is used for irrigated crops such as potatoes, small grain, hay, sugar beets, and

pasture. An additional 20 percent could be cropped if water for irrigation were available.

Noncultivated areas of this map unit have potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use arid management of the soils."

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

This survey describes soils that were mapped at two levels of detail. The soils mapped in greater detail are called narrowly defined map units. Those mapped in lesser detail are called broadly defined map units. The boundaries of soil delineations of the narrowly defined map units were plotted and verified at closely spaced intervals. The boundaries of delineations of the broadly defined units were plotted and verified at greater intervals. The intensity of mapping selected for a given soil was based on the anticipated long-term use of the soil. The map units were designed to meet the needs for that use. The broadly defined units described in this section are identified on the soil legend, which immediately precedes the detailed soil maps, and in the tables by an asterisk.

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

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

Soils of one series can differ in texture of the surface layer or the substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a soil phase commonly indicates a feature that affects use or management. For example, Modkin loamy sand, 2 to 12 percent slopes, is one of several phases within the Modkin series.

Some map units are made up of two or more dominant kinds of soil. Such map units in this survey area are called soil complexes and undifferentiated groups.

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

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Minnewaukan soils is an undifferentiated group in this survey area.

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

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

The acreage and proportionate extent of each map unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions

1-Aecet-Rock outcrop complex. This complex is on basalt plains. Slope is 0 to 12 percent. The frost-free period is 80 to 115 days.

This complex is about 35 percent Aecet very stony sandy loam, 25 percent Rock outcrop, and 20 percent Bereniceton very stony sandy loam. The Aecet soil is on the sides of ridges and on convex side slopes, Rock outcrop is on the sides of ridges, and the Bereniceton

soil is on convex side slopes. Rock outcrop occurs in an intricate pattern throughout the complex.

Included with this complex in mapping is about 20 percent Bondfarm sandy loam, Aecet sandy clay loam, and Matheson sandy loam.

The Aecet soil is moderately deep and well drained. It formed in wind-laid deposits. Typically, the surface layer is pale brown very stony sandy loam about 5 inches thick. The subsoil is pale brown clay loam 8 inches thick. The substratum is very pale brown clay loam 10 inches thick over basalt. The soil is calcareous throughout. A layer of lime accumulation is at a depth of 13 inches.

Permeability of the Aecet soil is moderately slow. Effective rooting depth is 20 to 40 inches. Available water capacity is moderate. Surface runoff is slow or medium, and the hazard of erosion is slight to high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of shrubs, grasses, and forbs. Rock outcrop areas have little value for grazing.

The Bereniceton soil is deep and well drained. It formed in reworked wind-laid deposits over basalt. Typically, the surface layer is about 7 inches of brown very stony sandy loam over pale brown very stony loam. The upper part of the underlying material is pale brown loam 7 inches thick. The lower part is very pale brown clay loam 32 inches thick. Basalt is at a depth of 46 inches.

Permeability of this Bereniceton soil is moderately slow. Effective rooting depth is 40 to 60 inches. Available water capacity is high. Surface runoff is slow or medium, and the hazard of erosion is slight to high.

This complex is used as range, for wildlife habitat, and for recreation.

Where the range vegetation is in good or excellent condition, the dominant native grasses are bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, forbs, grasses, and woody plants increases.

This unit is used for livestock grazing mainly in spring and fall. Mechanical seeding or brush management is difficult because of areas of Rock outcrop and stones on the surface. Management practices suitable for use on this complex are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This unit has potential for producing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass Vlls, nonirrigated.

2-Annis silty clay loam. This very deep, moderately well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is grayish brown silty clay loam and silt loam 12 inches thick. The subsoil is light brownish gray silt loam 9 inches thick. The upper part of the substratum is light brownish gray and gray silty clay loam 28 inches thick. The lower part to a depth of 60 inches or more is light gray silt loam. The soil is calcareous and moderately alkaline throughout.

Included with this soil in mapping are small areas of Blackfoot silt loam and Annis loam, both of which have slopes of 0 to 1 percent.

Permeability of this Annis soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 3 and 5 feet.

This soil is used for irrigated hay, small grain, pasture, potatoes, and sugar beets (fig. 2).

A suitable cropping system is 4 years of alfalfa for hay, 1 or 2 years of potatoes or sugar beets, 1 year of wheat or barley, and then alfalfa seeded in spring with a grain nurse crop. The grain crop is harvested, and then the alfalfa is used for hay for 4 years. When grass and legume pasture is included in the cropping system, the period of use is 5 or 6 years followed by row crops or grain. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Most crops respond to nitrogen, and legumes respond to phosphate. Good tilth can be maintained by using crop residue and practicing minimum tillage. Furrow, border, and sprinkler irrigation systems are suited to this soil. Furrow irrigation is suited to row crops, border irrigation is suited to grain, hay, and pasture, and sprinkler irrigation is suited to all crops. Regardless of the irrigation method used, water should be applied carefully to avoid raising the water table so much that it affects crop production.

Russian-olive, golden willow, and Scotch pine are examples of trees that are suitable for use in windbreaks on this soil.

This soil has potential for producing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. Habitat for birds that obtain their food and shelter mainly in areas of cropland can be improved by planting shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide cover and protection from predators and inclement weather. Food should be close to shelter. Food crops also provide some cover. Capability subclass IIw, irrigated.

3-Annis silty clay loam, drained. This very deep, moderately well drained soil is on flood plains. It formed in alluvium derived from mixed sources. The frost-free period is 100 to 115 days. Slope is 0 to 1 percent.

Typically, the surface layer is grayish brown silty clay loam and silt loam 12 inches thick. The subsoil is light brownish gray silt loam 9 inches thick. The upper part of the substratum is light brownish gray and gray silty clay

loam 28 inches thick. The lower part to a depth of 60 inches or more is light gray silt loam.

Included with this soil in mapping are small areas of Blackfoot silt loam, Labenzo silt loam, and Annis silty clay loam. All included soils have slopes of 0 to 1 percent.

Permeability of this Annis soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 4 and 6 feet.

These soils are used for irrigated hay, pasture, small grain, sugar beets, and potatoes.

A suitable cropping system is 4 years of alfalfa for hay, 1 or 2 years of potatoes, 1 year of wheat or barley, and then alfalfa seeded in spring with a grain nurse crop. The grain crop is harvested, and the alfalfa is used for hay for 4 years. Where grass and legume pasture is used in the rotation, the period of use is 4 to 6 years followed by row crops or small grain. To maintain high production of crops, commercial fertilizer is needed in addition to manure and plant residue. Legumes generally respond to phosphate, and all crops respond to nitrogen. Border, sprinkler, and furrow irrigation systems. are suited to this soil. The irrigation system used depends on the crop grown. Sprinkler irrigation is suited to all crops. Careful irrigation is necessary to avoid raising the water table.

Russian-olive, golden willow, and Scotch pine are examples of trees that are suitable for use in windbreaks on this soil.

This soil has potential for producing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. The habitat can be improved by planting Siberian peashrub, European privet, and lilac along fence rows and ditchbanks, in odd field corners, or in windbreaks. These shrubs protect the birds from predators and inclement weather. Food plants provide some cover. Capability subclass IIc, irrigated.

4-Annis silty clay loam, moderately saline-alkali. This very deep, moderately well drained soil is on flood plains. It formed in mixed alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free period is 100 to 115 days.

Typically, the surface layer is grayish brown silty clay loam and silt loam about 12 inches thick. The subsoil is light brownish gray silt loam 9 inches thick. The upper part of the substratum is light brownish gray and gray silty clay loam 28 inches thick. The lower part to a depth of 60 inches or more is light gray silt loam.

Included with this soil in mapping are small areas of Blackfoot silt loam, 0 to 1 percent slopes.

Permeability of this Annis soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight. The water table fluctuates between depths of 3.5 and 5 feet.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. Crop yields are reduced because of the saline-alkali condition.

A suitable cropping system is 4 years of alfalfa hay, 1 year of beets or potatoes, and 1 year of barley with a seeding of alfalfa. Grass and legume pasture can be used in place of alfalfa for 5 to 6 years. Pasture is followed by grain, and then row crops are grown. Minimum tillage should be used. To maintain high production of crops, commercial fertilizer is needed in addition to manure and crop residue. Most crops respond to nitrogen fertilizer, and legumes respond to phosphate fertilizer. Border, furrow, and sprinkler irrigation systems are suitable for use on this soil. Furrow irrigation is suited to row crops, border irrigation is suited to alfalfa, small grain, and pasture, and sprinkler irrigation is suited to all crops. Adequate surface and subsurface drainage should be provided to avoid increasing the salinity problem.

Idahybrid poplar, Russian-olive, and Rocky Mountain juniper are examples of trees that are suitable for use in windbreaks on this soil.

This soil has potential for producing habitat suitable for ring-necked pheasant, mourning dove, birds of prey, and songbirds. These birds obtain their food and shelter mainly in areas of cropland. Plants such as tall wheatgrass and lilac planted along fence rows and ditchbanks and in odd field corners improve the wildlife habitat. Food should be close to shelter that protects the birds from predators and inclement weather. Food plants provide some cover. Capability subclass IIIw, irrigated.

5-Annis silty clay loam, strongly saline-alkali. This very deep, moderately well drained, strongly saline-alkali affected soil is on river flood plains. It formed in mixed alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is grayish brown silty clay loam and silt loam about 12 inches thick. The subsoil is light brownish gray silt loam 9 inches thick. The upper part of the substratum is light brownish gray and gray silty clay loam 28 inches thick. The lower part to a depth of 60 inches or more is light gray silt loam.

Included with this soil in mapping are small areas of Blackfoot silt loam and Labenzo silt loam.

Permeability of this Annis soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight. The water table fluctuates between depths of 2 and 4 feet.

This soil is used for irrigated pasture and hay. Crop yields are low because of the saline-alkali condition. A suitable cropping system is alfalfa hay for 5 or 6 years, or until grass and weeds begin to reduce hay production. Barley can be seeded as a nurse crop along with alfalfa to establish a new stand. Grass and legume pasture can be used for 6 to 8 years before returning to hay. Crop residue, green manure, or livestock manure should be

used to promote good tilth and to reduce surface crusting because of the content of salts. Legumes generally respond to phosphate, and all crops respond to nitrogen. Border irrigation is suitable for use on this soil. Sprinkler irrigation is also suitable. Water should be applied properly to avoid raising the water table and increasing the salt problem. Adequate drainage is needed to increase crop production and to help reduce the accumulation of soluble salts.

.Available trees for windbreak plantings are poorly suited to this soil.

This soil has potential for providing habitat suitable for ring-necked pheasant, mourning dove, and songbirds. These birds obtain their food and shelter mainly from areas of cropland. To improve the habitat for these birds, plants such as tall wheatgrass can be planted along fence rows and ditchbanks and in odd corners. Such plantings provide cover and protection from predators and inclement weather. Food should be close to shelter. Food crops provide some cover. Capability subclass lVw, irrigated.

6-Bannock sandy loam. This deep, well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is brown sandy loam about 11 inches thick. The upper part of the underlying material is light gray loam 15 inches thick. The lower part is light gray sandy loam 5 inches thick over very gravelly sand that extends to a depth of 60 inches or more. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 11 inches.

Included with this soil in mapping are small areas of Bannock gravelly loam, Bannock loam, Xeric Torriorthents, and Bockston sandy loam. These soils have slopes of less than 2 percent. Also included are small areas of channeled soils.

Permeability of this Bannock soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, potatoes, small grain, pasture, and sugar beets.

A suitable cropping system is 4 or 5 years of alfalfa for hay, 1 or 2 years of grain, and 1 year of grain seeded with alfalfa. A suitable cropping system that includes pasture in the rotation can be grown for 6 to 8 years followed by 1 year of grain to prepare the seedbed. To maintain high production of crops, commercial fertilizer is commonly needed in addition to manure and plant residue. Legumes generally respond to phosphate, and all crops respond to nitrogen. Furrow, border, and sprinkler irrigation systems are suited to this soil. Furrow irrigation is suited to row crops, border irrigation is suited to grain, hay, and pasture, and sprinkler irrigation is suited to all crops. Irrigation water should be applied with care to avoid creating a high water table that will injure crop roots. Surface drains can be used to carry away the excess water and prevent ponding.

Russian-olive, golden willow, and Scotch pine are well suited to use in windbreaks on this soil.

This soil has potential for producing habitat suitable for ring-necked pheasant, mourning dove, and songbirds. These birds obtain their food and shelter mainly in areas of cropland. Plants such as Siberian peashrub, European privet, and lilac planted along fence rows and ditchbanks, in odd field corners, or in windbreaks improve the habitat for these birds. They also provide cover and protect the birds from predators and inclement weather. Food crops provide some cover. Capability subclass lls, irrigated.

7-Bannock loam. This deep, well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is brown loam about 11 inches thick. The upper part of the underlying material is light gray loam and sandy loam 20 inches thick. The lower part to a depth of 60 inches or more is light gray very gravelly sand.

Included with this soil in mapping are small areas of Bannock gravelly loam, Wardboro soils,. Bannock sandy loam, and Bockston sandy loam. These soils have slopes of less than 2 percent. Also included are small areas of channeled soils.

Permeability of this Bannock soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, potatoes, small grain, pasture, and sugar beets.

A suitable cropping system is 4 or 5 years of alfalfa for hay, 1 or 2 years of grain, and 1 year of a nurse crop seeded with alfalfa. Potatoes or sugar beets can be grown the first year after the alfalfa. A suitable cropping system that includes pasture in the rotation is 6 to 8 years of pasture followed by 1 year of grain to prepare the seedbed. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. All crops respond to nitrogen, and legumes respond to phosphate. Border, furrow, and sprinkler irrigation systems are suitable for use on this soil. Border irrigation is suited to close growing crops, and furrow irrigation is suited to row crops. If border or furrow irrigation systems are used, waste water drains can generally be used to carry away excess water and prevent ponding. Irrigation water should be applied with care to avoid creating a high water table that will injure plant roots.

Russian-olive, golden willow, and Scotch pine are well suited to use in windbreaks on this soil.

This soil has potential for producing habitat suitable for ring-necked pheasant, mourning dove, and songbirds. These birds obtain their food and shelter mainly in areas of cropland. Shrubs such as Siberian peashrub, European privet, and lilac planted along fence rows and ditchbanks, in odd field corners, and as part of windbreaks improve the wildlife habitat. These plantings provide cover that protects the birds from predators and inclement weather. Food crops also provide some cover. Capability subclass IIs, irrigated.

8-Bannock gravelly loam. This deep, well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slopes are 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is brown gravelly loam about 11 inches thick. The upper part of the underlying material is light gray loam and sandy loam 20 inches thick. The lower part to a depth of 60 inches or more is light gray very gravelly sand. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Wardboro soils, Bannock sandy loam, and Bannock loam. These soils have slopes of less than 2 percent. Also included are small areas of channeled soils.

Permeability of this Bannock soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated pasture, hay, small grain, and potatoes. The gravel content of this soil reduces the available water capacity and the production of crops.

A suitable cropping system is 4 or 5 years of alfalfa for hay, 1 or 2 years of grain, and then 1 year of grain used as a nurse crop with alfalfa. Occasionally, 1 year of potatoes can be grown after plowing up hay. When pasture is used in the cropping system, the pasture is grown for 6 to 8 years and then 1 year of grain is grown to provide a seedbed before reseeding the grass and legume pasture mixture. To maintain high production of crops, commercial fertilizer is commonly needed in addition to manure and plant residue. Most crops respond to nitrogen, and legumes respond to phosphate. Border, furrow, and sprinkler irrigation methods are suited to this soil. Border irrigation is suited to close growing crops, and furrow irrigation is suited to row crops. Sprinkler irrigation is suited to all crops. Irrigation water should be properly applied, and surface drains should be used to prevent buildup of the water table.

Russian-olive, golden willow, and Scotch pine are suitable for use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, and songbirds. These birds obtain their food and shelter mainly in areas of cropland. Planting shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle along fence rows and ditchbanks, in odd field corners, and in windbreaks improves the habitat for these birds. These shrubs provide cover that protects the birds from predators and inclement weather. Food crops also provide some cover. Capability subclass IIIs, irrigated.

9-Bereniceton loam. This deep, well drained soil is on alluvial fans and old lakebeds. It formed in lacustrine and alluvial material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is brown and pale brown loam about 7 inches thick. The underlying material is pale brown and very pale brown clay loam and loam that extends to a depth of 60 inches or more. The soil is calcareous throughout.

Included with this soil in mapping are about 25 percent Lidy sandy loam, Matheson sandy loam, and a soil that is similar to this Bereniceton soil but that has a subsoil.

Permeability of this Bereniceton soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, small grain, pasture, and potatoes.

A suitable cropping system is 4 to 5 years of alfalfa for hay, 1 to 2 years of grain, and then 1 year of grain grown as a nurse crop with a new seeding of alfalfa. Potatoes can be substituted for 1 year of grain following the alfalfa. To maintain high production of crops, commercial fertilizer is commonly needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Furrow, border, and sprinkler irrigation systems are suitable for use on this soil. Sprinkler irrigation is suited to all crops. Furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. Surface drainage should be provided to carry off surplus waste water and prevent ponding.

Russian-olive, golden willow, and. Scotch pine are examples of trees that can be used in windbreaks on this soil.

This soil has potential for producing habitat for ring-necked pheasant, mourning dove, and songbirds. These birds obtain their food and shelter mainly in areas of cropland. Planting shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle along fence rows and ditchbanks; in odd field corners, and in windbreaks improves the habitat for these birds. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIc, irrigated.

10-Bereniceton loam, warm. This deep, well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is brown and pale brown loam about 7 inches thick. The underlying material to a depth of 60 inches or more is pale brown and very pale brown clay loam. The soil is calcareous throughout.

Included with this soil in mapping are areas of a soil that is similar to this Bereniceton soil but that has a subsoil. Also included are areas of Bockston loam, Bannock sandy loam, and Wardboro gravelly sandy loam. Included soils make up about 30 percent of the acreage.

Permeability is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, small grain, pasture, potatoes, and sugar beets.

A suitable cropping system is 3 to 4 years of alfalfa hay, 2 years of potatoes, 1 year of wheat or barley for grain, and then 1 year of grain grown as a nurse crop for alfalfa. Sugar beets can be substituted for 1 year of potatoes. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Legumes generally respond to phosphate, and all crops respond to nitrogen. Sprinkler, furrow, and border irrigation systems are suitable for use on this soil. Furrow irrigation is suited to row crops, border irrigation is suited to alfalfa, small grain, and pasture, and sprinkler irrigation is suited to all crops. Surface drainage should be provided to carry off waste water and prevent ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited for use in windbreaks on this soil.

This Bereniceton soil has potential for producing habitat for ring-necked pheasant, mourning dove, and songbirds. These birds obtain their food and shelter mainly in areas of cropland. Planting shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle along fence rows and ditchbanks, in odd field corners, or in windbreaks improves the habitat for these birds. These shrubs provide cover that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIc, irrigated.

11-Bereniceton clay loam. This deep, well drained soil is on old lakebeds. It formed in alluvium and lacustrine materials derived from mixed sources. Slope is 0 to 1 percent. The frost-free period is 80 to 100 days.

Typically, the surface layer is brown and pale brown clay loam about 7 inches thick. The underlying material to a depth of 60 inches is pale brown and very pale brown clay loam and loam. The soil is calcareous throughout.

Included with this soil in mapping are areas of a soil that is similar to this Bereniceton soil but that has a subsoil. Also included are areas of Matheson sandy loam. Included soils make up about 10 percent of the total acreage.

Permeability of this Bereniceton soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, small grain, pasture, and potatoes.

A suitable cropping system is 4 or 5 years of alfalfa, 1 or 2 years of grain, and then 1 year of grain grown as a nurse crop with a new seeding of alfalfa. The period of alfalfa hay can be extended to as long as 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and crop residue. Legumes generally respond to phosphate, and all crops respond to nitrogen. Furrow, border, and sprinkler irrigation systems are suitable for use on this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. Regardless of the irrigation method used, water should be applied carefully to avoid excessive runoff because of the moderately slow permeability and to prevent ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited for use in windbreaks on this soil.

This soil has potential for producing habitat for ring-necked pheasant, mourning dove, and songbirds. These birds obtain their food and shelter mainly in areas of cropland. Planting shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle along fence rows and ditchbanks, in odd field corners, or in windbreaks improves the habitat for these birds. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIc, irrigated.

12-Bereniceton-Aecet loams. This complex is on basalt plains. Slope is 1 to 6 percent. The frost-free period is 80 to 115 days.

This complex is 60 percent Bereniceton loam, 15 percent Aecet loam, and 25 percent included areas. The Bereniceton soil is on concave and convex side slopes, and the Aecet soil is on convex slopes near areas of Rock outcrop.

Included with this soil in mapping are areas of Bereniceton loam that is more than 60 inches deep over bedrock, Bondfarm sandy loam, Terreton loam or clay loam, Matheson loam, and Rock outcrop. Also included are some small hummocky areas of loamy sand.

The Bereniceton soil is deep and well drained. It formed in wind-deposited material. Typically, tile surface layer is brown and pale brown loam about 7 inches thick. The underlying material is pale brown and very pale brown clay loam and loam 39 inches thick. Basalt is at a depth of 46 inches.

Permeability of the Bereniceton soil is moderately slow. Effective rooting depth is 40 to 60 inches. Available water capacity is very high. Surface runoff is slow or medium, and the hazard of erosion is slight.

The Aecet soil is moderately deep and well drained. It formed in eolian deposits. Typically, the surface layer is pale brown loam about 5 inches thick. The subsoil is pale brown clay loam 8 inches thick. The substratum is very pale brown clay loam 13 inches thick. Basalt is at a depth of 23 inches.

Permeability of the Aecet soil is moderately slow. Effective rooting depth is 20 to 40 inches. Available water capacity is moderate. Surface runoff is slow or medium, and the hazard of erosion is slight.

This complex is used as range, for wildlife habitat, and for recreation.

If these soils are irrigated, they can be suited to hay, small grain, pasture, and potatoes.

If these soils are irrigated, Russian-olive, golden willow, Scotch pine, Siberian peashrub, European privet, and lilac grow well in windbreaks. These trees and shrubs also provide cover.

If the range is in good or excellent condition, the native vegetation on these soils is mainly bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these two grasses decreases and the proportion of less desirable forbs, weeds, grasses, and woody plants increases. Range seeding is a good practice if the range is in poor condition. Suitable grasses for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, and Indian ricegrass. The grass selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Minimum tillage is needed to control soil blowing.

A suitable cropping system is 3 or 4 years of alfalfa for hay, 2 years of potatoes, 1 year of wheat or barley for grain, and then 1 year of grain grown as a nurse crop for alfalfa. The grain is cut, and the alfalfa is left standing. To maintain high production of crops, commercial fertilizer is needed in addition to manure and plant residue. Generally, legumes respond to phosphate fertilizer and all crops respond to nitrogen fertilizer. Sprinkler irrigation is best suited to these soils.

Range areas of this complex have potential for producing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclasses IIIe, irrigated, and VIe, nonirrigated.

13-Bereniceton-Rock outcrop-Aecet complex. This complex is on basalt plains. Slope is 2 to 12 percent. The frost-free season is 80 to 115 days.

This complex is about 50 percent Bereniceton very stony sandy loam, 20 percent Rock outcrop, and 20 percent Aecet very stony sandy loam. The Bereniceton soil is on concave side slopes, Rock outcrop is on ridges and sides of ridges and is intermingled with areas of Bereniceton soils, and the Aecet soil is on convex side slopes.

Included with this complex in mapping is Bondfarm sandy loam. Also included are hummocky areas of loamy sand.

The Bereniceton soil is deep and well drained. It formed in wind-laid deposits. Typically, the surface layer is brown and pale brown very stony sandy loam and very stony loam about 7 inches thick. The underlying material is pale brown loam and very pale brown clay loam 39 inches thick. Basalt is at a depth of 46 inches.

Permeability of the Bereniceton soil is moderately slow. Effective rooting depth is 40 to 60 inches or more. Available water capacity is high. Surface runoff is slow or medium, and the hazard of erosion is moderate or high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of shrubs, forbs, and grasses. Rock outcrop has little value for grazing.

The Aecet soil is moderately deep and well drained. It formed in wind-laid deposits. Typically, the surface layer is pale brown very stony sandy loam about 5 inches thick. The subsoil is pale brown clay loam about 8 inches thick. The substratum is very pale brown clay loam 10 inches thick. Basalt is at a depth of 23 inches.

Permeability of the Aecet soil is moderately slow. Effective rooting depth is 20 to 40 inches. Available water capacity is moderate. Surface runoff is slow to medium, and the hazard of erosion is moderate or high.

This complex is used as range, for wildlife habitat, and for recreation. If the range is in good to excellent condition, the native vegetation is mainly bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, forbs, annual grasses, and woody plants increases.

This complex is used for grazing mainly in spring and fall. Mechanical seeding or brush management is very difficult because of stones on the surface and the intermingled areas of Rock outcrop. Management practices suitable for use on these soils include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for producing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIs, nonirrigated.

14-Bereniceton-Terreton-Aecet complex. This complex is on basalt plains. Slope is 1 to 6 percent. The frost-free period is 80 to 115 days.

This complex is 30 percent Bereniceton silt loam, 25 percent Terreton silt loam, and 20 percent Aecet loam. The Bereniceton and Terreton soils are on concave and complex side slopes, and the Aecet soil is near areas of Rock outcrop on ridges.

Included with this complex in mapping are areas of soil that is similar to this Bereniceton soil but that are silty clay loam throughout, areas of Rock outcrop, and areas of Bondfarm loam.

The Bereniceton soil is deep and well drained. It formed in wind-laid deposits. Typically, the surface layer is brown and pale brown silt loam about 7 inches thick. The underlying material is pale brown and very pale brown loam and clay loam 39 inches thick. Basalt is at a depth of 46 inches. The soil is calcareous throughout.

Permeability of the Bereniceton soil is moderately slow. Effective rooting depth is 40 inches to 60 inches or more. Available water capacity is high. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate.

The Terreton soil is very deep and well drained. It formed in lacustrine sediment. Typically, the surface layer is light brownish gray silt loam about 6 inches thick. The underlying material to a depth of 60 inches or more is stratified light brownish gray and light gray clay and silty clay loam. The soil is calcareous throughout.

Permeability of the Terreton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate.

The Aecet soil is moderately deep and well drained. It formed in eolian deposits. Typically, the surface layer is pale brown loam about 6 inches thick. The subsoil is pale brown clay loam about 8 inches thick. The substratum is very pale brown clay loam 10 inches thick. Basalt is at a depth of 23 inches. This soil is calcareous throughout and has a layer of lime accumulation at a depth of 13 inches.

Permeability of the Aecet soil is moderately slow. Effective rooting depth is 20 to 40 inches, and available water capacity is moderate. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate.

This complex is used as range, for wildlife habitat, and for recreation.

When the range vegetation is in good or excellent condition, the native grasses on these soils are mainly bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, forbs, grasses, and woody plants increases.

Range seeding is a suitable practice if the range vegetation is in poor condition. Grasses suitable for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, or Indian ricegrass. The grass species selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This complex has potential for producing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If these, soils are irrigated, they can be used for hay, small grain, pasture, or potatoes. Sprinkler irrigation is best suited to these soils.

A suitable cropping system for irrigated cropland is 3 to 4 years of alfalfa hay, 2 years of potatoes, 1 year of wheat or barley for grain, and then 1 year of grain grown as a nurse crop for alfalfa. The grain is cut, and the alfalfa is left to start the cropping system again. To maintain high production of crops, commercial fertilizer is commonly needed in addition to manure and plant residue. Legumes generally respond to phosphate fertilizer, and all crops respond to nitrogen fertilizer.

If these soils are irrigated, Russian-olive, golden willow, Scotch pine, Siberian peashrub, European privet, and lilac are suitable trees and shrubs for use in windbreaks. These plants also provide food and cover for wildlife. Capability subclasses IIIe, irrigated, and VIe, nonirrigated.

15-Bereniceton-Terreton-Rock outcrop complex. This complex is on basalt plains and on the edges of old lakebeds. Slope is 3 to 6 percent. The frost-free period is 80 to 115 days.

This complex is about 30 percent Bereniceton very stony silt loam, 25 percent Terreton very stony silt loam, and 20 percent Rock outcrop. The Bereniceton and Terreton soils are both on convex and concave side slopes, and Rock outcrop is intermingled with areas of these soils.

Included with this complex in mapping are areas of Aecet very stony loam, a soil that is similar to the Bereniceton soil but that is silty clay throughout, and Bondfarm loam. Included soils make up about 25 percent of this complex.

The Bereniceton soil is deep and well drained. It formed in wind-laid deposits. Typically, the surface layer is brown and pale brown very stony silt loam about 7 inches thick. The underlying material is pale brown and very pale brown loam and clay loam 39 inches thick. Basalt is at a depth of 46 inches. The soil is calcareous throughout.

Permeability of the Bereniceton soil is moderately slow. Effective rooting depth is 40 to 60 inches. Available water capacity is high. Surface runoff is slow or medium, and the hazard of erosion is moderate.

The Terreton soil is very deep and well drained. It formed in old lake sediment. Typically, the surface layer is light brownish gray very stony silt loam about 6 inches thick. The underlying material to a depth of 60 inches or more is stratified light brownish gray and light gray clay and silty clay loam. The soil is calcareous throughout.

Permeability of the Terreton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow or medium, and the hazard of erosion is slight.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain

some soil material that supports a sparse stand of shrubs, forbs, and grasses. Rock outcrop has little value for grazing.

This complex is used as range, for wildlife habitat, and for recreation.

If the vegetation is in good or excellent condition, the main native grasses are bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, forbs, grasses, and woody plants increases. This unit is used for grazing mainly in spring and fall. Mechanical seeding or brush management is very difficult or impracticable because of stones on the surface and intermingled areas of Rock outcrop. Management practices suitable for use on this complex are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

Range areas of this complex have potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIs, nonirrigated.

16--Blackfoot silt loam, drained. This very deep, moderately well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is grayish brown silt loam about 10 inches thick. The underlying material to a depth of 60 inches or more is stratified light brownish gray loam, silty clay loam, silt loam, and fine sandy loam. The soil is calcareous throughout and is mildly alkaline or moderately alkaline.

Included with this soil in mapping are small areas of Heiseton sandy loam, Labenzo silt loam, and a soil that is similar to this Backfoot soil but that has a light colored surface layer. These soils all have slopes of 0 to 1 percent. Also included are some areas of channeled soils.

Permeability of this Blackfoot soil is moderate or very high. Surface runoff is slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 4 and 6 feet for brief periods.

These soils are used for irrigated hay, potatoes, sugar beets, small grain, and pasture.

A suitable cropping system is 3 to 4 years of alfalfa for hay, 2 years of potatoes, 1 year of wheat or barley for grain, and 1 year of grain grown as a nurse crop for alfalfa. The grain is cut, and the alfalfa is grown for 3 to 4 years to start the cropping system. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Most crops respond to nitrogen, and legumes respond to phosphate. Furrow, border, and sprinkler irrigation systems are suitable for use on this soil. Furrow irrigation is suited to row crops, border irrigation is suited to grain, hay, and pasture, and sprinkler irrigation is suited to all crops. Irrigation water should be applied carefully to avoid raising the water table. Surface drainage should be provided to carry off waste water and to prevent ponding (fig. 3).

Russian-olive, golden willow, and Scotch pine are examples of trees that are suitable for use in windbreaks on this soil.

This soil has potential for producing habitat for ring-necked pheasant, mourning dove, and songbirds. These birds obtain their food and shelter mainly in areas of cropland. Shrubs, such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle, planted along fence rows and ditchbanks, in odd field corners, or in windbreaks provide shelter that protects the birds from predators and inclement weather. Food crops also provide some cover. Capability subclass IIc, irrigated.

17-Blackfoot clay loam, drained. This very deep, moderately well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is grayish brown clay loam 10 inches thick. The underlying material to a depth of 60 inches is stratified light brownish gray loam, silty clay loam, silt loam, and fine sandy loam. The soil is calcareous throughout and is mildly alkaline or moderately alkaline.

Included with this soil in mapping are small areas of Annis silty clay loam, Labenzo silt loam, Heiseton sandy loam, and a soil that is similar to Blackfoot silt loam but that has a light colored surface layer. All of these soils have slopes of 0 to 1 percent.

Permeability of this Blackfoot soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high or very high. Surface runoff is slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 4 and 6 feet for brief periods.

This soil is. used for irrigated hay, small grain, potatoes, sugar beets, and pasture. Working this soil when it is too moist results in the formation of clods.

A suitable cropping system is 3 to 4 years of alfalfa for hay, 2 years of potatoes, 1 year of wheat or barley for grain, and 1 year of grain grown as a nurse crop for alfalfa. The grain is cut, and the alfalfa is grown to start the cropping system again. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and crop residue. Most crops respond to nitrogen, and legumes respond to phosphate. Furrow, border, and sprinkler irrigation systems are suitable for use on this soil. Furrow irrigation is suited to row crops, border irrigation is suited to grain, hay, and pasture, and sprinkler irrigation is suited to all crops. Irrigation water should be applied carefully to avoid raising the water table. Surface drainage must be provided to carry off waste water and to prevent ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are suitable for use in windbreaks on this soil.

This soil has potential for producing habitat for ring-necked pheasant, mourning dove, and songbirds. These birds obtain their food and shelter mainly in areas of cropland. Planting shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle along fence rows and ditchbanks, in odd field corners, or in windbreaks improves the habitat for these birds. These shrubs provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIc, irrigated.

18-Bockston sandy loam. This deep, well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is brown sandy loam about 9 inches thick. The subsoil is pale brown silt loam about 12 inches thick. The upper part of the substratum is light gray and light brownish gray silt loam and fine sandy loam. The lower part to a depth of 60 inches or more is light brownish gray very gravelly fine sandy loam and very gravelly loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 21 inches.

Included with this soil in mapping are small areas of Bannock sandy loam, Heiseton sandy loam, Hayeston sandy loam, and Xeric Torriorthents.

This Bockston soil is moderately permeable. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, potatoes, small grain, sugar beets, and pasture.

An example of a suitable cropping system is 3 or 4 years of alfalfa for hay, 2 years of potatoes, 1 year of wheat or barley for grain, and then 1 year of grain grown as a nurse crop for alfalfa. The grain is cut, and the alfalfa is left to start the cropping system again. Sugar beets are substituted for potatoes for 1 year in some areas. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and crop residue. Legumes respond to phosphate, and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suitable for use on this soil. The furrow method is suited to row crops, border irrigation is suited to alfalfa, small grain, and pasture, and sprinkler irrigation is suited to all crops. If border and furrow irrigation systems are used, surface drainage should be provided to carry off waste water.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for producing suitable habitat for ring-necked pheasant, mourning dove, and songbirds. These birds obtain their food and shelter mainly in areas of cropland. Planting shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle along fence rows and ditchbanks, in odd field corners, and in windbreaks improves the habitat for these birds. These shrubs provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIc, irrigated.

19-Bockston loam. This deep, well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slopes are 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is brown loam about 9 inches thick. The subsoil is pale brown silt loam about 12 inches thick. The upper part of the substratum is light gray and light brownish gray silt loam and fine sandy loam about 17 inches thick. The lower part to a depth of 60 inches or more is fine sandy loam and very gravelly loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 21 inches.

Included with this soil in mapping are small areas of Bannock sandy loam, Bereniceton loam, and Xeric Torriorthents and some areas of channeled soils.

Permeability of this Bockston soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, potatoes, small grain, sugar beets, and pasture.

An example of a suitable cropping system is 3 to 4 years of alfalfa for hay, 2 years of potatoes, 1 year of wheat or barley for grain, and then 1 year of grain grown as a nurse crop for alfalfa. The grain is cut, and the alfalfa is left for 3 or 4 additional years to start the cropping system again. Sugar beets are substituted for potatoes for 1 year in some areas. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and crop residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suitable for use on this soil. Furrow irrigation is suited to row crops, border irrigation is suited to alfalfa, small grain, and pasture, and sprinkler irrigation is suited to all crops. If border and furrow irrigation systems are used, surface drainage must be provided to carry off waste water and prevent ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are suitable for use in windbreaks on this soil.

This soil has potential for producing habitat for ring-necked pheasant, mourning dove, and songbirds. These birds obtain their food and shelter mainly in areas of cropland. Planting shrubs such as Siberian peashrub, European privet, lilac, Tatarian honeysuckle, and cranberry cotoneaster along fence rows and ditchbanks, in odd field corners, or in windbreaks improves the habitat

for these birds. These shrubs provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIc, irrigated.

20-Bondfarm-Rock outcrop complex. This complex is on basalt plains. Slope is 2 to 12 percent. The frost-free season is 80 to 100 days.

Bondfarm sandy loam makes up 60 percent of the complex, and Rock outcrop makes up 25 percent. The Bondfarm soil is in the lower, concave areas, and Rock outcrop is in the higher, convex areas.

Included with this complex in mapping is about 15 percent Malm sandy loam and Matheson sandy loam. Also included are areas of soils that have as much as 5 percent stones on the surface.

The Bondfarm soil is shallow and well drained. It formed in sandy wind-laid deposits. Typically, the surface layer is light brownish gray sandy loam about 4 inches thick. The subsoil and substratum are very pale brown sandy loam 14 inches thick. Basalt is at a depth of about 18 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 4 inches.

Permeability of this Bondfarm soil is moderately rapid. Effective rooting depth is 10 to 20 inches. Available water capacity is low. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of shrubs, grasses, and forbs. Rock outcrop has little value for grazing.

This complex is used for range, for wildlife habitat, and for recreation.

If the range is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable grasses, weeds, forbs, and woody plants increases.

This complex is used for grazing mainly in spring and fall. Mechanical treatment, such as seeding or brush control, is very difficult because of the shallow depth to bedrock and the areas of Rock outcrop. Management practices suitable for use on this soil are proper range use, deferred grazing, and rotation grazing. Aerial spraying for brush control is practical in places where adequate quantities of desirable plants are present.

This complex has potential for producing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIs, nonirrigated.

21-Bondfarm-Rock outcrop-Grassy Butte complex. This complex is on basalt plains. Slope is 2 to 6 percent. The frost-free period is 80 to 100 days.

The complex is about 40 percent Bondfarm loamy sand, 30 percent Rock outcrop, and 20 percent Grassy Butte loamy sand. The Bondfarm soil is on concave and convex side slopes and is surrounded by areas of the Grassy Butte soils, Rock outcrop is in areas slightly higher than areas of Bondfarm soils, and the Grassy Butte soil is in hummocky areas.

Included with this complex in mapping are about 10 percent Matheson loamy sand, a soil that is similar to the Grassy Butte soils but that is less than 40 inches deep to bedrock, and Terreton loamy sand.

The Bondfarm soil is shallow and well drained. It formed in eolian material. Typically, the surface layer is light brownish gray loamy sand about 4 inches thick. The subsoil and substratum are very pale brown sandy loam 14 inches thick. Basalt is at a depth of 18 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 4 inches.

Permeability of the Bondfarm soil is moderately rapid. Effective rooting depth is 10 to 20 inches. Available water capacity is low. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate. The hazard of soil blowing is very high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and shrubs. Rock outcrop has little value for grazing.

The Grassy Butte soil is very deep and somewhat excessively drained. It formed in sandy eolian material. Typically, the surface layer is grayish brown loamy sand about 7 inches thick. The underlying material to a depth of 60 inches or more is grayish brown and gray loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 19 inches.

Permeability of the Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more, and the available water capacity is low or moderate. Surface runoff is very slow or slow. The hazard of soil blowing is very high. The hazard of erosion is slight.

This complex is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and needleandthread. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of annual grasses, forbs, and woody plants increases. Less desirable weeds and annual grasses become more abundant as the range condition further deteriorates.

This complex is used for grazing mainly in spring and fall. Mechanical treatment for seeding or brush management is limited by the very high hazard of soil blowing. Management practices suitable for use on this complex include proper range use, deferred grazing, and rotation grazing. Aerial spraying for brush control is practical

where a reasonable understory of desirable grasses is present.

This complex has potential for producing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIe, nonirrigated.

22-Bondranch sandy loam, 2 to 12 percent slopes. This shallow, well drained soil is on basalt plains. It formed in sandy wind-laid deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray sandy loam about 5 inches thick. The subsoil is pale brown sandy loam about 6 inches thick. The substratum is very pale brown sandy loam. Basalt is at a depth of 19 inches. The soil is noncalcareous from the surface to the layer of lime accumulation, which is at a depth of 11 inches.

Included with this soil in mapping are areas of Modkin sandy loam and Matheson sandy loam, soils that are similar to this Bondranch soil but that do not have lime in the substratum, soils that have stones on the surface, soils that have a sandy surface layer, and Rock outcrop.

Permeability of this Bondranch soil is moderately rapid. Effective rooting depth is 10 to 20 inches. Available water capacity is low. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used as range, for wildlife habitat, and for recreation.

When the vegetation is in good or excellent condition, the main native grasses are bluebunch wheatgrass and Thurber needlegrass. When the range condition deteriorates, the proportion of these grasses decreases and the proportion of less desirable forbs, weeds, grasses, and woody plants increases. Range seeding is a good practice if the range vegetation is in poor condition. Grasses suitable for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, and Indian ricegrass. The grasses selected for seeding should meet the seasonal needs of the livestock or wildlife, or both. Minimum tillage for range seeding helps to control soil blowing.

This soil has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIe, nonirrigated.

23-Bondranch-Rock outcrop complex. This complex is on basalt plains. Slope is 1 to 12 percent. The frost-free season is 80 to 100 days.

Bondranch very stony loam makes up about 45 percent of this complex, Rock outcrop 30 percent, and included areas 25 percent. The Bondranch soil is in concave and nearly level areas. Rock outcrop is mainly in the higher positions and in some nearly level or convex areas.

Included with this complex in mapping are areas of a soil that is 20 to 40 inches deep over bedrock and areas of a soil that is similar to this Bondranch soil but that is less than 10 inches deep over bedrock. Also included are areas of Modkin sandy loam and Grassy Butte loamy sand and small areas of a soil that is similar to this Bondranch sod but that does not have lime in the substratum.

The Bondranch soil is shallow and well drained. It formed in eolian material. Typically, the surface layer is light brownish gray very stony sandy loam about 5 inches thick. The subsoil is pale brown sandy loam 6 inches thick. The substratum is pale brown and very pale brown sandy loam 8 inches thick. Basalt is at a depth of 19 inches. The soil is noncalcareous from the surface to the layer of lime accumulation, which begins at a depth of 11 inches.

Permeability of the Bondranch soil is moderately rapid. Effective rooting depth is 10 to 20 inches. Available water capacity is low. Surface runoff is very slow to medium, and the hazard of erosion is slight or moderate.

Rock outcrop consists of basalt rock. It mostly supports moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and shrubs. Rock outcrop areas have little value for grazing.

This complex is used as range, for wildlife habitat, and for recreation.

When the range vegetation is in good to excellent condition, the native grasses are mainly bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable forbs, weeds, grasses, and woody plants increases.

This complex is used for grazing mainly in spring and fall. Mechanical treatment such as seeding or brush control is very difficult because of the stony surface and the intermingled areas of Rock outcrop. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This unit has potential for providing habitat suitable for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIs, nonirrigated.

24-Diston loamy sand, 0 to 4 percent slopes. This moderately deep, somewhat excessively drained soil is on basalt plains. It formed in sandy wind-laid deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is grayish brown loamy sand about 5 inches thick. The upper part of the substratum is light brownish gray and light gray loamy sand about 6 inches thick over an indurated hardpan about 16 inches thick. The lower part of the substratum to a depth

of more than 60 inches is sand. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Grassy Butte sand, Grassy Butte loamy sand, and Rock outcrop.

Permeability of this Diston soil is rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high. Trafficability of machinery is impaired by the loamy sand texture. Minor areas of blowouts are common.

This soil is used for sprinkler irrigated potatoes, small grain, hay, and pasture, and as range.

An example of a suitable irrigated cropping system is 1 year of potatoes and 1 year of grain. Alternately, alfalfa hay can be seeded with the grain and left for 3 to 5 years, followed by a potato-grain cropping system for 2 or 3 years. The hazard of soil blowing requires that about 25 percent of the close growing crops be replanted each year. To protect this soil from blowing, all crop residue should be returned to the soil. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate, and all crops respond to nitrogen. Sprinkler irrigation systems are suited to this soil.

Russian-olive, Idahybrid poplar, Rocky Mountain juniper, Siberian peashrub, and lilac are trees and shrubs that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat suitable for ring-necked pheasant, coyote, songbirds, and birds of prey.

When the range vegetation is in good or excellent condition, the native grasses are mainly needleandthread and Indian ricegrass. When the range deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases.

Range areas are used for grazing mainly in spring and fall. Mechanical treatment for range seeding or brush control is difficult because of the very high hazard of soil blowing. Management practices suitable for use on this soil include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control. Capability subclasses lVe, irrigated, and VIIe, nonirrigated.

25-Diston loamy sand, 4 to 8 percent slopes. This moderately deep, somewhat excessively drained soil is on basalt plains. It formed in sandy eolian deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is grayish brown loamy sand about 5 inches thick. The upper part of the substratum is light brownish gray and light gray loamy sand about 26 inches thick over an indurated hardpan about 16 inches thick. The lower part to a depth of 60 inches or more is grayish brown sand. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Grassy Butte sand, a Diston loamy sand that has slopes of 8 to 12 percent, and Rock outcrop.

Permeability of this Diston soil is rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high. Minor areas of blowouts are common.

This soil is used for sprinkler irrigated potatoes, small grains, and hay.

An example of a suitable cropping system is 1 year of potatoes and 1 year of grain. Alternately, alfalfa hay can be seeded with the grain and left for 3 to 5 years, followed by a potato-grain cropping system for 2 or 3 years. Trafficability of machinery is impaired by the loamy sand texture. Soil blowing usually requires that about 25 percent of the close growing crops be replanted each year. Soil blowing can be controlled by leaving crop residue on the surface. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation systems are suited to this soil.

Russian-olive, Idahybrid poplar, Rocky Mountain juniper, Siberian peashrub, and lilac are examples of trees and shrubs that are suitable for use in windbreaks on this soil.

This soil has potential for producing suitable habitat for ring-necked pheasant, coyote, songbirds, and birds of prey. The birds obtain their food and shelter mainly in areas of cropland. Food should be close to shelter that will protect the birds from predators and inclement weather. Food crops also provide some cover. Capability subclass IVe, irrigated.

26-Diston-Grassy Butte complex. This complex is on basalt plains. Slope is 2 to 8 percent. The frost-free season is 80 to 100 days.

Diston loamy sand makes up about 70 percent of this complex, Grassy Butte loamy sand makes up 20 percent, and included areas make up 10 percent. The Diston soil is in the lower concave positions, and the Grassy Butte soil is in hummocky areas.

Included with this complex in mapping are areas of a soil that is similar to this Diston soil and that is 10 to 20 inches deep over basalt. Also included are areas of Rock outcrop.

The Diston soil is moderately deep and somewhat excessively drained. It formed in eolian deposits. Typically, the surface layer is grayish brown loamy sand about 5 inches thick. The upper part of the substratum is light brownish gray and light gray loamy sand about 26 inches thick over an indurated hardpan about 16 inches thick. The lower part to a depth of 60 inches or more is grayish brown sand. The soil is calcareous throughout.

Permeability of the Diston soil is rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

The Grassy Butte soil is deep and somewhat excessively drained. It formed in sandy eolian deposits. Typically, the surface layer is grayish brown loamy sand about 7 inches thick. The underlying material to a depth of 60 inches or more is grayish brown and gray loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 19 inches.

Permeability of the Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This complex is used as range, for wildlife habitat, and for recreation.

When the range vegetation is in good or excellent condition, the main native grasses are needleandthread and Indian ricegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. Mechanical treatment for range seeding or brush control is difficult because of the loamy sand texture and the hazard of soil blowing. Management practices suitable for use on these soils include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This unit has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If these soils are irrigated, they can be used for small grain, potatoes, and hay. An example of a suitable cropping system is 1 year of potatoes and 1 year of grain. Alternately, alfalfa hay can be seeded with the grain and left for 3 to 5 years, followed by a cropping system of potatoes and grain for 2 or 3 years. The main management concerns are impaired trafficability of machinery and the very high hazard of soil blowing. The hazard of soil blowing usually requires that about 25 percent of the close growing crops be replanted each year. The low available water capacity necessitates light and frequent applications of irrigation water. Residue should be left on the surface to protect the soils from soil blowing. To maintain high production of crops, commercial fertilizer is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation systems are suited to these soils.

If these soils are irrigated, trees and shrubs such as Russian-olive, Idahybrid poplar, Rocky Mountain juniper, Siberian peashrub, and lilac are suitable for use in windbreaks. Capability subclasses IVe, irrigated, and VIIe, nonirrigated.

27-Diston-Rock outcrop complex. This complex is on basalt plains. Slope is 2 to 8 percent. The frost-free season is about 80 to 100 days.

Diston extremely stony loamy sand makes up about 40 percent of the complex, and Rock outcrop makes up 35 percent. The Diston soil is on the lower concave and convex side slopes, and Rock outcrop is in the somewhat higher convex positions.

Included with this complex in mapping are areas of Grassy Butte loamy sand and Matheson loamy sand. Included areas make up about 25 percent of the mapped acreage.

The Diston soil is moderately deep and somewhat excessively drained. It formed in sandy eolian deposits over basalt. Typically, the surface layer is grayish brown extremely stony loamy sand about 5 inches thick. The upper part of the substratum is light brownish gray and light gray loamy sand 26 inches thick over an indurated hardpan. The lower part to a depth of 60 inches or more is grayish brown sand. The soil is calcareous throughout. Depth to the hardpan ranges from 20 to 40 inches.

Permeability of the Diston soil is rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and shrubs. Rock outcrop areas have little value for grazing.

This complex is used mainly as range, for wildlife habitat, and for recreation. When the range vegetation is in good or excellent condition, the main native grasses are needleandthread and Indian ricegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of forbs and woody plants increases. Less desirable weeds and annual plants become more abundant as range vegetation further deteriorates. This complex is used for grazing mainly in spring and fall. Mechanical treatment for range seeding or brush control is difficult because of the very high hazard of soil blowing. Management practices suitable for use on this soil include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIe, nonirrigated.

28-Dune land. This map unit is made up of hills and ridges consisting of wind-deposited sand that is actively shifting. It supports little if any vegetation. Capability subclass VIIIe, nonirrigated.

29-Fluvaquents, nearly level. This map unit consists of very deep, very poorly drained soils on old lakebeds.

They are in marsh areas that are inundated most of the time between May and October. The vegetation is mainly cattails and other water loving plants.

Included with these soils in mapping are small areas of Psammaquents.

Typically, these soils are erratically stratified and variable. A reference profile has a mat of roots 3 inches thick over stratified silt loam, silty clay loam, and clay that extends to a depth of 60 inches or more.

These soils are used for wildlife habitat and recreation. They are especially well suited to habitat for waterfowl (fig. 4). Capability subclass VIIIw, nonirrigated.

30-Grassy Butte sand, 2 to 4 percent slopes. This very deep, excessively drained soil is on basalt plains. It formed in wind-laid deposits of sand derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is grayish brown sand about 7 inches thick. The substratum to a depth of 60 inches or more is grayish brown and gray loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 19 inches.

Included with this soil in mapping are small areas of Modkin sandy loam, Matheson sandy loam, and a soil that is similar to this Grassy Butte soil but that is 20 to 40 inches deep to bedrock. Also included are areas of soils that have slopes of less than 2 percent and areas of Rock outcrop.

Permeability of this Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high. Minor blowouts are common.

This soil is used almost entirely for sprinkler irrigated hay, small grain, potatoes, and pasture.

An example of a suitable cropping system is 3 to 5 years of alfalfa hay, 1 year of potatoes, 1 year of grain, and then return to hay. Pastures are commonly used for 4 to 8 years, and then potatoes are grown for 1 year. To maintain high production of crops, commercial fertilizer is commonly needed in addition to manure and plant residue. Legumes generally respond to phosphate, and all crops respond to nitrogen. Lateral or pivoted sprinkler systems are suited to this soil. Trafficability of machinery is impaired because of the sand texture. Soil blowing makes it necessary to replant close-grown crops 1 year out of 4.

Russian-olive, Idahybrid poplar, Rocky Mountain juniper, Siberian peashrub, and lilac are examples of trees and shrubs that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter mainly in areas of cropland. Food should be close to shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IVe, irrigated.

31-Grassy Butte sand, 2 to 20 percent slopes. This very deep, somewhat excessively drained soil is on basalt plains. It formed in wind-laid deposits of sand derived from mixed sources. The frost-free season is 80 to 115 days.

Typically, the surface layer is grayish brown sand about 7 inches thick. The underlying material to a depth of 60 inches or more is grayish brown and gray loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 19 inches.

Included with this soil in mapping are small areas of Matheson loamy sand, a soil that is similar to this Grassy Butte soil but that is 20 to 40 inches deep over bedrock, and Rock outcrop.

Permeability of this Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This soil is used mainly as range, for wildlife habitat, and for recreation. Some areas have been cultivated.

Sprinkler irrigation is suitable for use on this soil. The main limitations for management are the impaired trafficability of machinery and the very high hazard of soil blowing. Soil blowing usually makes it necessary to replant about one-half of the close-growing crops each year.

When the range vegetation is in good or excellent condition, the dominant native grasses are needleandthread and Indian ricegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable annual grasses, forbs, and woody plants increases. This soil is used for grazing mainly in spring and fall. It generally is not suited to mechanical treatments such as those used for seeding or brush control because of the very high hazard of soil blowing. Management practices suitable for use on this soil include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This soil has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Elk also use areas of this soil in the east-central part of the county for winter range and as a migratory path.

If this soil is irrigated, it can be used mostly for permanent pasture. Crop seedings are difficult to establish because of the very high hazard of soil blowing. Sprinkler systems are suitable for use on this soil. Capability subclasses VIe, irrigated, and VIIe, nonirrigated.

32-Grassy Butte loamy sand, 2 to 4 percent slopes. This very deep, somewhat excessively drained soil is on basalt plains. It formed in wind-laid sandy

deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is grayish brown loamy sand about 7 inches thick. The underlying material to a depth of 60 inches is grayish brown and gray loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 19 inches.

Included with this soil in mapping are small areas of Matheson loamy sand, Modkin loamy sand, a soil that is similar to this Grassy Butte soil but that is 20 to 40 inches deep over bedrock, and Rock outcrop.

Permeability of this Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high. Minor blowouts occur in many fields each year.

This soil is used almost entirely for sprinkler irrigated hay, potatoes, small grain, and pasture.

An example of a suitable cropping system is 3 to 5 years of alfalfa hay, 1 year of potatoes, and 1 or 2 years of grain. Pasture can be used to replace alfalfa in the rotation. It is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation systems can be used. Trafficability of machinery is limited by the loamy sand texture. The very high hazard of soil blowing makes it necessary to replant close grown crops about 1 year in 4.

Russian-olive, Idahybrid poplar, Rocky Mountain juniper, Siberian peashrub, and lilac are trees and shrubs that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter mainly in areas of cropland. Food should be close to shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IVe, irrigated.

33-Grassy Butte loamy sand, 4 to 8 percent slopes. This very deep, somewhat excessively drained soil is on basalt plains. It formed in wind-laid sandy deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is grayish brown loamy sand about 7 inches thick. The underlying material to a depth of 60 inches or more is grayish brown and gray loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 19 inches.

Included with this soil in mapping are small areas of Modkin loamy sand, Matheson loamy sand, a soil that is similar to this Grassy Butte soil but that is 20 to 40 inches deep over bedrock, and Rock outcrop.

Permeability of this Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high. Minor blowouts occur in many fields each year.

This soil is used almost entirely for sprinkler irrigated hay, small grain, potatoes, and pasture.

An example of a suitable cropping system is 3 to 5 years of alfalfa hay, 1 year of potatoes, and 1 or 2 years of grain. If pasture is used in the cropping system, it is used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation systems are suited. Trafficability of machinery is limited because of the loamy sand texture. Soil blowing makes it necessary to replant close grown crops about 1 year in 4.

Russian-olive, Idahybrid poplar, Rocky Mountain juniper, Siberian peashrub, and lilac are examples of trees and shrubs that are well suited for use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter mainly in areas of cropland. Food should be close to shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IVe, irrigated.

34-Grassy Butte loamy sand, 2 to 20 percent slopes. This very deep, somewhat excessively drained soil is on basalt plains. It formed in wind-laid sandy deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is grayish brown loamy sand 7 inches thick. The underlying material to a depth of 60 inches or more is grayish brown and gray loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 19 inches.

Included with this soil in mapping are small areas of a soil that is similar to this Grassy Butte soil but that is 20 to 40 inches deep to bedrock. Also included are Diston loamy sand and Matheson loamy sand and areas of Rock outcrop.

Permeability of this Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This soil is used as range, for wildlife habitat, and for recreation.

If this soil is irrigated, it can be used as cropland (fig. 5).

If the range vegetation is in good or excellent condition, the main native grasses on this soil are needleandthread and Indian ricegrass. As the range

vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable grasses, forbs, and woody plants increases. This soil is used for grazing mainly in spring and fall. Mechanical treatment for range seeding or brush management is difficult because of the very high hazard of soil blowing. Management practices suitable for use on this soil include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush management.

Range areas of this soil have potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Elk also use these areas as winter range and as migratory paths to the east-central part of the county.

If this soil is irrigated, it can be used for hay, small grain, pasture, and potatoes. An example of a suitable cropping system is 3 to 5 years of alfalfa hay, 1 year of potatoes, and 1 or 2 years of grain. If pasture is used in the cropping system in place of alfalfa, it should be for 5 to 8 years. Fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation systems are suited. The main limitations are impaired trafficability of machinery and a very high hazard of soil blowing. Soil blowing makes it necessary to replant about one-fourth of the close grown crops each year. Low available water capacity makes frequent light applications of irrigation water necessary. Areas where slope is more than 12 percent need to be smoothed.

If this soil is irrigated, Russian-olive, green ash, Rocky Mountain juniper, Siberian peashrub, and lilac are well suited to use in windbreaks. These plantings also improve the wildlife habitat. Capability subclasses IVe, irrigated, and VIIe, nonirrigated.

35-Grassy Butte-Matheson complex. This complex is on basalt plains. Slope is 1 to 8 percent. The frost-free season is 80 to 100 days.

Grassy Butte loamy sand makes up about 70 percent of this complex, and Matheson loamy sand makes up about 25 percent. The Grassy Butte soil is in dunelike areas.

Included with this complex in mapping is 5 percent Rock outcrop.

The Grassy Butte soil is very deep and somewhat excessively drained. It formed in sandy eolian deposits. Typically, the surface layer is grayish brown loamy sand about 7 inches thick. The underlying material to a depth of 60 inches or more is grayish brown and gray loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of about 19 inches.

Permeability of the Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

The Matheson soil is very deep and well drained. It formed in sandy alluvial and eolian deposits. Typically, the surface layer is light brownish gray loamy sand about 10 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray sandy loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Permeability of the Matheson soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

These soils are used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses on these soils are mainly needleandthread and Indian ricegrass. As the range vegetation deteriorates, the proportion of these two grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. These soils are used for grazing mainly in spring and fall. Mechanical treatment for range seeding or brush management is difficult because of the very high hazard of soil blowing. Management practices suitable for use on these soils include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

Range areas of this complex have potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If these soils are irrigated, they can be used for hay, small grain, pasture, and potatoes. An example of a suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. If pasture is used in the cropping system, it generally is used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation systems are suited. These soils are limited by impaired trafficability of machinery and the very high hazard of soil blowing. Soil blowing makes it necessary to replant close grown crops about 1 year in 4.

If these soils are irrigated, Russian-olive, Idahybrid poplar, Rocky Mountain juniper, Siberian peashrub, and lilac are well suited for use in windbreaks. Capability subclasses IVe, irrigated, and Vile, nonirrigated.

36-Grassy Butte-Medano complex. This complex is on old lakebeds. Some areas are underlain by basalt. Slope is 0 to 4 percent. The frost-free season is 80 to 100 days.

Grassy Butte loamy sand makes up about 60 percent of the complex, and Medano loamy sand makes up 20 percent. The Grassy Butte soil is in the higher lying areas on dunes, and the Medano soil is in concave and depressional areas.

Included with this complex in mapping are areas of Matheson loamy sand, Zwiefel sand, Diston loamy sand, and Psammaquents.

The Grassy Butte soil is very deep and somewhat excessively drained. It formed in sandy eolian deposits. Typically, the surface layer is grayish brown loamy sand about 7 inches thick. The underlying material to a depth of 60 inches or more is grayish brown and gray loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 19 inches.

Permeability of the Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

The Medano soil is very deep and very poorly drained. It formed in alluvial and lacustrine sediment. Typically, the surface is covered with a mat of roots 2 inches thick. The surface layer is grayish brown loamy sand about 6 inches thick. The upper part of the underlying material is grayish brown and dark grayish brown sandy clay loam and sandy loam about 10 inches thick. The lower part to a depth of 60 inches or more is stratified brown and gray coarse sand, gravelly coarse sand, and sand.

Permeability of the Medano soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is ponded, and the hazard of erosion is slight. The hazard of soil blowing is very high. A fluctuating water table is at the surface to a depth of 2 feet from April through June.

These soils are used mainly as native range.

These soils are used for grazing mainly in spring and fall. Mechanical treatment for seeding or brush control is difficult because of the very high hazard of soil blowing and very poor drainage. Management practices suitable for use on these soils include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control. Fall grazing tends to adversely affect the spring nesting areas of waterfowl.

These soils have potential for providing habitat for waterfowl, shore birds, jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIe, nonirrigated.

37-Grassy Butte-Rock outcrop complex. This complex is on basalt plains. Slope is 2 to 20 percent. The frost-free season is 80 to 100 days.

Grassy Butte very stony loamy sand makes up 30 percent of this complex, and Rock outcrop makes up 20 percent. The Grassy Butte soil is in the lower areas, and Rock outcrop is in the higher areas on convex ridges.

Included with this complex in mapping are about 10 percent each of a soil that is similar to this Grassy Butte soil but that is 10 to 40 inches deep to bedrock, a Grassy Butte soil that is 40 to 60 inches deep to bedrock, Matheson loamy sand, Bondfarm sandy loam, and Grassy Butte loamy sand.

The Grassy Butte soil is deep and somewhat excessively drained. It formed in sandy eolian deposits. Typically, the surface layer is grayish brown very stony loamy sand about 7 inches thick. The underlying material to a depth of 60 inches or more is grayish brown and gray loamy sand. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 19 inches.

Permeability of the Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and shrubs. Rock outcrop areas have little value for grazing.

This complex is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses are mainly needleandthread and Indian ricegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases.

This complex is used for grazing mainly in spring and fall. Mechanical treatment for range seeding or brush control is difficult because of the very high hazard of soil blowing and the intermingled areas of Rock outcrop. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Elk also use areas of this complex for winter range and as a migratory path to the east-central part of the county. Capability subclass VIIe, nonirrigated.

38-Greybo silt loam, 2 to 30 percent slopes. This very deep, well drained soil is on loess plains. It formed in silty wind-laid deposits derived from mixed sources. Slope is 2 to 30 percent. The frost-free season is 40 to 70 days.

Typically, the surface is covered with an organic mat 2 inches thick. The surface layer is brown silt loam about 19 inches thick. The underlying material to a depth of 60 inches or more is pale brown and light yellowish brown silt loam. The soil is noncalcareous throughout.

Included with this soil in mapping are small areas of Greybo soils that have slopes of more than 30 percent and areas of stony, very stony, or extremely stony soils.

Permeability of this Greybo soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is slow to rapid, and the hazard of erosion is moderate to very high.

This soil is used for woodland, wildlife habitat, and recreation.

The native vegetation is an overstory of quaking aspen and an understory of Columbia needlegrass, mountain brome, bearded wheatgrass, sweetanise, sweetroot, common chokecherry, and Saskatoon serviceberry. Forage production varies inversely with the density of the tree canopy and height of the quaking aspen. When the understory vegetation deteriorates, the preferred grasses and forbs decrease and weeds and shrubs increase.

This soil has potential for providing habitat for deer, squirrel, songbirds, and birds of prey. Capability subclass VIe, nonirrigated.

39-Hayeston sandy loam. This deep, well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray sandy loam about 7 inches thick. The upper part of the underlying material is light brownish gray sandy loam about 16 inches thick. The lower part to a depth of 60 inches or more is sand and gravel. The soil is calcareous throughout. Depth to sand and gravel is 20 to 40 inches.

Included with this soil in mapping are small areas of Heiseton sandy loam, Xeric Torrifluvents, and Labenzo sandy loam, all of which have slopes of 0 to 1 percent. Also included are some areas of channeled soils.

Permeability of this Hayeston soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is low or moderate. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, potatoes, small grain, and pasture.

A suitable cropping system is 3 or 4 years of alfalfa for hay, 2 years of potatoes, 1 year of wheat or barley for grain, and 1 year of grain grown as a nurse crop with alfalfa. Potatoes can be substituted for the first year of grain following alfalfa. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and crop residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. Water should be applied carefully to avoid raising the water table. Where border or furrow irrigation is used, surface drainage is needed to carry off waste water and to prevent ponding.

Russian-olive, golden willow, and Scotch pine are trees that are suitable for use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food from plants, animals, and insects produced in areas of cropland. Shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle planted along fence rows and ditchbanks, in odd field corners, or in windbreaks improve the habitat for these birds. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIs, irrigated.

40-Hayeston sandy loam, frequently flooded. This deep, well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray sandy loam about 7 inches thick. The upper part of the underlying material is light brownish gray sandy loam about 16 inches thick. The lower part to a depth of 60 inches or more is sand and gravel. The profile is calcareous throughout. Depth to sand and gravel is 20 to 40 inches.

Included with this soil in mapping are small areas of Xeric Torrifluvents, Heiseton sandy loam, and Blackfoot silt loam. Also included are small channeled areas.

Permeability of this Hayeston soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is low or moderate. Surface runoff is very slow, and the hazard of erosion is slight. Flooding normally occurs more frequently than once every 2 years.

This soil is used for irrigated hay and pasture.

Yields of hay and pasture are low in years when flooding occurs. A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop for an alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border irrigation is most commonly used on this soil, but sprinkler irrigation is also suited. If border irrigation is used, a waste water drain should be provided to carry the water away and prevent ponding. Irrigation water should be applied with care to avoid creating a high water table.

Russian-olive, golden willow, and Scotch pine are well suited to use in windbreaks on this soil.

This Hayeston soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter mainly in areas of cropland. Shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle planted along fence rows and ditchbanks, in odd field corners, or in windbreaks improves the habitat for these birds. These plants provide shelter that protects the birds from predators and inclement weather. Food plants provide some cover. Capability subclass IIIw, irrigated.

41-Hayeston gravelly sandy loam. This deep, well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray gravelly sandy loam about 7 inches thick. The upper part of the underlying material is light brownish gray gravelly sandy loam about 16 inches thick. The lower part to a depth of 60 inches is sand and gravel. The soil is calcareous throughout. Depth to sand and gravel ranges from 20 to 40 inches.

Included with this soil in mapping are small areas of Heiseton sandy loam, Xeric Torrifluvents, and Labenzo sandy loam, all of which have slopes of less than 1 percent. Also included are small areas of channeled soils.

Permeability of this Hayeston soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, potatoes, small grain, and pasture.

The gravel content of this soil limits the yield of high quality potatoes. An example of a suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 to 2 years of grain. Pasture is usually used for 5 to 8 years. To maintain high production of crops, commercial fertilizer is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. Waste water drains are needed to remove surplus water and to prevent ponding. In areas where border or furrow irrigation is used, water should be applied with care to avoid creating a high water table.

Russian-olive, golden willow, and Scotch pine are trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. Shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle planted along fence rows and ditchbanks, in odd field corners, or in windbreaks improve the habitat for these birds. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIs, irrigated.

42-Hayeston loam. This deep, well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray loam about 7 inches thick. The upper part of the underlying material is light brownish gray sandy loam about 16 inches thick. The lower part to a depth of 60 inches or more is sand and gravel. Depth to sand and gravel ranges from 20 to 40 inches.

Permeability of this Hayeston soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is very slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Heiseton sandy loam, Wardboro sandy loam, Labenzo sandy loam; and Blackfoot silt loam, all of which have slopes of less than 1 percent. Also included are small areas of channeled soils.

This soil is used for irrigated hay, potatoes, small grain, and pasture.

A suitable cropping system is 3 or 4 years of alfalfa for hay, 2 years of potatoes, 1 year of wheat or barley for grain, and 1 year of grain grown as a nurse crop for alfalfa. The grain is cut, and the alfalfa is left to start the rotation over. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is well suited to row crops, and border irrigation is well suited to alfalfa, small grain, and pasture. Waste water drains are needed to carry the water away and prevent ponding. If furrow and border irrigation systems are used, water should be applied with care to avoid creating a high water table.

Russian-olive, golden willow, and Scotch pine are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly in areas of cropland. To improve wildlife habitat, brush species such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. Food should be close to shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIs, irrigated.

43-Heiseton sandy loam. This very deep, moderately well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is grayish brown sandy loam about 7 inches thick. The underlying material is light brownish gray .and light gray, stratified sandy loam to silt loam about 43 inches thick over sand and gravel that extend to a depth of 60 inches or more. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Xeric Torriorthents, Bereniceton loam, and Blackfoot silt loam, all of which have slope of less than 1 percent. Also included are small areas of channeled soils.

Permeability of this Heiseton soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow; and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 3 and 5 feet from April through June.

This, soil is used for irrigated hay, potatoes, small grain, sugar beets, and pasture.

A suitable cropping system is 3 or 4 years of alfalfa for hay, 2 years of potatoes, 1 year of wheat or barley for grain, and then 1 year of grain grown as a nurse crop for alfalfa. The grain is cut, and the alfalfa is left to start the rotation over. Sugar beets can be substituted the second year after hay. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border or furrow irrigation is used, drains are needed to carry the waste water away and to prevent development of a high water table. Irrigation water should be applied with care to avoid raising the water table.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. Habitat can be improved by planting such species as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle along fence rows and ditchbanks, in odd field corners, or in windbreaks: Food should be close to shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIs, irrigated.

44-Heiseton loam. This very deep, moderately well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is grayish brown loam 7 inches thick. The underlying material is light brownish gray and gray, stratified sandy loam to silt loam about 43 inches thick over sand and gravel that extend to a depth of 60 inches or more. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Blackfoot silt loam, Bereniceton loam, and Xeric Torriorthents, all of which have slopes of less than 1 percent.

Permeability of this Heiseton soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 3 to 5 feet from April through June.

This soil is used for irrigated hay, potatoes, small grain, sugar beets, and pasture.

A suitable cropping system is 3 or 4 years of alfalfa for hay, 2 years of potatoes, 1 year of wheat or barley for grain, and then 1 year of grain grown as a nurse crop for alfalfa. The grain is cut, and the alfalfa is left to start the rotation over. Beets can be substituted the second year after hay. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border or furrow systems are used, waste water drains should be adequate to carry the surplus water away and to prevent ponding. Irrigation water should be applied with care to avoid raising the water table.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. Habitat can be improved by planting such species as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle along fence rows and ditchbanks, in odd field corners, and in windbreaks. Food should be close to shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIs, irrigated.

45-Heiseton loam, slightly saline-alkali, 0 to 4 percent slopes. This deep, moderately well drained soil is on river terraces. It formed in alluvium derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is grayish brown loam about 7 inches thick. The underlying material is light brownish gray and light gray, stratified sandy loam to silt loam about 43 inches thick over sand and gravel that extend to a depth of 60 inches or more. The soil is calcareous throughout.

Included with this soil in mapping are small areas of soils that are similar to this Heiseton soil but that have a sandy clay loam and loamy sand surface layer, Montlid silty clay loam, and Matheson sandy loam. All these soils have slopes of as much as 4 percent.

Permeability of this Heiseton soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 3 and 4 feet.

This soil is used mostly for cropland. The saline-alkali condition of this soil affects the choice and yields of crops.

If this soil is irrigated, it can b used for hay, small grain, pasture, and potatoes. A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. Where pasture is used in the cropping system, it is usually used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation is suited to this soil.

Russian-olive, golden willow, and Scotch pine are well suited to use in windbreaks on this soil.

This soil has potential for producing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. Habitat can be improved by planting such species as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle along fence rows and ditchbanks, in odd field corners, and in windbreaks. Food should be close to shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIw, irrigated.

46-Hovey stony loam. This very deep, somewhat poorly drained soil is on old lakebeds. It formed in lacustrine and alluvial material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray, moderately saline-alkali affected stony loam about 9 inches thick. The subsoil is light brownish gray silty clay loam about 5 inches thick. The upper part of the substratum is white silty clay loam 8 inches thick. The lower part to a depth of 60 inches is light gray and light brownish gray sandy loam and loam. The soil is calcareous throughout and has a concentration of lime between depths of 14 and 53 inches.

Included with this soil in mapping are small areas of a soil that is similar to this Hovey soil but that has a sandy loam surface layer. Also included are small areas of Levelton loam and a few areas where 25 to 50 percent of the surface is covered with cobbles.

Permeability of this Hovey soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal water table fluctuates between depths of 2 and 3 feet from May to October.

This soil is used for native pasture, wildlife habitat, and recreation. It could be used for cropland if it were properly managed and if irrigation water were available.

If the range vegetation is in good or excellent condition, the dominant native grasses are alkali sacaton and saltgrass. Seeding is advisable only if the range vegetation is in poor condition and supplemental irrigation-water is available. Grasses suitable for seeding are tall wheatgrass, tall fescue, and other salt-tolerant grasses. The grass selected should meet the seasonal requirements of livestock or wildlife, or both.

Russian-olive and Rocky Mountain juniper are well suited to use in windbreaks on this soil. Lilac also grows well.

This soil has potential for producing habitat for jackrabbit, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIw.

47-Hovey silt loam. This very deep, somewhat poorly drained soil is on old lakebeds. It formed in lacustrine and alluvial material derived from mixed sources. Slopes are 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray, slightly saline-alkali affected silt loam about 9 inches thick. The subsoil is light brownish gray silty clay loam about 5 inches thick. The upper part of the substratum is white silty clay loam about 8 inches thick. The lower part to a depth of 60 inches or more is light gray and light brownish gray sandy loam and loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 14 inches.

Included with this soil in mapping are small areas of a soil that is similar to this Hovey soil but that has a dark surface layer; areas of moderately well drained Hovey Variant soils; areas of Blackfoot silt loam; and areas of a Hovey silt loam that is moderately saline-alkali affected.

Permeability of this Hovey soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 2 and 3 feet from May to October. The saline-alkali condition and seasonal high water table adversely affect the growth and yields of crops. Spring tillage is often difficult because of wetness.

This soil is used for irrigated pasture, hay, and small grain.

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop to the alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border irrigation is suitable for use on this soil. Sprinkler irrigation is also suitable. If border irrigation is used, waste water drains should be adequate to carry the surplus water away and to help prevent ponding. Irrigation water should be applied with care to avoid raising the water table.

Russian-olive, golden willow, Scotch pine, and lilac are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. Habitat for these birds can be improved by planting such species as tall wheatgrass and lilac along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plants provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIw, irrigated.

48-Hovey clay. This very deep, somewhat poorly drained soil is on old lakebeds. It formed in lacustrine and alluvial material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray, slightly saline-alkali affected clay about 9 inches thick. The subsoil is light brownish gray silty clay loam about 5 inches thick. The upper part of the substratum is white silty clay loam about 8 inches thick. The lower part to a depth of 60 inches or more is light gray and light brownish gray sandy loam and loam.

Included with this soil in mapping are small areas of Hovey silt loam, Hovey Variant clay, Market clay, and Levelton clay, all of which have slopes of less than 1 percent. Some areas of soils north of Roberts are channeled.

Permeability of this Hovey soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 2 and 3 feet from May to October. The saline-alkali condition and the seasonal water table adversely affect the growth and yield of crops. In some years spring tillage is delayed because of wetness.

This soil is used for irrigated small grain, hay, pasture, native pasture, wildlife habitat, and recreation.

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley hay grown as a nurse crop for the alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and crop residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border irrigation is suited to this soil. Waste water drains should be adequate to carry the surplus water away and to help prevent development of a high water table. Irrigation water should be applied with extreme care to avoid raising the water table.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. Habitat can be improved by planting such species as tall wheatgrass and lilac along fence rows and ditchbanks, in odd field corners, or in windbreaks. Such plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIw, irrigated.

49-Hovey Variant silty clay loam. This somewhat poorly drained soil is on old lakebeds. It formed in lacustrine and alluvial material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray, slightly saline-alkali affected silty clay loam about 6 inches thick. The underlying material is stratified light brownish gray, white, and light gray silty clay loam, clay loam, and sandy loam about 26 inches thick over gravelly sand that extends to a depth of 60 inches or more. The soil is calcareous throughout and has a layer of lime accumulation between depths of 11 and 32 inches. Depth to sand and gravel ranges from 20 to 40 inches.

Included with this soil in mapping are small areas of Hovey clay and small areas of soils that are similar to this Hovey soil but that are clay throughout or that are 10 to 20 inches deep to sand and gravel. Also included are small areas of Levelton clay.

Permeability of this Hovey Variant soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is moderate or high. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 2 and 3 feet between May and October. The saline-alkali condition and the seasonal high water table adversely affect the growth and yield of crops. Spring tillage is often delayed because of the wet surface.

This soil is used for irrigated small grain, hay, pasture, native pasture, recreation, and wildlife habitat.

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop to the alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border irrigation is suited to this soil. Sprinkler irrigation is also suited. If border irrigation is used, waste water drains should be provided to carry the surplus water away and to help prevent development of a high water table. Irrigation water should be applied with care to avoid raising the water table.

Russian-olive, Rocky Mountain juniper, and lilac are well suited to use in windbreaks on this soil.

This soil has potential for producing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the habitat for these birds, plants such as tall wheatgrass and lilac can be planted along fence rows and ditchbanks, in

odd field corners, and in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIw, irrigated.

50-Hovey Variant clay. This deep, poorly drained soil is on old lakebeds. It formed in lacustrine and alluvial material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray slightly saline-alkali affected clay about 6 inches thick. The upper part of the underlying material is brownish gray silty clay loam about 5 inches thick. The lower part is brownish gray, white, and light gray silty clay loam, clay loam, and sandy loam about 26 inches thick over gravelly sand that extends to a depth of 60 inches or more. The soil is calcareous throughout and has a concentration of lime between depths of 11 and 32 inches.

Permeability of this Hovey Variant soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 2 and 3 feet between May and October. The saline-alkali condition and seasonal high water table adversely affect the growth and yield of crops. Spring tillage is often delayed because the surface is wet.

This soil is used for irrigated pasture, native pasture, recreation, and wildlife habitat.

A suitable cropping system is 4 to 6 years of pasture followed by 1 year of wheat or barley grown as a nurse crop for the pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border irrigation systems are suited to this soil. Waste water drains should be adequate to carry the surplus water away and to prevent development of a high water table. Irrigation water should be applied with care to avoid raising the water table.

Russian-olive, Rocky Mountain juniper, and lilac are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the habitat for these birds, plants such as tall wheatgrass and lilac can be planted along fence rows and ditchbanks, in odd field corners, and in windbreaks. These plants provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIw, irrigated.

51-Labenzo sandy loam. This deep, moderately well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is grayish brown sandy loam about 13 inches thick. The underlying material is pale brown, stratified light brownish gray and dark gray silt loam to loamy sand about 21 inches thick over sand and gravel. Depth to sand and gravel ranges from 24 to 36 inches.

Included with this soil in mapping are small areas of Hayeston sandy loam and Blackfoot silt loam, both of which have slopes of less than 1 percent. Also included are small areas of channeled soils.

Permeability of this Labenzo soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table is at a depth of 3 to 5 feet from July through September.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 to 2 years of grain. Pasture is usually used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If furrow or border irrigation is .used, waste water drains should be provided to carry the surplus water away and to prevent ponding. Irrigation water should be applied with care to avoid raising the water table.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the habitat for these birds, plants such as Siberian peashrub, Nanking cherry, lilac, and cranberry cotoneaster can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIs, irrigated.

52-Labenzo gravelly loam. This deep, moderately well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is grayish brown gravelly loam about 13 inches thick. The underlying material is stratified, pale brown, light brownish gray, and dark gray silt loam to loamy sand about 21 inches thick over sand and gravel. The soil is calcareous throughout. Depth to sand and gravel ranges from 24 to 36 inches.

Included with this soil in mapping are small areas of Labenzo sandy loam, Labenzo silt loam, Hayeston sandy loam, Wardboro sandy loam, Blackfoot silt loam, and Xeric Torrifluvents, all of which have slope of less than 1 percent. Also included are small channeled areas.

Permeability of this Labenzo soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 3 and 5 feet from July through September.

This soil is used for irrigated hay, pasture, and small grain.

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop for the hay or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border irrigation is suitable for use on this soil. Sprinklers are also suitable. If border irrigation is used, waste water drains should be adequate to carry the surplus water away and to avoid raising the water table.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the habitat, such plants as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, and in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIs, irrigated.

53-Labenzo silt loam. This deep, moderately well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is grayish brown silt loam about 13 inches thick. The underlying material is stratified pale brown, light brownish gray, and dark gray silt loam to loamy sand about 21 inches thick over sand and gravel. The soil is calcareous throughout. Depth to sand and gravel ranges from 24 to 36 inches.

Included with this soil in mapping are small areas of Hayeston sandy loam and Blackfoot silt loam, both of which have slopes of less than 1 percent. Also included are small areas of channeled soils.

Permeability of this Labenzo soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate or high. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 3 and 5 feet from July through September.

This soil is used for irrigated hay, small grain, pasture, and potatoes.

A suitable cropping system is 3 to 5 years of alfalfa hay, 1 year of potatoes, and 1 to 2 years of grain. Pasture is usually used for 5 to 8 years when used in the cropping system. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border or furrow irrigation is used, waste water drains should be adequate to carry the surplus water away and to prevent ponding. Irrigation water should be applied with care to avoid raising the water table.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the habitat for these birds, shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, and in windbreaks. These shrubs provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIs, irrigated,

54-Levelton loamy sand. This very deep, very poorly drained soil is on old lakebeds. It is in the lower depressional areas and in areas around standing water. It formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is white loamy sand about 7 inches thick. The upper part of the underlying material is light gray silty clay about 30 inches thick. The lower part to a depth of 60 inches or more is stratified light brownish gray sandy loam to silty clay. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Levelton loam, Levelton clay loam, Hovey silt loam, and Grassy Butte loamy sand.

Permeability of this Levelton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is ponded, and the hazard of soil erosion is slight. The hazard of soil blowing is very high. A seasonal high water table fluctuates between depths of 1 and 2 feet from July through September.

This soil is used for native pasture, recreation, and wildlife habitat.

If the range vegetation is in good or excellent condition, the main plants are sedges and tufted hairgrass. Because of the loamy sand surface layer and the high water table, range seeding is difficult. Soil blowing is also a limitation for seeding. Where seeding is necessary, suitable grasses are meadow foxtail, tall wheatgrass, tall fescue, and basin wildrye.

This soil has potential for providing habitat for shore birds, waterfowl, and birds of prey. Capability subclass Vlw, nonirrigated.

55-Levelton loam. This deep, very poorly drained soil is on old lakebeds. It formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface is covered by a root mat 2 inches thick. The surface layer is white loam about 7 inches thick. The upper part of the underlying material is light gray silty clay about 30 inches thick. The lower part to a depth of 60 inches or more is stratified light brownish gray sandy loam over silty clay. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Levelton clay loam; Levelton silty clay loam, drained, moderately saline-alkali; Hovey silt loam; and Hovey clay. All of these soils have slopes of less than 2 percent. Also included are small areas of channeled soils.

Permeability of the Levelton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is ponded, and the hazard of erosion is slight. This soil has a high water table that fluctuates between depths of 1 and 2 feet from July through September.

This soil is used for native pasture, recreation, and wildlife habitat.

If the range vegetation is in good or excellent condition, the main plants are sedges and tufted hairgrass. Because of the high water table, it is difficult to cultivate and successfully seed this soil. Where seeding is necessary, grasses such as meadow foxtail, tall wheatgrass, tall fescue, and basin wildrye are suitable.

This soil has potential for providing habitat for shore birds, waterfowl, songbirds, and birds of prey. Capability subclass Vw, nonirrigated.

56-Levelton loam, drained, moderately saline-alkali. This very deep soil is on old lakebeds. It formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is moderately saline-alkali affected white loam about 7 inches thick. The upper part of the underlying material is light gray silty clay about 30 inches thick. The lower part to a depth of 60 inches is stratified light brownish gray sandy loam to silty clay. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Levelton silty clay loam, drained, moderately saline-alkali; Hovey clay; a soil that is similar to this Levelton soil but that has a gravelly loam surface layer; some areas of soils that are 1 to 5 percent lava rock fragments; and some areas that are about 10 percent Matheson loamy sand. Also included, at the western edge of the Camas National Wildlife Refuge, is 5 percent soils that are similar to this Levelton soil but that have a clay loam surface layer or that are loamy sand throughout.

Permeability of this Levelton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow or ponded, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 1 and 3 feet from July through September.

This soil is used for native pasture, recreation, and wildlife habitat.

When the range vegetation is in good or excellent condition, the main grasses are alkali sacaton and inland saltgrass. Seeding grasses is difficult because of wetness and the high water table. Suitable grasses for seeding are tall wheatgrass, tall fescue, and meadow foxtail.

This soil has potential for providing habitat for coyote, sage grouse, waterfowl, songbirds, and birds of prey. Capability subclass Vlw, nonirrigated.

57-Levelton clay loam. This very deep, very poorly drained soil is on old lakebeds. It formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface is covered by a root mat 2 inches thick. The surface layer is white clay loam about 7 inches thick. The upper part of the underlying material is light gray silty clay about 30 inches thick. The lower part to a depth of 60 inches or more is stratified light brownish gray sandy loam to silty clay. The soil is calcareous throughout.

Included with this soil in mapping are small areas of a soil that is similar to this Levelton soil but that is sandy loam throughout, a Levelton soil that has a clay surface layer, Hovey clay, and a soil that is similar to this Levelton soil but that is 20 to 40 inches deep over sand and gravel. All of these soils have slopes of less than 2 percent.

Permeability of this Levelton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is ponded, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 1 and 2 feet from July through September.

This soil is used for native pasture, wildlife habitat, and recreation.

If the range vegetation is in good or excellent condition, the main plants are sedges and tufted hairgrass. Because of the clay loam surface layer and wetness, it is difficult to till this soil and to prepare a suitable seedbed.

Where seeding is necessary, suitable grasses are meadow foxtail, tall wheatgrass, tall fescue, and basin wildrye.

This soil has potential for providing habitat for shore birds, waterfowl, songbirds, and birds of prey. Capability subclass Vw, nonirrigated.

58-Levelton clay loam, moderately saline-alkali. This very deep, very poorly drained soil is on old lakebeds and river terraces. It formed in alluvium and lacustrine sediment derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 115 days.

Typically, the surface layer is white, moderately saline-alkali affected clay loam about 7 inches thick. The upper part of the underlying material is light gray silty clay about 30 inches thick. The lower part to a depth of 60 inches or more is stratified light brownish gray sandy loam to silty clay. The soil is calcareous throughout.

Included with this soil in mapping are small areas of a soil that is similar to this Levelton soil but that is sandy loam throughout, Levelton clay loam, Hovey clay, and a soil that is less than 20 inches deep to sand.

Permeability of this Levelton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is ponded, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 1 and 2 feet.

This soil is used for native pasture.

When the range vegetation is in good or excellent condition, the dominant grasses are alkali sacaton and inland saltgrass. Because of the high water table and the moderate saline-alkali condition, it is difficult to successfully seed pasture or to grow crops. Grasses suitable for seeding are tall wheatgrass and tall fescue.

This soil has potential for providing habitat for shore birds, waterfowl, songbirds, ring-necked pheasant, and birds of prey. Capability subclass Vlw, nonirrigated.

59-Levelton silty clay loam, drained, moderately saline-alkali. This very deep, very poorly drained soil is on old lakebeds. It formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is white, moderately saline-alkali affected silty clay loam about 7 inches thick. The upper part of the underlying material is light gray silty clay about 30 inches thick. The lower part to a depth of 60 inches or more is stratified light brownish gray sandy loam to silty clay. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Levelton loam, Montlid silty clay loam, and Hovey clay, all of which have slopes of 0 to 1 percent. Also included are small areas of Levelton soils that are only slightly saline-alkali affected.

Permeability of this Levelton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal high water table fluctuates between depths of 1 and 3 feet.

This soil is used for native pasture, recreation, and wildlife habitat. If this soil is properly managed, it can support salt- and alkali-tolerant crops.

The native vegetation is mainly alkali sacaton and inland saltgrass. Seeding grasses such as tall wheatgrass, tall fescue, and meadow foxtail increases the production of forage in most areas of this soil.

This soil has potential for providing habitat for coyote, jackrabbit, sage grouse, songbirds, and birds of prey. Capability subclass Vlw, nonirrigated.

60-Levelton-Medano complex. This complex is on old lakebeds. Slope is 0 to 1 percent. The frost-free period is 80 to 100 days.

Levelton clay loam makes up 45 percent of this complex, and Medano sandy loam makes up 30 percent. The Levelton soil is in the slightly higher areas, and the Medano soil is in the depressions.

Included with this complex in mapping is about 25 percent a soil that is similar to this Medano soil but that is poorly drained, Zwiefel sand, a soil that is similar to Hovey soils but that is very poorly drained, and Psammaquents.

The Levelton soil is very deep and very poorly drained. It formed in lacustrine material. Typically, the surface is covered by a root mat 2 inches thick. The surface layer is white clay loam about 7 inches thick. The upper part of the underlying material is light gray silty clay about 30 inches thick. The lower part to a depth of 60 inches or more is stratified light brownish gray sandy loam to silty clay. The soil is calcareous throughout.

Permeability of the Levelton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is ponded, and the hazard of erosion is slight. The seasonal high water table fluctuates between depths of 1 and 2 feet.

The Medano soil is very deep and very poorly drained. It formed in alluvial and lacustrine sediment. Typically, the surface is covered by a root mat 2 inches thick. The surface layer is grayish brown sandy loam about 6 inches thick. The upper part of the underlying material is grayish brown and dark grayish brown sandy clay loam and sandy loam about 10 inches thick. The lower part to a depth of 60 inches or more is brown and gray coarse sand, gravelly coarse sand, and sand.

Permeability of the Medano soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is ponded, and the hazard of erosion is slight. The seasonal high water table fluctuates between the surface and a depth of 2 feet. The soil is subject to flooding in years of excessive moisture.

These soils are used for native pasture, wild hay, recreation, and wildlife habitat.

When the range vegetation is in good or excellent condition, the vegetation is mainly sedges and tufted hairgrass.

This complex has potential for providing habitat for shore birds, pronghorn antelope, coyote, songbirds, and birds of prey. Capability subclass Vw, nonirrigated.

61-Lidy sandy loam, 0 to 2 percent slopes. This deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is pale brown sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is light gray sandy loam 24 inches thick over sand and gravel. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 5 inches. Depth to gravel ranges from 23 to 34 inches.

Included with this soil in mapping are small areas of Matheson sandy loam, Lidy loamy sand, and a soil that is similar to this Lidy soil but that does not have a layer of strong lime accumulation.

Permeability of this Lidy soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. The pasture is usually used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border, furrow, and sprinkler irrigation systems are used. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. Where border or furrow irrigation systems are used, waste water drains should be adequate to carry the surplus water away and to prevent ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the habitat for these birds, shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIs, irrigated.

62-Lidy sandy loam, 2 to 4 percent slopes. This deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is pale brown sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is light gray sandy loam 24 inches thick over sand and gravel. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 5 inches. Depth to sand and gravel ranges from 23 to 34 inches.

Included with this soil in mapping are small areas of Matheson sandy loam and Lidy gravelly loam, both of which have slopes of 0 to 2 percent. Also included are small areas of soils that have slopes of 8 to 12 percent.

Permeability of this Lidy soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is moderate.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. Where pasture is used in the rotation, it is usually used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border, furrow, and sprinkler irrigation systems are used. Sprinkler irrigation is suited to all crops, and furrow irrigation is suited to row crops. In some areas border irrigation can be used for alfalfa, small grain, and pasture. Where furrow or border systems are used, waste water drains should be adequate to carry the surplus water away and to prevent ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the habitat for these birds, shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIe, irrigated.

63-Lidy gravelly loam. This deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed sources. Slope is 0 to 2 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is pale brown gravelly loam 5 inches thick. The underlying material to a depth of 60 inches or more is light gray sandy loam 24 inches thick

over sand and gravel. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 5 inches. Depth to sand and gravel ranges from 23 to 34 inches.

Included with this soil in mapping are small areas of Matheson sandy loam and Lidy loam, both of which have slopes of 0 to 2 percent.

Permeability of this Lidy soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, small grain, potatoes, and pasture. The gravelly surface layer adversely affects tillage and the quality of potatoes.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 to 2 years of grain. Where pasture is used in the cropping system, it generally is used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border, furrow, and sprinkler irrigation systems are used. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border or furrow systems are used, waste water drains should be adequate to carry the surplus water away and to prevent ponding.

Russian-olive, golden willow, and Norway spruce are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain .their food and shelter either directly or indirectly from cropland. To improve the habitat for these birds, shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass Ills, irrigated.

64-Malm-Matheson loamy sands. This complex is on basalt plains. Slope is 2 to 8 percent. The frost-free season is 80 to 100 days.

Malm loamy sand makes up about 75 percent of the complex, and Matheson loamy sand makes up about 15 percent.

Included with this complex in mapping is about 10 percent Bereniceton loamy sand, Bondranch loamy sand, and Rock outcrop.

The Malm soil is moderately deep and well drained. It formed in eolian sandy material. Typically, the surface layer is brown loamy sand about 4 inches thick. The underlying material is pale brown and white sandy loam. Basalt is at a depth of 24 inches. The profile is calcareous throughout and has a layer of lime accumulation at a depth of 12 inches.

Permeability of the Malm soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

The Matheson soil is deep and well drained. It formed in sandy eolian material. Typically, the surface layer is light brownish gray loamy sand about 10 inches thick. The underlying material is light brownish gray and light gray sandy loam about 36 inches thick. Basalt bedrock is at a depth of 46 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Permeability of the Matheson soil is moderately rapid. Effective rooting depth is 40 to 60 inches. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

These soils are used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the main grasses are needleandthread, bluebunch wheatgrass, and Indian ricegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. These soils are used for grazing mainly in spring and fall. They are not suited to mechanical seeding or brush control because of the very high hazard of soil blowing. Management practices suitable for use on these soils are proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control:

These soils have potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If these soils are irrigated, they can be used for hay, small grain, pasture, and potatoes.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. Where pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation systems are used. The main limitations are impaired trafficability of machinery and a very high hazard of soil blowing. Soil blowing makes it necessary to plant close grown crops about 1 year in 4.

If these soils are irrigated, Russian-olive, green ash, Rocky Mountain juniper, Siberian peashrub, and lilac are well suited to use in windbreaks. Capability subclasses IVe, irrigated, and Vlle, nonirrigated.

65-Malm-Matheson sandy loams. This complex is on basalt plains. Slope is 1 to 8 percent. The frost-free season is 80 to 100 days.

Malm sandy loam makes up about 70 percent of the complex, and Matheson sandy loam makes up 20 percent. The Malm soil is on convex side slopes, and the Matheson soil is on concave side slopes and on some convex side slopes.

Included with this complex in mapping is about 10 percent Bondranch sandy loam and Rock outcrop.

The Malm soil is moderately deep and well drained. It formed in sandy eolian material: Typically, the surface. layer is brown sandy loam about 4 inches thick. The underlying material is pale brown and white sandy loam. Basalt is at a depth of 24 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 12 inches.

Permeability of the Malm soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate.

The Matheson soil is deep and well drained. It formed in sandy eolian material. Typically, the surface layer is light brownish gray sandy loam about 10 inches thick. The underlying material is light brownish gray and light gray sandy loam. Basalt is at a depth of 46 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Permeability of the Matheson soil is moderately rapid. Effective rooting depth is 40 to 60 inches. Available water capacity is moderate. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate.

This complex is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the main grasses are bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. Seeding is a good practice if the range vegetation is in poor condition. Grasses suitable for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, and Indian ricegrass. The grass selected should meet the seasonal grazing requirements of livestock or wildlife, or both. To help control soil blowing, minimum tillage should be practiced when seeding grasses.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If these soils are irrigated, they can be used for hay, small grain, pasture, and potatoes. A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. Where pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation is best suited to these soils because of the variable slopes.

If these soils are irrigated, Russian-olive, Idahybrid poplar, Rocky Mountain juniper, Siberian peashrub, and lilac are among the trees and shrubs that are well suited to use in windbreaks. Such plantings improve the wildlife habitat by providing protection from predators and inclement weather. Capability subclasses IIIe, irrigated, and VIe, nonirrigated.

66-Malm-Matheson-Rock outcrop complex. This complex is on basalt plains. Slope is 2 to 8 percent. The frost-free season is 80 to 115 days.

Malm loamy sand makes up about 35 percent of this complex. Matheson loamy sand makes up 20 percent, and Rock outcrop makes up 20 percent. The Malm soil is in convex areas and on flat ridgetops, the Matheson soil is in convex and undulating areas, and Rock outcrop is on the upper parts of ridges.

Included with this complex in mapping is about 25 percent Bondranch loamy sand, Malm sandy loam, Bondfarm loamy sand, and Grassy Butte sand.

The Malm soil is moderately deep and well drained. It formed in sandy eolian material. Typically, the surface layer is brown loamy sand about 4 inches thick. The underlying material is pale brown and white sandy loam. Basalt is at a depth of 24 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 12 inches.

Permeability of the Malm soil is moderate. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

The Matheson soil is deep and well drained. It formed in sandy eolian material. Typically, the surface layer is light brownish gray loamy sand about 10 inches thick. The underlying material is light brownish gray and light gray sandy loam. Basalt is at a depth of 46 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Permeability of the Matheson soil is moderately rapid. Effective rooting depth is 40 to 60 inches. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and shrubs. Rock outcrop areas have little value for grazing.

These soils are used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the main grasses are needleandthread, bluebunch

wheatgrass, and Indian ricegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of annual grasses, forbs, and woody plants increases.

This complex is used for grazing mainly in spring and fall. It generally is not suited to mechanical seeding or brush control because of the very high hazard of soil blowing. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIe, nonirrigated.

67-Malm-Rock outcrop complex. This complex is on basalt plains. The frost-free season is 80 to 100 days.

Malm extremely stony sandy loam makes up about 40 percent of this complex, Rock outcrop makes up about 30 percent, and Bondfarm sandy loam makes up about 20 percent. The Malm soil is in concave and nearly level areas; Rock outcrop and the Bondfarm soil are on convex slopes.

Included with this complex in mapping is about 10 percent Matheson sandy loam and a soil that is similar to the Malm soil but that is loamy sand throughout. Also included are some areas of soils that have slopes of 30 to 60 percent.

The Malm soil is moderately deep and well drained. It formed in sandy wind-laid material. Slope is 2 to 20 percent. Typically, the surface layer is brown extremely stony sandy loam about 4 inches thick. The underlying material is pale brown and white sandy loam. Basalt is at a depth of 24 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 12 inches.

Permeability of the Malm soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is slow or medium, and the hazard of erosion is slight to high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and shrubs. Rock outcrop areas have little value for grazing.

The Bondfarm soil is shallow and well drained. It formed in sandy eolian material. Slope is 4 to 12 percent. Typically, the surface layer is light brownish gray sandy loam about 4 inches thick. The subsoil and substratum are very pale brown sandy loam. Basalt is at a depth of 18 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 4 inches.

Permeability of the Bondfarm soil is moderately rapid. Effective rooting depth is 10 to 20 inches. Available water capacity is low. Surface runoff is medium, and the hazard of erosion is moderate or high.

These soils are used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. It generally is not suited to mechanical seeding or brush control because of the extremely stony surface and the areas of Rock outcrop. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIs, nonirrigated.

68-Market clay. This very deep, well drained soil is in playas on old lakebeds. It formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is gray clay about 8 inches thick. The upper part of the underlying material is gray clay about 20 inches thick. The lower part to a depth of 60 inches or more is stratified light gray silt to silty clay.

Included with this soil in mapping are small areas of Market silty clay loam and Hovey clay.

Permeability of this Market soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. The hazard of erosion is slight. Surface runoff is very slow, and the hazard of soil blowing is moderate. Clods form easily if this soil is tilled.

This soil is used for irrigated hay, small grain, and pasture.

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop for a new alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border irrigation is the system most commonly used. Waste water drains should be adequate to carry the surplus water away and to prevent ponding. Because of the slow permeability, irrigation water should be applied with care to avoid excessive ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve wildlife habitat, such plants as Siberian peashrub, European

privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIs, irrigated.

69-Matheson loamy sand, 2 to 4 percent slopes. This very deep, well drained soil is on basalt plains and alluvial fans. It formed in sandy wind-laid deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray loamy sand about 10 inches thick. The underlying material to a depth of 60 inches is light brownish gray and light gray sandy loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Included with this soil in mapping are small areas of Grassy Butte loamy sand and Malm loamy sand.

Permeability of this Matheson soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. If pasture is used in the cropping system, it is commonly used for 5 to 8 years. Soil blowing makes it necessary to replant close grown crops about 1 year in 4. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation generally is used. Border and furrow irrigation are difficult to use because of the slope. Special management is needed to reduce the risk of soil blowing.

Russian-olive, golden willow, and Rocky Mountain juniper are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for producing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the habitat for these birds, plants such as Siberian peashrub, Nanking cherry, lilac, and European privet can be planted along fence rows and ditchbanks, in odd field corners, and in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IVe, irrigated.

70-Matheson loamy sand, 2 to 8 percent slopes. This very deep, well drained soil is on basalt plains. It formed in sandy wind-laid deposits derived from mixed sources. The frost-free season is 80 to 115 days.

Typically, the surface layer is light brownish gray loamy sand about 10 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray sandy loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Included with this soil in mapping are areas of Grassy Butte loamy sand, Zwiefel sand, and Rock outcrop. Also included, in the area north of Mud Lake, is Lidy loamy sand.

Permeability of this Matheson soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This soil is used as range, for wildlife habitat, and for recreation.

If this soil is irrigated and properly managed, it can be used as cropland. The main limitations are impaired trafficability of machinery and the very high hazard of soil blowing. Soil blowing makes it necessary to replant close grown crops about 1 year in 4.

If the range vegetation is in good or excellent condition, the main grasses are needleandthread, bluebunch wheatgrass, and Indian ricegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of forbs and woody plants increases. Areas of rangeland are used for grazing mainly in spring and fall. They are not suited to mechanical seeding or brush control because of the loamy sand surface layer and the very high hazard of soil blowing. Management practices suitable for use on these soils include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This Matheson soil has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If this soil is irrigated, it can be used for hay, small grain, pasture, and potatoes. An example of a suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. If pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation systems are used.

If this soil is irrigated, Russian-olive, green ash, Rocky Mountain juniper, Siberian, peashrub, and lilac are examples of trees and shrubs that are well suited to use in windbreaks. These plants also improve the wildlife habitat. Capability subclasses IVe, irrigated, and VIIe, nonirrigated.

71-Matheson sandy loam, 0 to 2 percent slopes. This very deep, well drained soil is on basalt plains and alluvial fans. It formed in sandy wind-laid deposits de-

rived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray sandy loam about 10 inches thick. The underlying material is light brownish gray and light gray sandy loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Included with this soil in mapping are small areas of Lidy sandy loam and areas of soils that are similar to this Matheson soil but that are mostly loam and silty clay loam throughout.

Permeability of this Matheson soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. If pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are used on this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture.

Russian-olive, green ash, and Rocky Mountain juniper are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve wildlife habitat, such plants as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass Ills, irrigated.

72-Matheson sandy loam, 2 to 4 percent slopes.

This very deep, well drained soil is on basalt plains and alluvial fans. It formed in alluvium and wind-laid sandy deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray sandy loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Included with this soil in mapping are small areas of Malm sandy loam.

Permeability of this Matheson soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is moderate.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of small grain. When pasture is used in the cropping system, it is usually used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation is most commonly used. Furrow and border irrigation systems are difficult to use because of the slope.

Russian-olive, green ash, and Rocky Mountain juniper are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the wildlife habitat, such plants as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIe, irrigated.

73-Matheson sandy loam, 4 to 8 percent slopes.

This deep, well drained soil is on basalt plains. It formed in sandy wind-laid deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray sandy loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Included with this soil in mapping. are small areas of Matheson sandy loam, 0 to 4 percent slopes, and small areas of Matheson loamy-sand, Bondranch sandy loam, Lidy sandy loam, Malm sandy loam, and Pancheri silt loam, all of which have slopes of 4 to 8 percent. Also included are areas of Rock outcrop.

Permeability of this Matheson soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is high.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. When pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of

crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation is most commonly used. Furrow and border irrigation systems are difficult to use because of the slope.

Russian-olive, green ash, and Rocky Mountain juniper are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve wildlife habitat, such plants as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, and in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIe, irrigated.

74-Matheson sandy loam, 1 to 6 percent slopes. This very deep, well drained soil is on basalt plains. It formed in wind-laid sandy deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray sandy loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Included with this soil in mapping are small areas of Malm sandy loam, Malm loamy sand, Matheson loamy sand, and Rock outcrop.

Permeability of this Matheson soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow or medium, and the hazard of erosion is slight to high.

This soil is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the main native grasses are bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. Seeding is a good practice if the range vegetation is in poor condition. Suitable grasses for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, and Indian ricegrass. The grass selected for seeding should meet the seasonal grazing requirements of livestock or wildlife, or both.

This soil has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If this soil is irrigated and properly managed, it can be used for hay, small grain, pasture, and potatoes. A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. If pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation is best suited to this soil because of the variable slopes.

If this soil is irrigated, Russian-olive, green ash, Rocky Mountain juniper, Siberian peashrub, and lilac are among the plants that are well suited for use in windbreaks. These plants provide protection from predators and inclement weather. Capability subclasses IIIe, irrigated, and VIe, nonirrigated.

75-Matheson loam. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed sources. Slope is 0 to 2 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray loam about 10 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray sandy loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Included with this soil in mapping are small areas of Bereniceton loam and Lidy sandy loam. Also included, where this soil is near Montlid soils, are areas of soils that are similar to this Matheson soil but that are moderately well drained or somewhat poorly drained.

Permeability of this Matheson soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. When pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border or furrow systems are used, waste water drains should be adequate to carry the surplus water away and to prevent ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the

wildlife habitat, such plants as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIs, irrigated.

76-Matheson-Malm sandy loams. This complex is on basalt plains. Slope is 0 to 2 percent. The frost-free season is 80 to 100 days.

Matheson sandy loam makes up 70 percent of this complex, and Malm sandy loam makes up 20 percent. The Matheson soil is in concave areas and on some leeward slopes, and the Malm soil is on convex slopes and in areas near Rock outcrop.

Included with this complex in mapping is about 10 percent a soil that is similar to this Malm soil but that is loam throughout, and Rock outcrop.

The Matheson soil is very deep and well drained. It formed in wind-laid sandy material derived from mixed sources. Typically, the surface layer is light brownish gray sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray sandy loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Permeability of the Matheson soil is moderately rapid. The effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

The Malm soil is moderately deep and well drained. It formed in wind-laid sandy material derived from mixed sources. Typically, the surface layer is brown sandy loam about 4 inches thick. The underlying material is pale brown and white sandy loam. Basalt is at a depth of 24 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 12 inches.

Permeability of the Malm soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is slow, and the hazard of erosion is slight.

This complex is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 4 or 5 years of alfalfa for hay or pasture, 1 or 2 years of grain, and then 1 year of grain with a new seeding of alfalfa or pasture. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border and sprinkler irrigation systems are used on this soil. Sprinkler irrigation is suited to all crops, and border irrigation is suited to hay, small grain, and pasture. If border irrigation is used, waste water drains should be adequate to carry the surplus water away and to prevent development of a high water table.

Russian-olive, green ash, and Rocky Mountain juniper are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the habitat for these birds, shrubs such as Siberian peashrub, Nanking cherry, lilac, and cranberry cotoneaster can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIs, irrigated.

77-Matheson-Malm loams. This complex is on basalt plains. Slope is 2 to 12 percent. The frost-free season is 80 to 100 days.

Matheson loam makes up about 45 percent of this complex, and Malm loam makes up 20 percent. The Matheson soil is on concave and convex side slopes, and the Malm soil is in knoll-like areas near Rock outcrop and on some broad ridges.

Included with this complex in mapping is about 25 percent Bereniceton loam, Terreton sandy clay loam, Bondfarm sandy loam, and Rock outcrop.

The Matheson soil is deep and well drained. It formed in sandy wind-laid material. Typically, the surface layer is light brownish gray loam about 10 inches thick. The underlying material is light brownish gray and light gray sandy loam. Basalt is at a depth of 46 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Permeability of the Matheson soil is moderately rapid. Effective rooting depth is 60 inches or more. The available water capacity is high. Surface runoff is slow or medium, and the hazard of erosion is moderate or high.

The Malm soil is moderately deep and well drained. It formed in sandy wind-laid material. Typically, the surface layer is brown loam about 4 inches thick. The underlying material is pale brown and white sandy loam. Basalt is at a depth of 24 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 12 inches.

Permeability of the Malm soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is slow or medium, and the hazard of erosion is moderate or high.

These soils are used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the main native grasses are bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. Seeding is a good practice if the range vegetation is in poor condition. Suit-

able grasses for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, or Indian ricegrass. The grass selected for seeding should meet the seasonal grazing requirements of livestock or wildlife, or both.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass Vls, nonirrigated.

78-Matheson complex. This complex is on basalt plains. Slope is 1 to 8 percent. The frost-free season is 80 to 100 days.

Matheson loamy sand makes up about 45 percent of this complex, and Matheson loam makes up 35 percent. The Matheson loamy sand occurs as hummocks less than 12 inches high, and the Matheson loam is between the hummocks.

Included with this complex in mapping is about 20 percent Bereniceton loamy sand, Bereniceton loam, Terreton loamy sand, Terreton sandy clay loam, and Rock outcrop.

The Matheson loamy sand is deep and well drained. It formed in eolian deposits. Typically, the surface layer is light brownish gray loamy sand about 10 inches thick. The underlying material is light brownish gray and light gray sandy loam. Basalt is at a depth of 46 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 10 inches.

Permeability of the Matheson loamy sand is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate or high. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate. The hazard of soil blowing is very high.

The Matheson loam is deep and well drained. It formed in eolian deposits. Typically, the surface layer is light brownish gray loam about 10 inches thick. The underlying material is light brownish gray and light gray sandy loam. Basalt is at a depth of 46 inches. The soil is calcareous throughout and has ' layer of lime accumulation at a depth of 10 inches.

Permeability of the Matheson loam is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate or high. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate.

These soils are used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses are needleandthread, Indian ricegrass, and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of annual grasses, forbs, and woody plants increases.

This complex is used for grazing mainly in spring and fall. Generally, mechanical seeding or brush management is not practical on this complex because of the very high hazard of soil blowing. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If these soils are irrigated, they can be used as cropland. The main limitations are restricted trafficability of machinery and a very high hazard of soil blowing on the Matheson loamy sand. It may be necessary to replant close grown crops 1 year in 4 because of the risk of soil blowing.

Among the crops that can be grown on these soils are hay, small grain, pasture, and potatoes. A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. If pasture is used in the rotation, it is commonly used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation systems are suited to these soils.

If these soils are irrigated, Russian-olive, green ash, Rocky Mountain juniper, Siberian peashrub, and lilac are well suited to use in windbreaks. These plantings also improve the wildlife habitat. Capability subclasses IVe, irrigated, and VIIe, nonirrigated.

79-Mathon-Rock outcrop complex. This complex is on basalt plains. Slope is 2 to 20 percent. The frost-free season is 80 to 100 days.

Mathon loamy sand makes up 40 percent of this complex, and Rock outcrop makes up 35 percent. The Mathon soil is in the lower concave areas, and Rock outcrop is in the slightly higher, convex areas.

Included with this complex in mapping is about 25 percent Modkin loamy sand, Matheson loamy sand, and a loamy sand that is 10 to 20 inches deep over basalt.

The Mathon soil is very deep and well drained. It formed in sandy wind-laid material. Typically, the surface layer is brown loamy sand about 5 inches thick. The subsoil is brown sandy loam 20 inches thick. The substratum is very pale brown and pale brown sandy loam. Basalt is at a depth of 62 inches. The soil is noncalcareous from the surface to the layer of lime accumulation, which is at a depth of 25 inches.

Permeability of the Mathon soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow to medium, and the hazard of erosion is slight. The hazard of soil blowing is very high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of

grasses, forbs, and woody plants. Rock outcrop areas have little value for grazing.

This complex is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the main native grasses are needleandthread, bluebunch wheatgrass, and Indian ricegrass. If the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. Mechanical range seeding or brush control is difficult because of the hazard of soil blowing and areas of Rock outcrop. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Elk use areas of this complex as winter range and as a migratory path. Capability subclass Vlls, nonirrigated.

80-Mathon-Rock outcrop-Modkin complex. This complex is on basalt plains. Slope is 2 to 12 percent. The frost-free season is 80 to 100 days.

Mathon sandy loam makes up about 35 percent of the complex, Rock outcrop makes up about 30 percent, and Modkin sandy loam makes up 20 percent. The Mathon soil is in the lower concave areas, and Rock outcrop and the Modkin soil are in convex areas.

Included with this complex in mapping is about 15 percent Bondranch sandy loam and Grassy Butte loamy sand.

The Mathon soil is deep and well drained. It formed in sandy wind-laid material. Typically, the surface layer is brown sandy loam about 5 inches thick. The subsoil is brown sandy loam about 20 inches thick. The substratum is very pale brown and pale brown sandy loam. Basalt is at a depth of 57 inches. The soil is noncalcareous from the surface to the layer of lime accumulation, which is at a depth of 25 inches.

Permeability of the Mathon soil is moderately rapid. Effective rooting depth is 40 to 60 inches. Available water capacity is moderate. Surface runoff is slow or medium, and the hazard of erosion is moderate or high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and woody plants. Rock outcrop areas have little value for grazing.

The Modkin soil is moderately deep and well drained. It formed in sandy wind-laid material. Typically, the surface layer is brown sandy loam about 6 inches thick. The subsoil is brown and light brownish gray sandy loam and gravelly sandy loam about 22 inches thick. The substratum is white sandy loam. Basalt is at a depth of 32 inches. The soil is noncalcareous from the surface to the layer of lime accumulation, which begins at a depth of 28 inches.

Permeability of the Modkin soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low. Surface runoff is medium, and the hazard of erosion is moderate or high.

These soils are used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the main native grasses are bluebunch wheatgrass and Thurber needlegrass. When the range deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. Mechanical range seeding or brush control is difficult because of the areas of Rock outcrop. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control;

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Elk use areas of this complex as winter range and as a migratory path. Capability subclass Vlls, nonirrigated.

81-Medano complex. This complex is in areas on old lakebeds. Slope is 0 to 2 percent. The frost-free season is 80 to 100 days.

Medano sandy loam makes up 50 percent of the complex, and Medano loamy sand makes up 30 percent. The Medano sandy loam is in concave and depressional areas, and the Medano loamy sand is in slightly elevated areas.

Included with this complex in mapping is about 20 percent Zwiefel sand, Grassy Butte loamy sand, Psammaquents, and Terreton loamy sand. Also included, along the western edge of Camas National Wildlife Refuge, are some areas of Levelton soils that vary in texture of the surface layer. In most areas in the Camas National Wildlife Refuge, the level of the water table is controlled to provide habitat for waterfowl. In the lower depressions, this produces ponding between July and November.

The Medano sandy loam is very deep and very poorly drained., It formed in alluvium and lacustrine sediment. Typically, the surface is covered with a mat of roots 2 inches thick. The surface layer is grayish brown sandy loam about 6 inches thick. The upper part of the underlying material is grayish brown and dark grayish brown sandy clay loam 10 inches thick. The lower part to a depth of 60 inches or more is brown and gray coarse sand, gravelly coarse sand, and sand.

Permeability of the Medano sandy loam is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is ponded. The hazard of erosion is slight. The hazard of

soil blowing is very high. The water table is at a depth of 0 to 2 feet.

The Medano loamy sand is very deep and very poorly drained. It formed in alluvium and in lacustrine sediment. Typically, the surface is covered with a mat of roots 2 inches thick. The surface layer is grayish brown loamy sand about 6 inches thick. The upper part of the underlying material is grayish brown and dark grayish brown sandy clay loam 10 inches thick. The lower part to a depth of 60 inches or more is brown and gray coarse sand, gravelly coarse sand, and sand.

Permeability of the Medano loamy sand is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is ponded. The hazard of erosion is slight. The hazard of soil blowing is very high. The water table is at a depth of 0 to 2 feet in most areas, but it is at a depth of 1 to 3 feet in higher lying areas.

This complex is used for wild hay, native pasture, wildlife habitat, and recreation.

The native grasses are mainly sedges, tufted hairgrass, and slender wheatgrass. If the vegetation deteriorates to poor condition, the proportion of these plants decreases and the proportion of less desirable plants increases. Fall grazing limits the use of this complex for wildlife nesting areas the following spring.

This complex has potential for providing habitat for waterfowl, shore birds, coyote, pronghorn antelope, songbirds, and birds of prey. Capability subclass Vw, nonirrigated.

82-Medano-Psammaquents complex. This complex is in low areas. on old lakebeds. Slope is 0 to 2 percent. The frost-free season is 80 to 100 days.

Medano sandy loam makes up about 80 percent of this complex, and Psammaquents make up 15 percent. The Medano soil is in the slightly elevated areas adjacent to areas of Psammaquents. The Psammaquents are in the depressional areas and are frequently covered with water.

Included with this complex in mapping is about 5 percent Grassy Butte loamy sand and Zwiefel sand. Also included, in some places along the western edge of the Camas Wildlife Refuge, are areas of Levelton clay loam.

The Medano soil is very deep and very poorly drained. It formed in alluvium and in lacustrine sediment. Typically, the surface is covered with a root mat 2 inches thick. The surface layer is grayish brown sandy loam 6 inches thick. The upper part of the underlying material is grayish brown and dark grayish brown sandy clay loam and sandy loam about 10 inches thick. The lower part to a depth of 60 inches or more is brown and gray coarse sand and gravelly coarse sand.

Permeability of the Medano soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is ponded or very slow, and the hazard of erosion is slight. The water table is at a depth of 0 to 2 feet during April through June.

Psammaquents are very deep, sandy, and very poorly drained. They formed in alluvial outwash. They consist of marsh areas that are usually inundated between May and October. Vegetation is mostly cattails and other water-loving plants.

This complex is used for wildlife habitat, recreation, and native pasture.

The native vegetation is sedges, tufted hairgrass, and slender wheatgrass. If the vegetation deteriorates to poor condition, the proportion of these plants decreases and the proportion of less desirable plants increases. Fall grazing limits the use of this complex for wildlife nesting areas the following spring.

This complex has potential for providing habitat for waterfowl, shore birds, coyote, songbirds, and birds of prey. Capability subclass Vw, nonirrigated.

83-Minnewaukan soils. These very deep, poorly drained soils are on river terraces. They formed in alluvium derived from mixed sources. Slope is 0 to 1 percent.

This map unit consists of. Minnewaukan coarse sandy loam and Minnewaukan loamy coarse sand. Either or both of these soils may occur in any mapped area.

Included with these soils in mapping are small areas of Levelton clay and Hovey clay, both of which have slopes of less than 1 percent. Also included are small areas of channeled soils.

Typically, the surface is covered by a mat of roots 2 inches thick. The surface layer is light brownish gray coarse sandy loam or loamy coarse sand about 8 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and gray loamy coarse sand and coarse sand.

Permeability of these soils is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is ponded, and the hazard of erosion is slight. A seasonal high water table fluctuates between the surface and a depth of 2 feet from April through June.

These soils are used for native pasture and wildlife.

Where the vegetation is in good or excellent condition, the main plants are sedges, tufted hairgrass, and slender wheatgrass. Range seeding is difficult because of the texture of the surface layer and the water table. Suitable grasses for seeding are tall wheatgrass, tall fescue, or meadow foxtail.

These soils have potential for producing habitat for waterfowl, songbirds, and birds of prey. Capability subclass Vw, nonirrigated.

84-Modkin loamy sand, 2 to 12 percent slopes. This moderately deep, well drained soil is on basalt plains. It formed in sandy wind-laid deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is brown loamy sand about 6 inches thick. The subsoil is brown and light brownish gray sandy loam about 22 inches thick. The substratum is white sandy loam. Basalt is at a depth of 32 inches. A calcareous layer is at a depth of 28 inches.

Included with this soil in mapping are small areas of a soil that is similar to this Modkin soil but that is loamy sand throughout, Mathon sandy loam, and Rock outcrop.

Permeability of this Modkin soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate. The hazard of soil blowing is very high.

This soil is used as range, for wildlife habitat, and for recreation.

If this soil is irrigated and properly managed, it can also be used as cropland. The main limitations are impaired trafficability of machinery and a very high hazard of soil blowing. Soil blowing makes it necessary to replant close grown crops about 1 year in 4.

If the range vegetation is in good or excellent condition, the main native grasses are needleandthread and Indian ricegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This soil is used for grazing mainly in spring and fall. Mechanical seeding or brush management is difficult on this soil because of the very high hazard of soil blowing. Suitable management practices include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This soil has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If this soil is irrigated, it can be used for hay, small grain, and pasture. A suitable cropping system is 3 to 5 years of alfalfa for hay, and 1 or 2 years of grain. If pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation systems, are used.

If this soil is irrigated, Russian-olive, Scotch pine, Rocky Mountain juniper, Siberian peashrub, and lilac are well suited to use in windbreaks. These plantings also improve the wildlife habitat. Capability subclasses IVe, irrigated, and Vlle, nonirrigated.

85-Modkin sandy loam, 0 to 2 percent slopes. This moderately deep, well drained soil is on basalt plains. It formed in sandy wind-laid deposits derived from mixed sources. The frost-free season is 80 to 115 days.

Typically, the surface layer is brown sandy loam about 6 inches thick. The subsoil is brown and light brownish gray sandy loam about 22 inches thick. The substratum is white sandy loam. Basalt is at a depth of 32 inches.A calcareous layer is at a depth of 28 inches.

Included with this soil in mapping are small areas of Grassy Butte loamy sand, Bondranch sandy loam, Mathon sandy loam, and Rock outcrop.

Permeability of this Modkin soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is very slow or slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, potatoes, small grain, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border and sprinkler irrigation systems are used. Sprinkler irrigation is suited to all crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border irrigation is used, waste water drains should be adequate to carry the surplus water away and to prevent excessive ponding.

Russian-olive, golden willow, and Scotch pine are trees that are well suited to use in windbreaks on this soil.

This soil has potential for producing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve the habitat, shrubs such as Siberian peashrub, lilac, and European privet can be planted along fence rows and ditchbanks, in odd field corners, and in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIs, irrigated.

86-Modkin sandy loam, 2 to 6 percent slopes. This moderately deep, well drained soil is on basalt plains. It formed in wind-laid deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is brown sandy loam about 6 inches thick. The subsoil is brown and light brownish gray sandy loam about 22 inches thick. The substratum is white sandy loam. Basalt is at a depth of 32 inches. Typically, the soil is calcareous below a depth of 28 inches.

Included with this soil in mapping are small areas of Mathon sandy loam, Bondranch sandy loam, and Rock outcrop.

Permeability of this Modkin soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate.

This soil is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses are bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. Seeding is a good practice if the range vegetation is in poor condition. Suitable grasses for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, and Indian ricegrass. The grass selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This soil has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If this soil is irrigated and properly managed, it can be used as cropland. It can be used for such crops as hay, small grain, pasture, and potatoes. A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. Where pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation is best suited to this soil because of the variable slopes.

If this soil is irrigated, Russian-olive, Idahybrid poplar, Rocky Mountain juniper, Siberian peashrub, and lilac are well suited for use in windbreaks. Windbreak plantings also improve the wildlife habitat. Capability subclasses VIe, nonirrigated, and IIIe, irrigated.

87-Modkin sandy loam, 2 to 12 percent slopes. This moderately deep, well drained soil is on basalt plains. It formed in sandy wind-laid deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is brown sandy loam about 6 inches thick. The subsoil is brown and light brownish gray sandy loam about 22 inches thick. The substratum is white sandy loam. Basalt is at a depth of 32 inches. Typically, the soil is calcareous below a depth of 28 inches.

Included with this soil in mapping are small areas of Mathon sandy loam, Bondranch sandy loam, and Rock outcrop.

Permeability of this Modkin soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is slow or medium, and the hazard of erosion is slight to high.

This soil is used as range, for wildlife habitat, and recreation.

If the range vegetation is in good or excellent condition, the main native grasses are bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. Seeding is a good practice if the range vegetation is in poor condition. Suitable grasses for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, and Indian ricegrass. The grass selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This soil is well suited to jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If this soil is irrigated and properly managed, it can also be used as rangeland. This soil can be used for hay, small grain, and pasture. A suitable cropping system is 3 to 5 years of alfalfa for hay, and 1 or 2 years of grain. If pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation is suited to this soil because of the variable slopes.

If this soil is irrigated, Russian-olive, Idahybrid poplar, Rocky Mountain juniper, Siberian peashrub, and lilac are well suited to use in windbreaks. These plantings also improve the wildlife habitat. Capability subclasses IVe, irrigated, and VIe, nonirrigated.

88-Modkin-Bondranch complex. This complex is on basalt plains. Slope is 4 to 20 percent. The frost-free season is 80 to 115. days.

Modkin sandy loam makes up about 45 percent of the complex, Bondranch very stony sandy loam makes up 20 percent, and Rock outcrop makes up 20 percent. The Modkin soil is in the lower, concave areas, the Bondranch soil is in areas adjoining Rock outcrop, and Rock outcrop is in the higher convex areas and is scattered throughout the complex.

Included with this complex in mapping is about 15 percent Mathon sandy loam and a soil that is similar to this Modkin soil but that is loamy sand throughout. Areas of this soil near the Snake River are 15 percent Grassy Butte loamy sand and Modkin loamy sand.

The Modkin soil is moderately deep and well drained. It formed in wind-laid material. Slope is 4 to 20 percent. Typically, the surface layer is brown very stony sandy loam about 6 inches thick. The subsoil is brown and light brownish gray sandy loam about 22 inches thick. The substratum is white sandy loam. Basalt is at a depth of 32 inches. The soil is calcareous below a depth of 28 inches.

Permeability of this Modkin soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is medium, and the hazard of erosion is moderate or high.

The Bondranch soil is shallow and well drained. It formed in sandy wind-laid material. Slope is 4 to 12 percent. Typically, the surface layer is light brownish gray very stony sandy loam about 5 inches thick. The subsoil

is pale brown sandy loam about 6 inches thick. The substratum is pale brown and very pale brown sandy loam about 8 inches thick. Basalt is at a depth of 19 inches.

Permeability of the Bondranch soil is moderately rapid. Effective rooting depth is 10 to 20 inches. Available water capacity is low. Surface runoff is medium, and the hazard of erosion is moderate to high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and woody plants. Rock outcrop areas have little value for grazing.

This complex is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. Seeding is a good practice if the range vegetation is in poor condition. Suitable grasses for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass; or Indian ricegrass. The grass selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This complex has potential for providing habitat, for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Elk use areas of this unit as winter range and as a migratory path. Capability subclass Vls, nonirrigated.

89-Modkin-Rock outcrop complex. This complex is on basalt plains. Slope is 4 to 30 percent. The frost-free season is 80 to 100 days.

Modkin extremely stony sandy loam makes up about 40 percent of this complex, Rock outcrop makes up 30 percent, and Bondranch sandy loam makes up 20 percent. The Modkin soil is in concave areas, Rock outcrop is in convex areas, and the Bondranch soil is in convex areas near the Rock outcrop.

Included with this complex in mapping is Mathon sandy loam and a soil that is similar to this Modkin soil but that is loamy sand throughout. Also included are some areas of soils that have slopes of as much as 60 percent.

The Modkin soil is moderately deep and well drained. It formed in sandy wind-laid material. Slope is 4 to 30 percent. Typically, the surface layer is brown extremely stony sandy loam about 6 inches thick. The subsoil is brown and light brownish gray sandy loam about 22 inches thick. The substratum is white sandy loam. Basalt is at a depth of 32 inches. The soil is calcareous below a depth of 28 inches.

Permeability of the Modkin soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is medium or rapid, and the hazard of erosion is moderate to very high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and woody plants. Rock outcrop areas have little value for grazing.

The Bondranch soil is shallow and well drained. It formed in sandy wind-laid material. Slope is 4 to 12 percent. Typically, the surface layer is light brownish gray sandy loam about 5 inches thick. The subsoil is pale brown sandy loam about 6 inches thick. The substratum is pale brown and very pale brown sandy loam. Basalt is at a depth of about 19 inches.

Permeability of the Bondranch soil is moderately rapid. Effective rooting depth is 10 to 20 inches. Available water capacity is low. Surface runoff is medium, and the hazard of erosion is high.

These soils are used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. Mechanical seeding or brush control is difficult because of the areas of Rock outcrop and stones on the surface. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Elk also use this complex as winter range and as a migratory path. Capability subclass Vlls, nonirrigated.

90-Montlid loam, moderately saline-alkali. This very deep, moderately well drained soil is on old lakebeds. It formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is very pale brown, moderately saline-alkali affected loam about 8 inches thick. The underlying material to a depth of 60 inches or more is light gray and gray silty clay loam. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Matheson sandy loam and Levelton loam.

Permeability of this Montlid soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight. The water table fluctuates between depths of 2 and 4 feet from July through September.

This soil is used for irrigated pasture, hay, and small grain. Yields are adversely affected by the moderate saline-alkali content and the high water table.

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop for the alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border and sprinkler irrigation systems are used. Both systems are suited to the crops commonly grown. Sprinkler irrigation can be more efficiently controlled and therefore usually adds less water to the water table.

Russian-olive, Idahybrid poplar, lilac, and Rocky Mountain juniper are examples of plants that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve the habitat for these birds, plants such as tall wheatgrass can be planted along fence rows and ditchbanks and in odd field corners. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIs, irrigated.

91-Montlid silty clay loam. This very deep, moderately well drained soil is on old lakebeds. It formed in lacustrine material derived from mixed sources,. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is very pale brown, slightly saline-alkali affected silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches or more is light gray and gray silty clay loam. The soil is calcareous throughout.

Included with this soil in mapping are small areas of a soil that is similar to this Montlid soil but that is sandy loam throughout, a soil that is similar to this Montlid soil but that does not have a seasonal high water table, and Levelton clay loam. Also included, in the areas transitional to the basalt plain, are areas of Montlid loam, Montlid clay, Montlid loamy sand, and Zwiefel loamy sand. Where this Montlid soil is near Terreton soils are small areas of a soil that is similar to this Montlid soil but that has clay between depths of 7 and 50 inches, small areas of Terreton silty clay loam, and small areas of soils that are moderately saline-alkali or strongly saline-alkali affected.

Permeability of this Montlid soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight. The seasonal water table fluctuates between depths of 3 and 5 feet from June through September.

This soil is used for irrigated hay, small grain, and pasture.

A suitable cropping system is 4 or 5 years of alfalfa for hay, 1 or 2 years of grain, and then 1 year of grain grown as a nurse crop for a new seeding of alfalfa or pasture. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border and sprinkler irrigation systems are used. Both methods are suited to the crops commonly grown. Sprinkler irrigation can be controlled so that less water is added to the water table.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil. .

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter either directly or indirectly from cropland. To improve wildlife habitat, such plants as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIs, irrigated.

92-Montlid silty clay loam, moderately saline-alkali. This very deep, moderately well drained soil is on old lakebeds. It formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is very pale brown, moderately saline-alkali affected silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches or more is light gray and gray silty clay loam. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Matheson sandy loam, a soil that is similar to this Montlid soil but that is clay below a depth of 7 inches, and a soil that is similar to this Montlid soil but that is loam throughout.

Permeability of this Montlid soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight. A seasonal water table is at a depth of 2 to 4 feet.

This soil is used for irrigated pasture, hay, and small grain. The moderate saline-alkali content and the water table adversely affect crop yields.

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop for a new alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and

All crops respond to nitrogen. Border and sprinkler irrigation systems are used. Both methods are suited to the crops commonly grown. Sprinkler irrigation can be controlled so that less water is added to the water table.

Russian-olive, Idahybrid poplar, lilac, and Rocky Mountain juniper are examples of plants that grow well in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve the habitat for these birds, plants such as tall wheatgrass can be planted along fence rows and ditchbanks and in odd field corners. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIs, irrigated.

93-Montlid-Heiseton complex. This complex is in playas on the fringes of old lakebeds. Slope is mainly 0 to 1 percent, but it is as much as 4 percent. The frost-free season is 80 to 100 days.

Montlid very stony silty clay loam makes up about 65 percent of this complex, and Heiseton very stony loam makes up 15 percent. The Montlid soil is in level areas, and the Heiseton soil is in the steeper areas.

Included with this complex in mapping are areas of a soil that is similar to this Montlid soil but that has a water table that fluctuates between depths of 50 and 60 inches. Also included are areas of Montlid silty clay loam and some areas of channeled soils. Included areas make up about 20 percent of the mapped acreage.

The Montlid soil is very deep and moderately well drained. It formed in lacustrine material. Typically, the surface layer is very pale brown, moderately saline-alkali affected very stony silty clay loam about 8 inches thick. The underlying material to a depth of 60 inches or more is light gray and gray silty clay loam.

Permeability of the Montlid soil is moderately slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight. The water table fluctuates between depths of 3 and 4 feet.

The Heiseton soil is deep and moderately well drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is light brownish gray, moderately saline-alkali affected very stony loam about 7 inches thick. The underlying material is light brownish gray and light gray stratified sandy loam to silt loam about 43 inches thick over sand and gravel that extend to a depth of 60 inches or more.

Permeability of the Heiseton soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight. The water table fluctuates between depths of 3 and 4.5 feet.

This complex is used as range, for wildlife habitat, and for recreation.

If the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. Range seeding is difficult because of the stones on the surface and the moderate saline-alkali condition. This complex is used for grazing mainly in spring and fall. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIs, nonirrigated.

94-Paesl loam. This deep, well drained soil is on river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is brown loam about 8 inches thick. The subsoil is brown loam about 5 inches thick. The substratum is pale brown and light gray loam and silt loam about 21 inches thick over sand and gravel that extend to a depth of 60 inches or more. Depth to sand and gravel ranges from 20 to 40 inches.

Included with this soil in mapping are small areas of Bannock loam, Bockston loam, Paesl gravelly loam, and Xeric Torriorthents.

Permeability of this Paesl soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate or high. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, small grain, pasture, and potatoes.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. If pasture is used in the cropping system, it is usually used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border or furrow irrigation is used, waste water drains should be adequate to carry the surplus water away and to prevent ponding. Irrigation water should be applied with care to avoid creating a high water table.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To

improve the habitat for these birds, shrubs such as Siberian peashrub, Tatarian honeysuckle, lilac, and European privet can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIs, irrigated.

95-Pancheri silt loam, 0 to 2 percent slopes. This very deep, well drained soil is on basalt plains. It formed in silty wind-laid deposits derived from mixed sources. The frost-free season is 100 to 115 days.

Typically, the surface layer is pale brown silt loam about 8 inches thick. The underlying material to a depth of 60 inches is pale brown, light gray, and very pale brown silt loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 8 inches.

Included with this soil in mapping are small areas of a soil that is similar to this Pancheri soil but that is 20 to 40 inches deep over bedrock. Also included are areas of Rock outcrop.

Permeability of this Pancheri soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for irrigated potatoes, small grain, hay, sugar beets, and pasture.

A suitable cropping system is 2 years of potatoes and 1 year of grain. In a few places alfalfa hay is used in the cropping system. It is seeded with the grain as a nurse crop and left for 3 to 5 years. Then a potato and grain cropping system is used for 4 or 5 years. In some places sugar beets are alternated with the potatoes. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. This soil is commonly irrigated by sprinkler systems, which are suited to all crops grown.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve wildlife habitat, such shrubs as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIc, irrigated.

96-Pancheri silt loam, 2 to 4 percent slopes. This very deep, well drained soil is on basalt plains. It formed in silty wind-laid deposits derived from mixed sources. The frost-free season is 100 to 115 days.

Typically, the surface layer is pale brown silt loam about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown, light gray, and very pale brown silt loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 8 inches.

Included with this soil in mapping are small areas of a soil that is similar to this Pancheri soil but that is 20 to 40 inches deep over bedrock, areas of soils that have slopes of 0 to 2 percent or of 4 to 8 percent, areas of Pancheri loamy sand, and Rock outcrop.

Permeability of this Pancheri soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is slow, and the hazard of erosion is moderate.

This soil is used for irrigated potatoes, small grain, hay, sugar beets, and pasture.

A suitable cropping system is 2 years of potatoes and 1 year of grain. In some places alfalfa hay is seeded with the grain and left for 3 to 5 years, and then the soil is returned to the potato and grain cropping system for 4 or 5 years. In some places sugar beets are alternated with potatoes. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. This soil generally is irrigated by sprinkler systems, which are suited to all crops commonly grown.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve wildlife habitat, such shrubs as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIe, irrigated.

97-Pancheri silt loam, 4 to 8 percent slopes. This deep, well drained soil is on basalt plains. It formed in silty wind-laid deposits derived from mixed sources. The frost-free season is 100 to 115 days.

Typically, the surface layer is pale brown silt loam about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown, light gray, and very pale brown silt loam. The soil is calcareous throughout and has \a layer of lime accumulation at a depth of 8 inches.

Included with this soil in mapping are small areas of a soil that is similar to this Pancheri soil but that is 20 to 40 inches deep over bedrock. Also included are small areas of Pancheri silt loam, 2 to 4 percent slopes; Pancheri stony silt loam; and Rock outcrop.

Permeability of this Pancheri soil is moderate. Effective rooting depth is 60 inches or more. Available water ca-

pacity is very high. Surface runoff is medium, and the hazard of erosion is high.

This soil is used for irrigated hay, small grain, pasture, and potatoes.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 to 2 years of grain. If pasture is used in the rotation, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. This soil commonly is irrigated by sprinkler systems, which are suited to all crops commonly grown.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve the wildlife habitat, such shrubs as Siberian peashrub, Tatarian honeysuckle, lilac, and European privet can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIe, irrigated.

98-Pancheri silt loam, 8 to 12 percent slopes. This very deep, well drained soil is on basalt plains. It formed in silty wind-laid deposits derived from mixed sources. The frost-free season is 100 to 115 days.

Typically, the surface layer is pale brown silt loam about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown, light gray, and very pale brown silt loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 8 inches. .

Permeability of this Pancheri soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is medium, and the hazard of erosion is very high.

This soil is used for irrigated hay, small grain, and pasture.

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop for a new alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. This soil commonly is irrigated by sprinkler systems, which are suited to all crops commonly grown.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve wildlife habitat, such shrubs as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IVe, irrigated.

99-Pancheri stony silt loam, 2 to 30 percent slopes. This very deep, well drained soil is on basalt plains. It formed in silty wind-laid deposits derived from mixed sources. The frost-free season is 100 to 115 days.

Typically, the surface layer is pale brown stony silt loam about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown, light gray, and very pale brown silt loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 8 inches.

Included with this soil in mapping are small areas of a soil that is similar to this Pancheri soil but that is 20 to 40 inches deep to bedrock. Also included are small areas of Rock outcrop.

Permeability of this Pancheri soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is slow to rapid, and the hazard of erosion is slight to very high.

This soil is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the main native grasses are bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. Range seeding is a good practice if the range vegetation is in poor condition. Range seeding is limited by the stony surface. Suitable grasses for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, or Indian ricegrass. The grass selected for seeding should meet the seasonal grazing requirements of livestock or wildlife, or both.

This Pancheri soil has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey.

If this soil is irrigated, Russian-olive, golden willow, Scotch pine, Siberian peashrub, Nanking cherry, and lilac are well suited to use in windbreaks. They also improve the wildlife habitat. Capability subclasses VIe, nonirrigated, and IVe, irrigated.

100-Pancheri-Rock outcrop complex. This complex is on basalt plains. Slope is 2 to 12 percent. The frost-free season is 100 to 115 days.

Pancheri very stony silt loam makes up 40 percent of this complex, and Rock outcrop makes up 35 percent. The Pancheri soil is on convex and concave side slopes, and Rock outcrop is in the higher, steeper areas.

Included with this complex in mapping is about 25 percent soils that are similar to this Pancheri soil but that are 10 to 40 inches deep over basalt. Also included are small areas of soils that have slopes of 12 to 60 percent.

The Pancheri soil is very deep and well drained. It formed in silty wind-laid deposits derived from mixed sources. Typically, the surface layer is pale brown very stony silt loam about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown, light gray, and very pale brown silt loam. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 8 inches.

Permeability of the Pancheri soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is slow or medium, and the hazard of erosion is moderate or high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and woody plants. Rock outcrop areas have little value for grazing.

These soils are used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the main grasses are bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. Mechanical seeding or brush control is difficult because of the very stony surface and the Rock outcrop. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIs, nonirrigated.

101-Rexburg silt loam, 4 to 8 percent slopes. This deep, well drained soil is on loess plains. It formed in silty wind-laid material. The frost-free season is 75 to 90 days.

Typically, the surface layer is grayish brown silt loam about 8 inches thick. The subsoil is brown silt loam about 11 inches thick. The substratum to a depth of 60 inches or more is light gray silt loam. The soil is noncalcareous to a depth of 19 inches and is strongly calcareous below that depth.

Included with this soil in mapping are areas of soils that have slopes of less than 4 percent and of more than 8 percent. Also included are areas of Greybo silt loam and a few areas of Rock outcrop.

Permeability of this Rexburg soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is medium, and the hazard of erosion is moderate.

Most areas of this soil are dryfarmed. The remaining areas are used as rangeland. This soil can be used for irrigated crops if water for irrigation is available.

A suitable dryland cropping system is 3 years of spring barley, 1 year of fallow for weed control, and 1 year of winter wheat. Alfalfa can be used in the rotation if desired. Pubescent wheatgrass, bluebunch wheatgrass, or intermediate wheatgrass are suitable for pasture seedings. To control erosion, minimum tillage should be practiced. All crop residue should be left on the surface, and contour farming should be practiced. Stubble should be allowed to stand over winter, and fall disking should not be used. If the soil is tilled in fall, it should be left in a rough and clodded condition over winter. The soil should be chiseled and subsoiled to a depth of 18 inches every third year in fall to help prevent a plowpan from forming and to keep the soil mellow. Grass and grain crops respond to nitrogen fertilizer.

If range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and Idaho fescue. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desriable grasses, forbs, annual weeds, and woody plants increases.

This soil has potential for providing habitat for mourning dove, cottontail rabbit, songbirds, and birds of prey. Some areas are also used by deer. Capability subclass IIIe, nonirrigated.

102-Rexburg-Rock outcrop complex. This complex is on basalt and sedimentary uplands. Slope is 30 to 60 percent. The frost-free season is 75 to 90 days.

Rexburg very stony silt loam makes up 45 percent of this complex, and Rock outcrop makes up 35 percent. The Rexburg soil is in vegetated, uneroded areas, and Rock outcrop is in steep areas and on slope breaks.

Included with this complex in mapping is about 20 percent a soil on north- and east-facing slopes that is similar to this Rexburg soil but that has a silty clay loam subsoil, small areas of recent colluvial and alluvial materials, and areas of soils that have slopes of 5 to 30 percent.

The Rexburg soil is deep and well drained. It formed in eolian material derived from mixed sources. Typically, the surface layer is brown very stony silt loam about 8 inches thick. The subsoil is brown silt loam 11 inches thick. The substratum to a depth of 60 inches or more is light gray silt loam. The soil is strongly calcareous below a depth of 19 inches.

Permeability of the Rexburg soil is moderate. Effective rooting depth is 60 inches or more. The available water

capacity is very high. Surface runoff is very rapid, and the hazard of erosion is very high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and woody plants. Rock outcrop areas have little value for grazing.

This complex is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and slender wheatgrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. Mechanical seeding or brush control is impractical because of slope, the stony surface, areas of Rock outcrop, and the very high hazard of erosion. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for cottontail, deer, coyote, chukar, songbirds, and birds of prey. Capability subclass Vlls, nonirrigated.

103-Riverwash. Riverwash consists of mixed gravel and water-washed sand. Most areas are sand or gravel bars. Riverwash occurs along streams or rivers, and it is often flooded in spring. Scattered willow trees and a few weeds grow in some places.

Riverwash is used mainly for wildlife habitat and recreation. Capability subclass Vlllw, nonirrigated.

104-Rock outcrop-Bondfarm complex. This complex is on the edge of old lakebeds and on basalt plains. Slope is 2 to 6 percent. The frost-free season is 80 to 100 days.

Rock outcrop makes up 40 percent of the complex, Bondfarm loamy sand makes up 30 percent (fig. 6), and Aecet very stony loamy sand makes up 20 percent. Rock outcrop is in slightly elevated areas, the Bondfarm soil is in convex areas that lead up to areas of Rock outcrop, and the Aecet soil is in convex and concave areas away from areas of Rock outcrop.

Included with this complex in mapping is about 10 percent Grassy Butte sand.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and woody plants. Rock outcrop areas have little value for grazing.

The Bondfarm soil is shallow and well drained. It formed in sandy wind-laid material. Typically, the surface layer is light brownish gray loamy sand about 4 inches thick. The subsoil and substratum are very pale brown sandy loam. Basalt is at a depth of 18 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 4 inches.

Permeability of the Bondfarm soil is moderately rapid. Effective rooting depth is 10 to 20 inches. Available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

The Aecet soil is moderately deep and well drained. It formed in reworked wind-laid deposits. Typically, the surface layer is pale brown very stony loamy sand about 5 inches thick. The subsoil is pale brown clay loam about 8 inches thick. The substratum is very pale brown clay loam. Basalt is at a depth of 23 inches. The soil is calcareous throughout and has a layer of lime accumulation at a depth of 13 inches.

Permeability of the Aecet soil is moderately slow. Effective rooting depth is 20 to 40 inches. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This complex is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass, Indian ricegrass, and needleandthread. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases.

This complex is used for grazing mainly in spring and fall. Mechanical seeding or brush control is impractical because of the areas of Rock outcrop and the loamy sand surface layer. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass Vlls, nonirrigated.

105-Rock outcrop-Modkin complex. This complex is on basalt plains. Slope is 6 to 30 percent. The frost-free season is 80 to 100 days.

Rock outcrop makes up 60 percent of the complex, and Modkin very stony sandy loam makes up 20 percent. Rock outcrop is in the steeper, higher areas, and the Modkin soil is in convex areas that lead up to the areas of Rock outcrop.

Included with this complex in mapping is about 20 percent Mathon sandy loam, Bondranch sandy loam, and areas of soils that have slopes of 30 to 60 percent.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and woody plants. Rock outcrop areas have little value for grazing.

The Modkin soil is moderately deep and well drained. It formed in sandy wind-laid material. Typically, the surface layer is brown very stony sandy loam about 6 inches thick. The subsoil is brown and light brownish gray sandy loam about 22 inches thick. The substratum is white sandy loam. Basalt is at a depth of 32 inches. Calcareous material is at a depth of 28 inches.

Permeability of the Modkin soil is moderately rapid. Effective rooting depth is 20 to 40 inches. Available water capacity is low or moderate. Surface runoff is medium or rapid, and the hazard of erosion is moderate to very high.

This complex is used as range, for wildlife habitat, and for recreation.

Where the range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. Mechanical seeding or brush control is not practical on this complex because of the areas of Rock outcrop. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Elk also use areas of this complex as winter range and as a migratory path. Capability subclass Vlls, nonirrigated.

106-Rock outcrop-Rexburg complex. This complex is on basalt and sedimentary uplands. Slope is 30 to 60 percent. The frost-free season is 75 to 90 days.

Rock outcrop makes up 55 percent of the complex, and Rexburg very stony silt loam makes up 30 percent. Rock outcrop is in the steeper, more eroded areas, and the Rexburg soil is in the less sloping areas.

Included with this complex in mapping is about 15 percent rockslide areas and a soil that is similar to this Rexburg soil but that is extremely stony and is 20 inches deep over basalt.

Rock outcrop consists of basalt and sedimentary rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and woody plants. Rock outcrop areas have little value for grazing.

The Rexburg soil is deep and well drained. It formed in silty wind-laid material derived from mixed sources. Typically, the surface layer is grayish brown very stony silt loam about 8 inches thick. The subsoil is brown silt loam about 11 inches thick. The substratum to a depth of 60 inches or more is light gray silt loam.

Permeability of the Rexburg soil is moderate. Effective rooting depth is 60 inches or more. The available water capacity is very high. Surface runoff is very rapid, and the hazard of erosion is very high.

This complex is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and slender wheatgrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. Mechanical seeding or brush control is not practical because of the areas of Rock outcrop. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for cottontail, deer, coyote, chukar, songbirds, and birds of prey. Capability subclass Vlls, nonirrigated.

107-Terreton loamy sand. This very deep, well drained soil is on old lakebeds. It formed in lacustrine-material derived from mixed sources. Slope is 0 to 1
percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray loamy sand about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay and silty clay loam. The soil is moderately calcareous in the surface layer and strongly calcareous below. It is moderately alkaline throughout.

Included with this soil in mapping are small areas of Terreton sandy loam and Terreton sandy clay loam, both of which have slopes of 0 to 1 percent. Also included are areas of Zwiefel sand, 2 to 4 percent slopes. Some areas of soils adjacent to standing or moving water have a high water table and are slightly or moderately saline-alkali affected.

Permeability of this Terreton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, 1 or 2 years of grain, and then return to alfalfa or pasture. Where pasture is used in the cropping system, it is commonly used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border, furrow, and sprinkler irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border or furrow irrigation systems are used, waste water drains should be ade-

quate to carry the surplus water away and to prevent ponding. Irrigation water should be applied with care to also avoid ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This Terreton soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve the habitat for these birds, shrubs such as caragana, Nanking cherry, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass lVe, nonirrigated.

108-Terreton sandy loam. This very deep, well drained soil is on old lakebeds. Slope is 0 to 1 percent. It formed in lacustrine material derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray sandy loam about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay and silty clay loam. The soil is moderately calcareous in the surface layer and strongly calcareous below. It is moderately alkaline throughout.

Included with this soil in mapping are small areas of Terreton loamy sand, Terreton sandy clay loam, and Terreton clay, all of which have slopes of 0 to 1 percent. Also included are small areas of Zwiefel loamy sand, 0 to 2 percent slopes. Some areas of soils adjacent to standing or moving water have a high water table and are slightly or moderately saline-alkali affected.

Permeability of this Terreton soil is slow. Effective rooting depth is 60 finches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, 1 or 2 years of grain, and then return to alfalfa or pasture. When pasture is used in the rotation, it is commonly used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border, furrow, and sprinkler systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border or furrow irrigation systems are used, waste water drains should be adequate to carry the surplus water away and to prevent ponding. Irrigation water should be applied with care to avoid ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve the habitat for these birds, shrubs such as Siberian peashrub, Tatarian honeysuckle, lilac, and European privet can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIe, irrigated.

109-Terreton loam. This very deep, well drained soil is on old lakebeds. It formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray loam about 6 inches thick. The substratum is light brownish gray and light gray clay and silty clay loam to a depth of 51 inches and light gray clay to a depth of more than 60 inches. The soil is moderately calcareous in the surface layer and strongly calcareous below. It is moderately alkaline throughout.

Included with this soil in mapping are small areas of Terreton sandy clay loam and Terreton sandy loam, both of which have slopes of 0 to 1 percent. Also included are some areas of soils, adjacent to standing or moving water, that have a high water table and that are slightly or moderately saline-alkali affected.

Permeability of this Terreton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, small grain, and pasture.

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop for a new alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border and sprinkler irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border irrigation is used, waste water drains should be adequate to carry away the surplus water and to prevent ponding. Irrigation water should be applied with care to avoid ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to

some extent either directly or indirectly from cropland. To improve the habitat for these birds, shrubs such as Siberian peashrub, Tatarian honeysuckle, lilac, and European privet can be planted along fence rows and ditchbanks, in odd field corners, and in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIc, irrigated.

110-Terreton sandy clay loam, 2 to 4 percent slopes. This very deep, well drained soil is on old lakebeds. It formed in lacustrine material derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray sandy clay loam about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay and silty clay loam. The soil is moderately calcareous in the surface layer and strongly calcareous below. It is moderately alkaline throughout.

Included with this soil in mapping are small areas of soils that have slopes of 0 to 1 percent or of 4 to 8 percent, Terreton loamy sand, Terreton clay, and Terreton sandy loam. Also included are small areas of Rock outcrop.

Permeability of this Terreton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is moderate.

This soil is used for irrigated hay, small grain, and pasture.

A suitable cropping system is 4 or 5 years of alfalfa for hay or pasture, 1 or 2 years of grain, and 1 year of grain grown as a nurse crop for a new seeding of alfalfa or pasture. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation is suited to this soil.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve the habitat for these birds, shrubs such as Siberian peashrub, Tatarian honeysuckle, lilac, and European privet can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIe, irrigated.

111-Terreton silty clay loam. This very deep, well drained soil is on old lakebeds. It formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 115 days.

Typically, the surface layer is light brownish gray silty clay loam about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay and silty clay loam. The soil is moderately calcareous in the surface layer and strongly calcareous below. It is moderately alkaline throughout.

Included with this soil in mapping are small areas of Terreton sandy loam and Terreton loamy sand, both of Which have slopes of 0 to 1 percent, and Zwiefel loamy sand, 0 to 2 percent slopes. Also included are some areas, adjacent to standing or moving water, that have a high water table and that are slightly or moderately saline-alkali affected.

Permeability of this Terreton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, small grain, and pasture and as range.

A suitable cropping system is 4 or 5 years of alfalfa for hay or pasture, 1 or 2 years of grain, and 1 year of grain grown as a nurse crop for a new seeding of alfalfa or pasture. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen, (fig. 7). Border and sprinkler irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border irrigation is used, waste water drains should be adequate to carry away the surplus water and prevent ponding. Irrigation water should be applied with care to avoid ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

If the vegetation is in good or excellent condition, the main grasses are bluebunch wheatgrass and Thurber needlegrass. When the vegetation deteriorates, the proportion of these grasses decreases and the proportion of the less desirable grasses, forbs, and woody plants increases. Seeding is a good practice if the range vegetation is in poor condition. Suitable grasses for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, and Indian ricegrass. The grass selected should meet the seasonal grazing requirements of livestock or wildlife, or both.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve the habitat for these birds, shrubs such as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators

and inclement weather. Food crops provide some cover. Capability subclasses IIIc, irrigated, and VIc, nonirrigated.

112-Terreton clay. This very deep, well drained soil is on old lakebeds. It formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is light brownish gray clay about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay and silty clay loam. The soil is moderately calcareous in the surface layer and strongly calcareous below. It is moderately alkaline throughout.

Included with this soil in mapping are small areas of Terreton clay loam, 0 to 1 percent slopes, and small areas of soils that are slightly saline-alkali affected. Also included are areas of soils, adjacent to standing or moving water, that have a high water table and are slightly saline-alkali affected.

Permeability of this Terreton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated hay, small grain, and pasture.

A suitable cropping system is 4 or 5 years of alfalfa hay or pasture, 1 or 2 years of grain, and 1 year of grain grown as a nurse crop for a new seeding of alfalfa or pasture. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border irrigation is suited to this soil. Waste water drains should be adequate to carry away the surplus water and to prevent ponding. Irrigation water should be applied with care to avoid ponding.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve the habitat for these birds, shrubs such as European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IIIs, irrigated.

113-Terreton-Bereniceton complex. This complex is on basalt plains. Slope is 0 to 5 percent. The frost-free season is 80 to 100 days.

Terreton silty clay loam makes up 50 percent of the complex, and Bereniceton silt loam makes up 30 percent.

Included with this complex in mapping is about 20 percent Terreton-silt loam, Pancheri silt loam, and Rock outcrop.

The Terreton soil is very deep and well drained. It formed in wind-laid and lacustrine material derived from mixed sources. Typically, the surface layer is light brownish-gray silty clay loam about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay and silty clay loam.

Permeability of the Terreton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate.

The Bereniceton soil is deep and well drained. It formed in wind-laid material derived from mixed sources. Typically, the surface layer is brown and pale brown silt loam about 7 inches thick. The underlying material is pale brown and very pale brown loam and clay loam. Basalt is at a depth of 46 inches.

Permeability of the Bereniceton soil is moderately slow. Effective rooting depth is 40 to 60 inches. Available water capacity is high. Surface runoff is slow or medium, and the hazard of erosion is slight or moderate.

This complex is used as range, for wildlife habitat, and for recreation. If irrigated, it can be used for hay, small grain, and pasture.

A suitable cropping system is 4 or 5 years of alfalfa for hay or pasture, 1 or 2 years of grain, and 1 year of grain grown as a nurse crop for a new seeding of hay or pasture. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation is best suited to these soils because of their variable slopes.

In irrigated areas, Russian-olive, golden willow, Scotch pine, Siberian peashrub, Nanking cherry, and lilac are well suited to use in windbreaks. These plantings also improve the wildlife habitat.

If the range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and needleandthread. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. Range seeding is a good practice if the range vegetation is in poor condition. Grasses suitable for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, and Indian ricegrass. The grass selected for seeding should meet the seasonal grazing requirements of livestock or wildlife, or both.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclasses IIIe, irrigated, and VIe, nonirrigated.

114-Terreton-Bereniceton-Rock outcrop complex. This complex is on basalt plains. Slope is 1 to 6 percent. The frost-free season is 80 to 100 days.

Terreton sandy clay loam makes up 45 percent of the complex, Bereniceton very stony sandy loam makes up 20 percent, and Rock outcrop makes up 15 percent. The Terreton and Bereniceton soils are in similar positions, and Rock outcrop is in the higher, ridgelike areas.

Included with this complex in mapping is about 20 percent Aecet sandy loam and Matheson sandy clay loam.

The Terreton soil is very deep and well drained. It formed in wind-laid and lacustrine material derived from mixed sources. Typically, the surface layer is light brownish gray sandy clay loam about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay and silty clay loam.

Permeability of the Terreton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is slow or medium, and the hazard of erosion is slight to high.

The Bereniceton soil is deep and well drained. It formed in wind-laid material. Typically, the surface layer is brown very stony sandy loam over pale brown sandy loam and is about 7 inches thick. The underlying material is pale brown and very pale brown loam and clay loam. Basalt is at a depth of 46 inches.

Permeability of the Bereniceton soil is moderately slow. Effective rooting depth is 40 to 60 inches. Available water capacity is moderate or high. Surface runoff is slow or medium, and the hazard of erosion is slight to high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and woody plants. Rock outcrop areas have little value for grazing.

This complex is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and Thurber needlegrass. When the range vegetation .deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. Range seeding is a good practice if the range is in poor condition. Suitable grasses for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, or Indian ricegrass. The grass selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass Vls.

115-Terreton-Rock outcrop complex. This complex is on the outer edge of old lakebeds on basalt plains. Slope is 2 to 6 percent. The frost-free season is 80 to 100 days.

Terreton sandy clay loam makes up 50 percent of this complex, and Rock outcrop makes up 30 percent. The Terreton soil is on the old lakebeds, and Rock outcrop is on the basalt plains.

Included with this complex in mapping is about 25 percent Bondfarm loamy sand, Terreton loamy sand, and Aecet soils.

The Terreton soil is very deep and well drained. It formed in lacustrine material. Typically, the surface layer is light brownish gray sandy clay loam about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay and silty clay loam.

Permeability of the Terreton soil is slow. Effective rooting depth is more than 60 inches. Available water capacity is very high. Surface runoff is slow or medium, and the hazard of erosion is moderate or high.

Rock outcrop consists of basalt rock. It supports mostly moss and lichens. Crevices in the rock contain some soil material that supports a sparse stand of grasses, forbs, and woody plants. Rock outcrop areas have little value for grazing.

This complex is used as range and for wildlife habitat.

If the range vegetation is in good or excellent condition, the native grasses are mainly bluebunch wheatgrass and Thurber needlegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. Mechanical seeding or brush control is difficult because of the Rock outcrop. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass Vlls, irrigated.

116-Terreton complex. This complex is on old lakebeds. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Terreton loamy sand makes up 55 percent of the complex, and Terreton sandy clay loam makes up 20 percent. The Terreton loamy sand is on mounds about 12 inches high, and the Terreton sandy clay loam is in the areas between the mounds.

Included with this complex in mapping is about 25 percent Grassy Butte loamy sand, Zwiefel fine sand, and Rock outcrop.

The Terreton soil is deep and well drained. It formed in lacustrine material. Typically, the surface layer is light

brownish gray loamy sand about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay and silty clay loam.

A typical profile of the Terreton sandy clay loam is similar to that of the Terreton loamy sand, but the surface layer is sandy clay loam.

Permeability of these Terreton soils is slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing on the Terreton loamy sand is very high.

This complex is used as range and for wildlife habitat.

If these soils are irrigated, they can be used for hay, small grain, pasture, and potatoes. A suitable cropping system is 3 to 5 years of alfalfa hay, 1 year of potatoes, 1 or 2 years of grain, and then return to hay or pasture. If pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Border, furrow, and sprinkler irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border and furrow irrigation systems are used, waste water drains should be adequate to carry away the surplus water and to prevent ponding. Irrigation water should be applied with care to avoid ponding.

In irrigated areas, Russian-olive, golden willow, Scotch pine, Siberian peashrub, European privet, and lilac are examples of trees and shrubs that are well suited to use in windbreaks. They also improve the wildlife habitat.

If the range vegetation is in good or excellent condition, the native grasses are mainly needleandthread and bluebunch wheatgrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. Mechanical seeding or brush control is difficult because of the very high hazard of soil blowing. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclasses IVe, irrigated, and VIIe, nonirrigated.

117-Terreton-Zwiefel complex. This complex is on old lakebeds. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Terreton silty clay loam makes up 60 percent of the complex, and Zwiefel fine sand makes up 20 percent. The Terreton soil is in nearly level areas without hummocks, and the Zwiefel soil is in dunelike areas about 20 inches high.

Included with this complex in mapping is about 20 percent Grassy Butte sand and Terreton loamy sand.

The Terreton soil is very deep and well drained. It formed in lacustrine material. Typically, the surface layer is light brownish gray silty clay loam about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay and silty clay loam.

Permeability of the Terreton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is slow. The .hazard of erosion is slight.

The Zwiefel soil is very deep and well drained. It formed in sandy wind-laid material over lacustrine deposits. Typically, the surface layer is grayish brown fine sand about 3 inches thick. The upper part of the substratum is grayish brown fine sand about 18 inches thick. The lower part to a depth of 60 inches or more is light brownish gray sandy clay and silty clay.

Permeability of the Zwiefel soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This complex is used as range, for wildlife habitat, and for recreation.

If these soils are irrigated, they can be used as cropland. The main management concerns on the Zweifel soil are impaired trafficability of machinery and the very high hazard of soil blowing. The risk of soil blowing makes it necessary to replant close grown crops about 1 year in 4.

If the range vegetation is in good or excellent condition, the native grasses are mainly needleandthread and bluebunch wheatgrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. This complex is used for grazing mainly in spring and fall. Mechanical seeding or brush control is difficult because of the very high hazard of soil blowing. Management practices suitable for use on this complex include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclasses IVe, irrigated, and VIIe, nonirrigated.

118-Urban land. Areas of Urban land have been altered or obscured by urban works and structures. Identification of the soils is not feasible. Urban land includes the communities of Rigby and Lewisville.

119-Wardboro sandy loam. This very deep, somewhat excessively drained soil is on low river terraces. It

formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray sandy loam about 2 inches thick. The underlying material to a depth of 60 inches or more is light gray and pale brown very gravelly sandy loam over very gravelly sand.

Included with this soil in mapping are small areas of Hayeston sandy loam and Heiseton sandy loam, both of which have slopes of 0 to 1 percent. Also included are small areas of channeled soils.

Permeability of this Wardboro soil is very rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated pasture, alfalfa hay, and small grain and as range.

Land leveling is difficult because of the very gravelly sand at a depth of about 8 inches (fig. 8).

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop for a new alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all, crops respond to nitrogen. Sprinkler and border irrigation systems are suited to this soil. If border irrigation is used, the land must be leveled; waste water drains should be adequate to carry the surplus water away and to prevent excessive ponding. Both methods are suited to all crops commonly grown. Irrigation water should be applied with care to avoid creating a high water table.

Russian-olive, green ash, and Rocky Mountain juniper are examples of trees that are well suited to use in windbreaks on this soil.

If the range vegetation is in good or excellent condition, the main grasses are bluebunch wheatgrass and Kentucky bluegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases.

Range seeding is a good practice if the range vegetation is in poor condition. Suitable grasses for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, or Indian ricegrass. The grass selected for seeding should meet the seasonal requirements for the grazing of livestock or wildlife, or both.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. The habitat for these birds can be improved by planting plants that provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclasses IVs, irrigated, and VIs, nonirrigated.

120-Wardboro loam. This very deep, well drained soil is on low river terraces. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray loam about 2 inches thick. The underlying material to a depth of 60 inches or more is light gray and pale brown cobbly and very gravelly sandy loam over very gravelly sand.

Included with this soil in mapping are small areas of Hayeston sandy loam and Bannock sandy loam, both of which have slopes of less than 1 percent. Also included are small areas of channeled soils.

Permeability of this Wardboro soil is very rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used for irrigated pasture, alfalfa hay, and small grain.

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop for a new alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler and border irrigation systems are suited to this soil. Both methods are suitable for all crops grown. If border irrigation is used, waste water drains should be adequate to carry the surplus water away and to prevent excessive ponding. Irrigation water should be applied with care 'to avoid creating a high water table.

Russian-olive, Idahybrid poplar, and Rocky Mountain juniper are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. The habitat for these birds can be improved by providing shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IVs, irrigated.

121-Water. This unit includes bodies of water, either moving or standing, that are less than one-eighth mile wide or less than 40 acres in size.

122-Whiteknob gravelly loam. This deep, well drained soil is on alluvial fans. It formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is very pale brown gravelly loam about 5 inches thick. The upper part of the underlying material is very pale brown gravelly loam about 9 inches thick. The lower part to a depth of 60 inches or more is very pale brown very gravelly sandy loam and very gravelly sand.

Included with this soil in mapping are small areas of Lidy sandy loam and a soil that is similar to this Whiteknob soil but that does not have a layer of lime accumulation.

Permeability of this soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used as range, for wildlife habitat, and for recreation.

If this soil is irrigated, it can be used for alfalfa hay, small grain, pasture, and potatoes.

A suitable cropping system is 3 to 5 years of alfalfa hay, 1 year of potatoes, 1 to 2 years of grain, and then return to alfalfa or pasture. If pasture is used in the cropping system, it is commonly used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and -all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border or furrow irrigation systems are used, waste water drains should be adequate to carry the surplus water away and prevent ponding. Irrigation water should be applied with care to avoid creating a high water table.

If irrigated, Russian-olive, golden willow, Scotch pine, Siberian peashrub, Tatarian honeysuckle, and lilac are well suited to use in windbreaks. These plants also improve the wildlife habitat.

If the range vegetation is in good or excellent condition, the native grasses are mainly Indian ricegrass and sand dropseed. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable grasses, forbs, and woody plants increases. Range seeding is a good practice if the range vegetation is in poor condition. Suitable grasses for seeding are Nordan crested wheatgrass, Siberian wheatgrass, bluebunch wheatgrass, or Indian ricegrass. The grass selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This soil has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclasses IVs, irrigated, and Vls, nonirrigated.

123-Wolverine sand, 0 to 30 percent slopes. This very deep, excessively drained soil is on terraces. It formed in wind-laid and alluvial sand derived from mixed sources. The frost-free season is 100 to 115 days.

Typically, the surface layer is light brownish gray sand about 6 inches thick. The underlying material to a depth of 60 inches or more is stratified light brownish gray, light gray, and dark gray loamy coarse sand to fine sand.

Included with this. soil in mapping are small areas of Hovey clay, Levelton clay loam, and Heiseton sandy loam.

Permeability of this Wolverine soil is very rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow to medium, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This soil is used as range, for wildlife habitat, and for recreation.

If the range vegetation is in good or excellent condition, the main native grasses are needleandthread and Indian ricegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable grasses, forbs, and woody plants increases. This soil is used as range mainly in spring and fall. Mechanical seeding or brush control on this soil are impractical because of the very high hazard of soil blowing. Management practices suitable for use on this soil include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This soil has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclass VIIe, nonirrigated.

124-Xeric Torrifluvents. . The map unit consists of deep, well drained soils on river terraces. These soils formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

A reference profile has a surface layer of light brownish gray and pale brown gravelly sandy loam about 9 inches thick. The underlying material to a depth of 60 inches or more is brown gravelly sandy loam about 9 inches thick over sand and gravel. These soils are extremely variable. The surface layer is sandy loam, loamy sand, or loam and ranges from gravelly to very cobbly. Depth to sand and gravel is 10 to 20 inches.

Included with these soils in mapping are small areas of Wardboro and Hayeston soils.

Permeability of these soils is moderate to rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight.

These soils are farmed with the same cropping system and are fertilized in the same way as the soils that surround them. Capability subclass IVs, irrigated.

125-Xeric Torrifluvents-Hayeston complex. This complex is on low river terraces. Slope is 0 to 1 percent. The frost-free season is 100 to 115 days.

Xeric Torrifluvents make up about 60 percent of the complex, and Hayeston gravelly sandy loam makes up about 35 percent. The Xeric Torrifluvents are in slightly elevated areas, and the Hayeston soil is in the lower areas.

Included with this complex in mapping is 5 percent Wardboro sandy loam, Hayeston sandy loam, and Heiseton sandy loam, all of which have slopes of less than 1 percent. Also included are some areas of channeled soils.

Xeric Torrifluvents are deep and well drained. They formed in alluvium derived from mixed sources. A reference profile has a surface layer of light brownish gray and pale brown gravelly sandy loam about 9 inches thick. The underlying material to a depth of 60 inches or more is brown gravelly sandy loam about 9 inches thick over sand and gravel. These soils are extremely variable. The surface layer is sandy loam, loamy sand, or loam and is gravelly to very cobbly. Depth to sand and gravel is 10 to 20 inches.

Permeability of these soils is moderate to rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight.

The Hayeston soil is deep and well drained. It formed in alluvium derived from mixed sources. Typically, the surface layer is light brownish gray gravelly sandy loam about 7 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray sandy loam about 16 inches thick over sand and gravel. Depth to sand and gravel ranges from 20 to 40 inches.

Permeability of the Hayeston soil is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight.

This complex is used for irrigated pasture, hay, and small grain.

A suitable cropping system is 4 to 6 years of alfalfa or pasture followed by 1 year of wheat or barley grown as a nurse crop for a new alfalfa or pasture seeding. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler and border irrigation systems are suited to this soil. Both systems are suited to all crops commonly grown. If border irrigation is used, waste water drains should be adequate to carry the surplus water away and prevent ponding. Irrigation water should be applied with care to avoid creating a high water table in the coarse underlying material.

Russian-olive, golden willow, and Scotch pine are examples of trees that are well suited to use in windbreaks on this complex.

This complex has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve wildlife habitat, such species as Siberian peashrub, Tatarian honeysuckle, lilac, and European privet can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IVs, irrigated.

126-Zwlefel fine sand, 0 to 2 percent slopes. This very deep, well drained soil is on old lakebeds. It formed in lacustrine sediment and wind-laid deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is grayish brown fine sand about 3 inches thick. The upper part of the underlying material is grayish brown fine sand about 18 inches thick. The lower part to a depth of 60 inches or more is light brownish gray sandy clay and silty clay.

Included with this soil in mapping are small areas of Terreton loamy sand, 0 to 1 percent slopes.

Permeability of this Zwiefel soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, 1 or 2 years of grain, and then return to alfalfa or pasture. If pasture is used in the cropping system, it is commonly used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure-and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border or furrow irrigation systems are used, waste water drains should be adequate to carry the surplus water away and to prevent ponding.

Russian-olive, Idahybrid poplar, and Rocky Mountain juniper are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve wildlife habitat, such species as Siberian peashrub, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IVe, irrigated.

127-Zwiefel sand, 2 to 4 percent slopes. This deep, well drained soil is on old lakebeds. It formed in lacustrine and wind-laid deposits derived from mixed sources. The frost-free season is 80 to 100 days.

Typically, the surface layer is grayish brown sand about 3 inches thick. The upper part of the underlying material is grayish brown fine sand about 18 inches thick. The lower part to a depth of 60 inches or more is light brownish gray sandy clay and silty clay.

Included with this soil in mapping are small areas of Terreton loamy sand, 0 to 1 percent slopes.

Permeability of this Zwiefel soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, 1 or 2 years of grain, and then return to hay or pasture. If pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Because slope is 2 to 4 percent, sprinkler irrigation is best suited to this soil.

Russian-olive, Idahybrid poplar, and Rocky Mountain juniper are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve wildlife habitat, such species as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IVe, irrigated.

128-Zwiefel loamy sand. This very deep, well drained soil is on old lakebeds. It formed in wind-laid deposits derived from mixed sources. Slope is 0 to 2 percent. The frost-free season is 80 to 100 days.

Typically, the surface layer is grayish brown loamy sand about 3 inches thick. The upper part of the underlying material is grayish brown fine sand about 18 inches thick. The lower part to a depth of 60 inches or more is light brownish gray sandy clay and silty clay.

Included with this soil in mapping are small areas of Terreton loamy sand.

Permeability of this Zwiefel soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is very slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This soil is used for irrigated hay, small grain, potatoes, and pasture.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, and 1 or 2 years of grain. If pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler, border, and furrow irrigation systems are suited to this soil. Sprinkler irrigation is suited to all crops, furrow irrigation is suited to row crops, and border irrigation is suited to alfalfa, small grain, and pasture. If border or furrow. irrigation systems are used, waste water drains should be adequate to carry the surplus water away and to prevent ponding.

Russian-olive, golden willow, and Rocky Mountain juniper are examples of trees that are well suited to use in windbreaks on this soil.

This soil has potential for providing habitat for ring-necked pheasant, mourning dove, songbirds, and birds of prey. These birds obtain their food and shelter to some extent either directly or indirectly from cropland. To improve wildlife habitat, such species as Siberian peashrub, European privet, lilac, and Tatarian honeysuckle can be planted along fence rows and ditchbanks, in odd field corners, or in windbreaks. These plantings provide shelter that protects the birds from predators and inclement weather. Food crops provide some cover. Capability subclass IVe, irrigated.

129-Zwiefel-Grassy Butte sands. This complex is in playas. Slope is 4 to 20 percent. The frost-free season is 80 to 100 days.

Zwiefel sand makes up 60 percent of this complex, and Grassy Butte sand makes up 25 percent. The Zwiefel soil is in the lower areas, and the Grassy Butte soil is in the higher areas.

Included with this complex in mapping are areas of Terreton loamy sand that has slopes of less than 4 percent. Also included, northeast of Camas, is a soil that is similar to this Zwiefel soil but that is clay loam below a depth of 21 inches. Included soils make up about 15 percent of the total acreage.

The Zwiefel soil is very deep and well drained. It formed in sandy lake sediment and wind-laid deposits on old lakebeds. Typically, the surface layer is grayish brown sand about 3 inches thick. The upper part of the underlying material is grayish brown fine sand about 18 inches thick. The lower part to a depth of 60 inches or more is light brownish gray sandy clay and silty clay.

Permeability of the Zwiefel soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

The Grassy Butte soil is very deep and somewhat excessively drained. It formed in sandy wind-laid and lacustrine deposits derived from mixed sources. Typically, the surface layer is grayish brown sand about 7 inches thick. The underlying material to a depth of 60 inches or more is grayish brown and gray loamy sand.

Permeability of the Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This complex is used as range, for wildlife habitat, and for recreation.

If this complex is irrigated, it can be used for permanent pasture. Pasture seeding is difficult to establish because of the slope and the very high hazard of soil blowing. Sprinkler irrigation or pivoted systems are suited to these soils.

If the range vegetation is in good or excellent condition, the main native grasses are needleandthread and Indian ricegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. These soils are used for grazing mainly in spring and fall. Mechanical seeding or brush control are not practical because of the sandy surface layer and the very high hazard of soil blowing. Management practices suitable for use on these soils include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclasses IVe, irrigated, and VIIe, nonirrigated.

130-Zwiefel-Grassy Butte-Terreton complex. This complex is in undulating areas in playas. Slope is 0 to 6 percent. The frost-free season is 80 to 100 days.

Zwiefel sand makes up 35 percent of this complex, Grassy Butte sand makes up 25 percent, and Terreton loamy sand makes up 25 percent. The Zwiefel soil is in convex areas on small stabilized dunes, the Grassy Butte soil is in large convex areas on stabilized dunes, and the Terreton soil is in the more nearly level interdune areas.

Included with this complex in mapping is about 15 percent Terreton sandy clay loam, Terreton silty clay loam, and Rock outcrop.

The Zwiefel soil is very deep and well drained. It formed in sandy eolian and lacustrine sediment derived from mixed sources. Typically, the surface layer is grayish brown fine sand about 3 inches thick. The upper part of the underlying material is grayish brown fine sand 18 inches thick. The lower part to a depth of 60 inches or more is light brownish gray sandy clay and silty clay.

Permeability of the Zwiefel soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.. The hazard of soil blowing is very high.

The Grassy Butte soil is very deep and somewhat excessively drained. It formed in sandy eolian and lacustrine deposits derived from mixed sources. Typically, the surface layer is grayish brown sand about 7 inches thick. The underlying material, to a depth of 60 inches or more is grayish brown and gray loamy sand.

Permeability of the Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

The Terreton soil is very deep and well drained. It formed in sandy lacustrine material derived from mixed sources and is on old lake bottoms. Typically, the surface layer is light brownish gray loamy sand about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray and light gray clay and silty clay loam.

Permeability of the Terreton soil is slow. Effective rooting depth is 60 inches or more. Available water capacity is very high. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

This complex is used as range and for wildlife habitat.

If these soils are irrigated, they can be used for hay, small grain, pasture, and potatoes. The main management concerns are impaired trafficability of machinery and the very high hazard of soil blowing. The hazard of soil blowing makes it necessary to replant close grown crops about 1 year in 4.

A suitable cropping system is 3 to 5 years of alfalfa for hay, 1 year of potatoes, 1 or 2 years of grain, and then return to alfalfa or plant to pasture. If pasture is used in the cropping system, it is generally used for 5 to 8 years. To maintain high production of crops, commercial fertilizer commonly is needed in addition to manure and plant residue. Generally, legumes respond to phosphate and all crops respond to nitrogen. Sprinkler irrigation systems are suited to these soils.

If the soil is irrigated, Russian-olive, green ash, Rocky Mountain juniper, Siberian peashrub, and lilac are well suited to use in windbreaks. These plantings also improve the wildlife habitat.

If the range vegetation is in good or excellent condition, the main native grasses are needleandthread and Indian ricegrass. When the range vegetation deteriorates, the proportion of these grasses decreases and the proportion of less desirable weeds, grasses, forbs, and woody plants increases. These soils are used for grazing mainly in spring and fall. Mechanical seeding or brush control is not practical because of the very high hazard of soil blowing and the sandy surface layer. Management practices suitable for use on these soils include proper range use, deferred grazing, rotation grazing, and aerial spraying for brush control.

This complex has potential for providing habitat for jackrabbit, pronghorn antelope, coyote, sage grouse, songbirds, and birds of prey. Capability subclasses IVe, irrigated, and VIIe, nonirrigated.

Use and management of the soils

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

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland; as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities; and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

More than 191,000 acres in the survey area was used for crops and pasture in 1966 (4). Of this total, 29,000 acres was used for row crops, mainly potatoes; 57,000 acres for close-grown crops, mainly wheat and barley; and 98,000 acres for alfalfa hay or pasture, and grass or meadow hayland. The rest was idle cropland.

Many acres of land in Jefferson County are suitable for cultivation if irrigation water is made available. There are also many other small areas of good 'soils that are surrounded by lava and are too small to be farmed by present-day methods. These soils may in the future be used for the production of crops. Acreage in crops has gradually been increasing as privately owned range has been tilled and irrigated. Some areas of National Resource Lands are being developed under the Desert Entry Act to go into private ownership.

Climate is the main factor that limits the use of the soils in the county for crops. There are 100 to 115 growing days in the Rigby-Roberts area and 80 to 100 days in the Mud Lake-Hamer area. In most of the survey area, precipitation is too low for crop production without irrigation.

Soil erosion is a major concern on both cropland and rangeland. If the slope of cropland soils is more than 2 percent, erosion by water is a hazard. Bereniceton, Lidy, Matheson, and Pancheri soils that have slopes of more than 2 percent are examples of soils on which erosion is a hazard. Soils that have a surface layer of loamy sand or sand are subject to soil blowing regardless of slope. Diston and Grassy Butte are the major sandy soils. Trafficability is also a concern on these soils, and farm machinery that has better than normal traction is needed.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the lower layers is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a loamy sand substratum, such as Diston soils or any other soils that have a layer that limits the rooting depth. Such layers include duripans, as in the Diston soils, or bedrock, as in the Malm, Aecet, Bondfarm, and Modkin soils. Productivity is reduced if the limy substratum of the

Pancheri and similar soils is exposed because of erosion. Second, some erosion on farmland results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves the suitability of water for municipal use, recreation, and fish and wildlife.

Maintaining protective plant cover reduces runoff and erosion and increases infiltration. A cropping system that keeps plant cover on the soil for extended periods can minimize soil erosion losses so that the productive capacity of the soils is not reduced. On livestock farms, which require pasture and hay, including legume and grass forage crops in the cropping system reduces erosion on sloping land and also provides nitrogen and improves tilth for the following crop.

Soil blowing is a hazard on the sandy Diston, Grassy Butte, Matheson, Terreton, and Zwiefel soils and on Market clay. This can damage these soils and form sand hummocks, or dunes, in a few hours if winds are strong and the soils are dry and not protected by vegetation or surface mulch. Maintaining plant cover, surface mulch, or rough surfaces through proper tillage minimizes soil blowing on these soils. Windbreaks of adapted trees and shrubs, such as Russian-olive and Tatarian honeysuckle, are effective in reducing soil blowing on all of the soils in the survey area.

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

Soil drainage is needed in some areas of the soils in the county. Some soils are naturally so wet that the production of crops common to the area is generally not possible. These are the poorly drained and very poorly drained Levelton, Medano, and Minnewaukan soils, which make up about 19,000 acres of the survey area. Other soils that have similar but not so serious limitations are the Hovey and Hovey Variant soils, which are somewhat poorly drained. These soils, however, support most of the locally grown crops. According to a recent study, it may be feasible to drain the latter two soils.

Blackfoot and Labenzo are examples of soils in the vicinity of Rigby that normally have a water table at a depth of 4 to 6 feet. When an excessive amount of water is applied in the area, the water table tends to rise. This, in addition to seepage from canals and ditches, causes the water to seep into basements, holes, or depressions. This problem can generally be alleviated by applying only the amount of water that can be used by the crops.

Soils that have a loamy sand surface layer and a clay substratum, such as Terreton loamy sand and Zwiefel soils, are limited by the way in which water moves through the profile. Irrigation water penetrates the surface layer faster than the lower layers, which causes the water to perch for a significant period of time. If excess water is applied, damage to crops results.

Much of the old lakebed surrounding Mud Lake is irrigated with water from shallow wells, and there is a slight rise in elevation toward the edges of the old lakebed, which makes it necessary to lift the water a few feet into the canal system (fig. 9). Border and furrow irrigation systems can be used.

Natural soil fertility is relatively high in most soils in the survey area. All soils respond to nitrogen and phosphate. Some trees and shrubs in the Mud Lake area show the effects of lime-induced chlorosis. No significant areas are known to be deficient in potash or trace elements.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular, have good structure, and are porous.

Most of the soils in the survey area are light colored and are low in organic matter content. Under normal farming practices, enough residue is incorporated into the soil to maintain sufficient organic matter so that the tilth is good. If crop residue is not returned periodically to the fine textured, light colored soils, a crust forms on the surface in spring and makes water penetration difficult. Regular additions of crop residue, manure, and other organic material improves soil structure and reduces crust formation.

Tilth is a problem on the silty clay loams, clay loams, and clays because such soils often stay wet until late in spring. If they are wet when plowed, they tend to be very cloddy when dry and good seedbeds are difficult to prepare. Fall plowing generally results in good tilth in spring.

Most field crops not recognized as being adapted to the soils of the survey area are grown to some extent. Corn for silage may be grown more in the future than it is now, but the length of the growing season is a limitation. Potatoes are the major row crop, but some sugar beets are grown. Wheat and barley, and to a lesser extent oats, are the common close-grown crops. Alfalfa for hay or an alfalfa hay-grass mixture is grown as the hay crop. Rye and some other grass seed crops can be produced.

Specialty crops are restricted to those that can mature in the short growing season.

The latest information and suggestions for growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

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

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. Only the levels class and subclass are used in this survey. Capability class and subclass are defined in the following paragraphs. A survey area may not have soils of all classes.

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

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices (fig. 10).

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s, or c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s, or c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Rangeland

By John Davis, range conservationist, Soil Conservation Service.

Of the 696,960 acres in Jefferson County, about 55 percent is Federal land managed mainly by the Bureau of Land Management and the Idaho National Engineering Laboratory. A small acreage is managed by the Forest Service. Almost all of the federally managed land is used as rangeland. With the addition of the privately owned rangeland, the total acreage presently used for range is about 400,000 acres, or 57 percent of the survey area.

About 3,000 to 4,000 acres of rangeland is being converted to sprinkler irrigated cropland annually. There is still a large acreage that could be cultivated if irrigation water were available.

Sheep and cow-calf operations are the dominant livestock enterprises. The cow-calf operations are generally located in the northern and northeastern parts of the county, and the sheep operations are in the western and southwestern parts. The average size of ranches varies, but ranches generally consist of 800 to 1,000 acres of private land plus grazing rights on the Federal lands.

Most of the water for cattle is provided by wells. In the past the pumping was done by windmills (fig. 11), but windmills have been mostly replaced by small gasoline engines.

Several livestock operations are located along the South Fork of the Snake River. The bottom lands are used as winter range and as calving pastures in spring. A thick stand of shrubs and deciduous trees affords the stock good protection from the cold, windy, and often snowy weather early in spring.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 5 shows, for each kind of soil, the name of the range site; the potential annual production of vegetation in favorable, normal, arid unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed are mostly cultivated or cannot support a natural plant community of predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 5.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community (fig. 12). Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high. water table are also important.

Potential production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Common plant names of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed. Under *Composition,* the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition (fig. 13). The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In the northwestern part of the county, most of the soils are very droughty gravelly loams. These soils generally support drought-tolerant, low-growing shrubs, grasses, and annual forbs. In much of the county the soils are sandy loams and loamy sands. There are large scattered areas of hummocks and dunes on which the hazard of soil blowing is very high. Soil drifting is common where the vegetation has deteriorated because of improper management. The potential production of

vegetation on the sandy loams and loamy sands is much greater than that on the gravelly loams of the northwestern part of the county.

The major management concern on most of the rangeland in the survey area is to control grazing so that the kinds and amounts of plants that. make up the potential plant community are re-established. In some areas even grazing control may not suffice to return the vegetation to its potential within a reasonable period of time. Invasion by the poisonous plant Halogeton has taken place in large areas in the south-central part of the area and is persisting even where control has been attempted by seeding to crested wheatgrass. Controlling brush, minimizing soil blowing, developing livestock water, and reseeding range are other important practices that can be used to improve the rangeland. If sound range management based on soil survey information and rangeland inventories is applied, the potential is good for increasing the rangeland productivity in the area.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

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

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

Table 6 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 6, based on measurements and observation of established plantings that have been irrigated and given adequate care, can be used as a guide in planning windbreaks and screens. All the soils that are irrigated or have potential for irrigation and that do not have other significant limitations are rated in table 6. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Engineering

Dale Schlader, area engineer, Soil Conservation Service, helped to prepare this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations

can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

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

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 7. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 7 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 8 shows the degree and kind of limitations of each soil for such uses and for use of the soil as

daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight,* soils are generally favorable for the specified use and limitations are minor and easily overcome; if moderate, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if severe, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms good, *fair,* and *poor*, which, respectively, mean about the same as the terms *slight, moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage *lagoons* are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the, refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 8 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover *is* desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, poor, or unsuited. The texture, thickness, and organic matter content of each soil horizon are important factors in rating soils for use as construction

materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 9 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 10 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table,

permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that .affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

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

The information in table 11 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

The wildlife in Jefferson County includes jackrabbit, pronghorn antelope, coyote, shore birds, songbirds, and birds of prey. The major game fish are the various kinds of trout.

Three areas in the county are reserved for the care and protection of wildlife-Camas National Wildlife Refuge, west of Hamer; Northlake Wildlife Management Area, around Mud Lake; and Market Lake Wildlife Management Area, north of Roberts.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of habitat are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, barley, sorghum, millet, buckwheat, cowpeas, soybeans, and sunflowers.

Grasses *and legumes* are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bluegrass, lovegrass, switchgrass, bromegrass, timothy, orchardgrass, clover, alfalfa, trefoil, and crownvetch.

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

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are big sagebrush and bitterbrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cattail, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines, These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include pheasant, meadowlark, field sparrow, killdeer, and cottontail rabbit.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, and beaver.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include pronghorn antelope, mule deer, jackrabbit, coyote, sage grouse, golden eagle, and songbirds.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They

note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features.

Engineering properties

Table 13 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 13 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 13 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

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

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes-eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils, are classified in group A-8 on the basis of visual inspection.

In table 13 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded, to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field-particularly soil structure, porosity, and gradation or texture-that influence the downward movement of water in the soil. The estimates are for vertical water

movement when the soil is saturated. Not considered in the estimates are lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 14. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

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

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

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

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

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

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

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

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

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

Soil and water features

Table 15 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils.

Cemented pans are hard subsurface layers, within a depth of 5 or 6 feet, that are strongly compacted (indurated). Such pans cause difficulty in excavation. The hardness of pans is similar to that of bedrock. Depth to cemented pans is shown in table 15.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity; permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Classification of the soils

This section describes the soil series and higher categories in the survey area, defines the current system of classifying soils, and classifies the soils of the area according to that system.

Soil series and higher categories and morphology

On the following pages each soil series and each soil mapped at a category higher than the series in the survey area are described in detail. The descriptions are presented in alphabetic order.

For each soil, some facts about the soil and its parent material are presented first. Then a pedon, a small three dimensional area of soil typical of the soil in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (5). Unless otherwise noted, colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil as mapped in this survey area. Map units of each soil are described in the section "Soil maps for detailed planning."

Aecet series

The Aecet series consists of moderately deep, well drained soils on basalt plains. These soils formed in eolian deposits. Slope is 0 to 12 percent.

Typical pedon of an Aecet very stony sandy loam in an area of Aecet-Rock outcrop complex, 300 feet north and 1,980 feet east of the southwest corner of sec. 14, T. 7 N., R. 34 E.:

A1-0 to 5 inches; pale brown (10YR 6/3) very stony sandy loam, dark grayish brown (10YR 4/2) moist; weak very thin platy structure parting to weak very fine granular; loose; many very fine, fine, and medium roots; slightly calcareous; moderately alkaline; clear wavy boundary.

B2-5 to 13 inches; pale brown (10YR 8/3) clay loam, brown (10YR 5/3) moist; weak fine and medium angular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots; many very fine tubular pores; strongly calcareous; strongly alkaline; clear wavy boundary.

Cca-13 to 23 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; many very fine tubular pores; about 5 percent basalt pebbles and cobbles; strongly calcareous; strongly alkaline; abrupt wavy boundary.

IIR-23 inches; basalt.

Depth to basalt ranges from 20 to 40 inches. Depth to the calcic horizon ranges from 5 to 17 inches. Content of angular coarse basalt fragments ranges from 5 to 20 percent throughout most pedons.

The A horizon has value of 5 or 6 and chroma of 2 or 3. The B horizon has value of 6 or 7 and chroma of 2 or 3. The Ca horizon has value of 7 or 8 and chroma of 1 to 3.

Annis series

The Annis series consists of very deep, moderately well drained soils on river terraces. These soils formed in mixed alluvium. Slope is 0 to 1 percent.

Typical pedon of Annis silty clay loam, about 1 mile north of Menan, 1,000 feet south and 75 feet east of the northwest quarter corner of sec. 27, T. 5 N., R. 38 E.:

Ap-0 to 7 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; common very fine and fine interstitial pores; slightly calcareous; moderately alkaline; abrupt smooth boundary.

A12-7 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; slightly calcareous; moderately alkaline; abrupt smooth boundary.

B2-12 to 21 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; few fine distinct dark yellowish brown (10YR 4/4, moist) mottles; weak coarse prismatic structure parting to weak thin and medium platy; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; slightly calcareous; moderately alkaline; gradual wavy boundary.

C1ca-21 to 31 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; few fine distinct dark yellowish brown (10YR 4/4, moist) mottles; weak coarse prismatic structure parting to weak very fine and fine subangular blocky; hard, friable, sticky and plastic; few very fine and fine roots; many very fine and fine tubular pores; slightly calcareous; moderately alkaline; clear wavy boundary.

C2ca-31 to 38 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; many fine distinct dark brown (10YR 3/3, moist) mottles; weak very fine subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; many very fine and fine tubular pores; moderately calcareous; moderately alkaline; abrupt wavy boundary.

C3ca-38 to 49 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; few fine prominent dark yellowish brown (10YR 3/4, moist) mottles; weak very fine subangular blocky. structure; hard, friable.; sticky and very plastic; few very fine and fine roots; many very fine and fine tubular pores; moderately calcareous; moderately alkaline; clear wavy boundary.

C4ca-49 to -60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; common medium distinct dark yellowish brown (10YR 3/4, moist) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; strongly calcareous; moderately alkaline.

The A horizon is strongly saline-alkali affected in some pedons. A few pedons have a buried A1 horizon. Many pedons below a depth of 30 inches are stratified fine sandy loam to silty clay loam.

Bannock series

The Bannock series consists of deep, well drained soils on river terrace. These soils formed in alluvium derived from mixed sources. Slope is 0 to 1 percent. Typical pedon of Bannock loam, 2 miles west, and 2 1/2 miles south of Rigby; 1,650 feet north and 80 feet east of the southwest corner of sec. 34, T. 4 N., R. 39 E.:

Ap-0 to 11 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; many very fine and fine tubular pores; slightly calcareous; mildly alkaline; abrupt smooth boundary.

C1ca-11 to 17 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; weak, medium, and fine subangular blocky structure; slightly hard, friable, slightly plastic; few very fine, fine, and medium roots; common very fine and fine tubular pores; strongly calcareous; moderately alkaline; clear wavy boundary.

C2ca-17 to 26 inches; light gray (10YR 7/2) loam, brown (10YR 4/3) moist; massive; slightly hard, friable, slightly plastic; few very fine, fine, and medium roots; common very fine and fine tubular pores; 10 percent fine veins and splotches of lime; strongly calcareous; moderately alkaline; gradual wavy boundary.

C3ca-26 to 31 inches; light gray (10YR 7/2) sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; few very fine and fine roots; moderately calcareous; moderately alkaline; clear wavy boundary.

IIC3ca-31 to 60 inches; light gray (10YR 7/2) very gravelly sand, brown (10YR 5/3) moist; few very fine and fine roots; 70 percent gravel and 15 percent cobbles; moderately calcareous; moderately alkaline.

The A horizon is grayish brown or brown and is slightly calcareous or moderately calcareous. In some places the upper 2 or 3 inches is platy. The C horizon in some places has strata of gravelly loam, gravelly sandy loam, or silt loam. Very gravelly sand occurs between depths of 20 and 40 inches, but its upper boundary is mostly above a depth of 35 inches.

Bereniceton series

The Bereniceton series consists of deep and very deep, well drained soils on river terraces, basalt plains, alluvial fans, and old lakebeds. These soils formed in mixed alluvium, eolian, and lacustrine deposits underlain by basalt. Slope is 0 to 12 percent.

Typical pedon of Bereniceton very stony sandy loam in an area of Bereniceton-Rock outcrop-Aecet complex, 1,950 feet north and 2,000 feet east of the southwest corner of sec. 16, T. 4 N., R. 34 E.:

A11-0 to 3 inches; brown (10YR 5/3) very stony sandy loam, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; slightly hard, very friable; few very fine, fine, medium, and coarse roots; slightly calcareous; moderately alkaline; clear wavy boundary.

A12-3 to 7 inches; pale brown (10YR 6/3) very stony loam; brown (10YR 5/3) moist; weak very fine granular structure; slightly hard, very friable, sticky and slightly plastic; few very fine, fine, medium, and coarse roots; many very fine tubular pores; slightly calcareous; moderately alkaline; clear wavy boundary.

C1ca-7 to 14 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; few very fine, fine, medium, and coarse roots; many very fine tubular pores; strongly calcareous; strongly alkaline; clear wavy boundary.

C2ca-14 to 30 inches; very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; many very fine tubular pores; strongly calcareous; common cicada nodules; strongly alkaline; clear wavy boundary.

C3ca-30 to 46 inches; very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; massive; hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores; strongly calcareous; common cicada nodules; strongly alkaline; abrupt wavy boundary.

IIR-46 inches; basalt.

Bedrock is at a depth of 40 to 60 inches or more. The A horizon is brown, light brownish gray, or pale brown. The Ca horizon is at a depth of 5 to 14 inches. Thin laminated layers are below a depth of 24 inches in some pedons. Thin strata of sandy loam or fine sand are below a depth of about 40 inches in some pedons.

Blackfoot series

The Blackfoot series consists of very deep, moderately well drained soils on river terraces. These soils formed in alluvium derived from mixed sources. Slope is 0 to 1 percent.

Typical pedon of Blackfoot silt loam, drained, 5 miles north and 1 mile west of Rigby; 1,040 feet south and 40 feet east of the northwest corner of sec. 24, T. 5 N., R. 38 E.:

Ap-0 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; many very fine and fine interstitial pores; slightly calcareous; mildly alkaline; abrupt smooth boundary.

C1-10 to 16 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; few fine faint brown (10YR 4/3) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores and few medium and coarse tubular pores; slightly calcareous; mildly alkaline; abrupt wavy boundary.

C2-16 to 22 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; few fine faint brown (10YR 4/3, moist) mottles; massive; hard, friable, sticky and plastic; few very fine and fine roots; many very fine and fine tubular pores; slightly calcareous; mildly alkaline; abrupt wavy boundary.

C3ca-22 to 35 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; common fine distinct dark yellowish brown (10YR 4/4, moist) mottles; massive; slightly hard, friable, sticky and plastic; few very fine and fine roots; many very fine and fine tubular pores; slightly calcareous; mildly alkaline; abrupt wavy boundary.

C4-35 to 42 inches; light brownish gray (10YR 6/2) fine sandy loam, brown (10YR 5/3) moist; common fine distinct dark yellowish brown (10YR 4/4, moist) mottles; massive; soft, very friable; few very fine and fine roots; many very fine and fine tubular pores and few medium tubular pores; slightly calcareous; moderately alkaline; abrupt wavy boundary.

C5-42 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; common fine distinct dark yellowish brown (10YR 4/4, moist) mottles; massive; slightly hard, friable, slightly sticky; few very fine and fine roots; many very fine and fine tubular pores; slightly calcareous; moderately alkaline.

The A horizon is gray, grayish brown, or light brownish gray and is noncalcareous to moderately calcareous. The part of the C horizon above a depth of 40 inches is stratified. It is dominantly loam and silt loam but ranges from fine sandy loam to silty clay loam. Below this depth the profile in places has strata of sandy loam and loamy sand. The C horizon ranges from noncalcareous to strongly calcareous. Mottles are few or common, and faint or distinct. Mottles commonly are at a depth of 20 to 40 inches, but in some profiles mottles are at a depth of 10 inches.

Bockston series

The Bockston series consists of very deep, well drained soils on river terraces. These soils formed in alluvium derived from mixed sources. Slope is 0 to 1 percent.

Typical pedon of Bockston loam, about 3 miles west and 2 1/2 miles south of Rigby; 530 feet south and 80 feet east of the southwest corner of sec. 34, T. 4 N., R. 38 E.:

Ap-0 to 9 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; strong medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; many very fine, fine, medium, and coarse tubular pores; slightly calcareous; mildly alkaline; abrupt smooth boundary.

B21-9 to 15 inches; pale brown (10YR 6/3) silt loam, grayish brown (10YR 5/2) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few very fine, fine, and medium roots; many very fine and fine tubular roots; common medium and coarse tubular pores; moderately calcareous; mildly alkaline; clear wavy boundary.

B22-15 to 21 inches; pale brown (10YR 6/3) silt loam, light brownish gray (10YR 6/2) moist; moderate medium platy structure that parts to strong fine angular blocks; slightly hard, friable, sticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores and few medium and coarse tubular pores; moderately calcareous; mildly alkaline; clear wavy boundary.

C1ca-21 to 28 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; moderate medium platy structure that parts to moderate medium subangular blocks; slightly hard, friable, sticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores and few medium and coarse tubular pores; many light gray

(10YR 7/2) lime veins and splotches; strongly calcareous; mildly alkaline; clear wavy boundary.

C2ca-28 to 38 inches; light brownish gray (10YR 6/2) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; few very fine and fine roots; many very1ine and fine tubular pores; moderately calcareous; mildly alkaline; clear wavy boundary.

IIC3ca-38 to 43 inches; light brownish gray (10YR 6/2) very gravelly fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; few very fine and fine roots; many very fine and fine tubular pores; about 60 percent gravel and 15 percent cobbles; moderately calcareous; moderately alkaline; clear wavy boundary.

IIIC4-43 to 60 inches; light brownish gray (10YR 6/2) very gravelly loamy sand, grayish brown (10YR 5/2) moist; single grain; loose, dry and moist; few very fine and fine roots; about 70 percent gravel and 20 percent cobbles; lime coatings on underside of pebbles and cobbles; moderately calcareous; mildly alkaline.

The A horizon is grayish brown or brown. The structure in the upper 0 to 4 inches of the profile is strong, medium, and granular or moderate, thin, and platy. Depth to very gravelly loamy sand is 40 inches to more than 60 inches. The B horizon, where present, is loam or silt loam and is slightly calcareous or moderately calcareous. Some pedons have up to 15 percent pebbles above the IIC horizon.

Bondfarm series

The Bondfarm series consists of shallow, well drained soils on basalt plains. These soils formed in sandy eolian deposits. Slope is 2 to 12 percent.

Typical pedon of a Bondfarm sandy loam in an area of Malm-Rock outcrop complex, about 3 miles north and 3 miles east of Monteview; 835 feet east and 50 feet south of the northwest corner of sec. 21, T. 8 N., R. 34 E.:

A1-0 to 4 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak very thin platy structure; slightly hard, very friable; many very fine, fine, and medium roots; many very fine interstitial pores; slightly calcareous; moderately alkaline; clear wavy boundary.

B2ca-4 to 13 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable; common very fine and fine roots; common very fine and fine tubular pores; strongly calcareous; moderately alkaline; gradual wavy boundary.

Cca-13 to 18 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular pores; strongly calcareous; moderately alkaline; abrupt wavy boundary.

IIR-18 inches; basalt with lime accumulations 3/8 inch thick on surface and in cracks and pores.

Bedrock is at a depth of 10 to 20 inches. The A horizon is brown, pale brown, grayish brown, or light brownish gray. The B horizon has weak or moderate subangular blocky structure.

Bondranch series

The Bondranch series consists of shallow, well drained soils on basalt plains. These soils formed in sandy wind-laid deposits. Slope is 2 to 12 percent.

Typical pedon of Bondranch sandy loam, 2 to 12 percent slopes, about 3 miles south and 9 miles east of Hamer; 300 feet north and 80 feet east of the southwest corner of sec. 17, T. 6 N., R. 38 E.:

A1-0 to 5 inches; light brownish gray (10YR 6/2) sandy loam, dark brown (10YR 3/3) moist; weak thin platy structure; slightly hard, very friable; common very fine, fine, and medium roots; many very fine interstitial pores; mildly alkaline; clear wavy boundary.

B2-5 to 11 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 3/3) moist; weak medium and fine subangular blocky structure; hard, friable; common very fine, fine, and medium roots; common very fine tubular pores; mildly alkaline; clear wavy boundary.

C1-11 to 16 inches; pale brown (10YR 6/3) sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structure; slightly hard, very friable; common very fine, fine, and medium roots; common very fine tubular pores; strongly calcareous; mildly alkaline; abrupt wavy boundary.

C2ca-16 to 19 inches; very pale brown (10YR 7/3) sandy loam, grayish brown (10YR 5/2) moist; weak medium and fine subangular blocky structure; very hard, friable; common very fine, fine, and medium roots; common very fine tubular pores; strongly calcareous; mildly alkaline; abrupt wavy boundary.

IIR-19 inches; basalt with thin lime coating on surface.

Basalt is at a depth of 10 to 20 inches. The A horizon is brown, pale brown, or light brownish gray. It is com monly noncalcareous, but it is moderately calcareous in areas where it is more than 7 inches thick. The B hori zon has weak or moderate, subangular blocky structure.

Diston series

The Diston series consists of moderately deep, somewhat excessively drained soils on basalt plains. These soils formed in sandy wind-laid deposits. Slope is 0 to 8 percent.

Typical pedon of Diston loamy sand, 4 to 8 percent slopes, about 2 miles north of Hamer; 160 feet north and 20 feet west of southeast corner of sec. 4, T. 7 N., R. 36 E.:

A1-0 to 5 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak very thin platy structure; soft, very friable; common very fine and fine roots; many very fine and fine interstitial pores; 5 percent hardpan chips less than 3/4 inch in diameter; moderately calcareous; moderately alkaline; clear wavy boundary.

C1-5 to 13 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; soft, very friable; common very fine and fine roots; common very fine and fine tubular pores; about 5 percent hardpan chips less than 3/4 inch in diameter; strongly calcareous; moderately alkaline; clear wavy boundary.

C2ca-13 to 31 inches; light gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; soft, very friable; few very fine and fine roots; common very fine and fine tubular pores; about 5 percent hardpan pebbles less than 3/4 inch in diameter; strongly calcareous; moderately alkaline; abrupt wavy boundary.

C3casim-31 to 40 inches; white (2.5Y 8/1) indurated duripan, very pale brown (10YR 7/3) moist; massive; extremely hard, extremely firm; many very fine and fine tubular pores; slightly calcareous; mildly alkaline; abrupt wavy boundary.

C4-40 to 45 inches; light gray (2.5Y 7/2) sand that contains weakly silica-cemented layers; grayish brown (10YR 5/2) moist; single grain and massive; loose and slightly hard, loose and friable; many very fine and fine tubular pores; 10 percent fractured duripan pebbles; strongly calcareous; mildly alkaline; abrupt smooth boundary.

C5casim-45 to 47 inches; white (2.5Y 8/1) indurated duripan, very pale brown (10YR 7/3) moist; massive; extremely hard, extremely firm; few very fine tubular pores; strongly calcareous; mildly alkaline; abrupt wavy boundary.

C6-47 to 60 inches; light gray (2.5Y 7/2) sand that is weakly silica-cemented, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; common very fine and fine tubular pores; strongly cemented duripan layers 1 inch to 5 inches thick; strongly calcareous; mildly alkaline.

The duripan is at a depth of 20 to 40 inches. The content of duripan pebbles in the profile is as much as 5 percent. Basalt generally is below a depth of 60 inches, but in some pedons the cemented layer rests directly on bedrock. The A horizon is grayish brown or light brownish gray.

Fluvaquents

Fluvaquents are very deep, very poorly drained soils on old lakebeds. The soils are in marsh areas that are inundated most of the time between May and October. The vegetation is mostly cattails and other water-tolerant plants.

Reference pedon of Fluvaquents, nearly level, about 3 miles northwest of Roberts; 500 feet east and 50 feet north of the southwest corner of sec. 7, T. 5 N., R. 37 E.:

A1g-0 to 8 inches; white (5Y 8/ 1) silty clay, gray (5Y 6/1) moist; massive; very hard, very firm, very sticky and very plastic; moderately alkaline; clear wavy boundary.

C1-8 to 60 inches; variably colored erratically stratified thin layers of silt loam, silty clay loam, and silty clay; strongly alkaline.

The surface is covered with a 3-inch mat of roots and other plant parts in most pedons. The profile is highly stratified. It is dominantly silt loam, silty clay loam, silty clay, and clay to a depth of more than 60 inches. Thin strata of coarser texture occur in some pedons.

Grassy Butte series

The Grassy Butte series consists of very deep, somewhat excessively drained soils on basalt plains. These soils formed in wind-laid sandy deposits. Slope is 2 to 20 percent.

Typical pedon of Grassy Butte loamy sand, 2 to 4 percent slopes, about 2 1/2 miles north and 1/4 mile east of Hamer; 50 feet south and 150 feet east of the west quarter corner of sec. 3, T. 7 N., R. 36 E.:

A1-0 to 7 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable; common very fine and fine roots; many very fine and fine interstitial pores; slightly calcareous; moderately alkaline; clear wavy boundary.

C1-7 to 19 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, dry and moist; few very fine and fine roots; many very fine and fine interstitial pores; moderately calcareous; moderately alkaline; clear wavy boundary.

C2ca-19 to 32 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, dry and moist; few very fine and fine roots; many very fine and fine interstitial pores; strongly calcareous; moderately alkaline; gradual wavy boundary.

C3ca-32 to 51 inches; gray (10YR 5/1) loamy sand, dark gray (10YR 4/1) moist; single grain; loose, dry and moist; few very fine and fine roots; many very

fine and fine interstitial pores; strongly calcareous; moderately alkaline; gradual smooth boundary.

C4-51 to 60 inches; gray (10YR 5/1) loamy sand, dark gray (10YR 4/1) moist; single grain; loose, dry and moist; very few very fine and fine roots; many very fine and fine interstitial pores; slightly calcareous; moderately alkaline.

Bedrock is at a depth of 60 inches or more. The part of the profile between depths of 10 and 40 inches generally is loamy sand or sand. The part below a depth of 33 inches or more is loam in some places. Some pedons have as much as 15 percent basalt fragments scattered throughout the profile. The A horizon is brown or grayish brown.

Greybo series

The Greybo series consists of very deep, well drained soils on loess plains. These soils formed in silty wind-laid material. Slope is 2 to 30 percent.

Typical pedon of Greybo silt loam, 2 to 30 percent slopes, about 2 miles north and 6 miles east of Ririe; 1,500 feet south and 900 feet east of the northwest corner of sec. 28, T. 4 IV., R. 41 E.:

O-2 inches to 0; black (10YR 2/1) decomposed organic mat.

A1-0 to 19 inches; brown (10YA 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable; many very fine, fine, and medium roots and common coarse and very coarse roots; common very fine and fine tubular pores; neutral; diffuse wavy boundary.

A2-19 to 37 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak, medium prismatic structure parting to weak medium subangular blocks; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; many very fine and fine tubular pores; 5 percent B material in the form of bands as much as 3/4 inch wide; neutral; diffuse wavy boundary.

A&B-37 to 58 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocks; slightly hard, friable; few medium and coarse roots; many very fine and fine tubular pores; 25 percent light yellowish brown (10YR 6/4) silty clay loam lamellae 1 /4 to 1 inch thick; strong very fine and fine subangular blocky structure; hard, friable, sticky and plastic; thin patchy clay films on peds and in pores; pale brown (10YR 6/3, moist) silt coatings on silty clay loam bands; neutral; diffuse wavy boundary.

B&A-58 to 60 inches; light yellowish brown (10YR 6/4) silt loam, brown (10YR 4/3) moist; moderate medium prismatic structure; slightly hard, friable, slightly sticky and plastic; few medium and coarse roots; many very fine, fine, and medium tubular pores; 25 percent tongues and lamellae of pale brown (10YR 6/3) silt loam (A2 material); neutral.

The A1 horizon is brown or grayish brown. It is neutral or slightly acid.

Hayeston series

The Hayeston series consists of very deep soils on river terraces. These soils formed in alluvium derived from mixed sources. They are moderately deep over gravel. Slope is 0 to 1 percent.

Typical profile of Hayeston sandy loam, about 6 miles east and 1/2 mile south of Rigby; 700 feet south of the west quarter corner of sec. 24, T. 4 IV., R. 39 E::

Ap-0 to 7 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine, few medium and coarse roots; many very fine and fine interstitial pores; slightly calcareous; moderately alkaline; abrupt smooth boundary.

C1-7 to 18 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; soft, very friable; many very fine, fine, and medium roots; many very fine and fine tubular roots and few coarse pores; slightly calcareous; moderately alkaline; clear smooth boundary.

C2-18 to 23 inches; light brownish gray (10YR 6/2) sandy loam, dark brownish gray (10YR 4/2) moist; massive; soft, very friable; many very fine and fine roots and few coarse roots; many very fine and fine tubular pores; slightly calcareous; moderately alkaline; clear wavy boundary.

IIC3-23 to 28 inches; light brownish gray (10YR 6/2) very gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; many very fine, fine, and medium roots; many very fine and fine tubular pores; slightly calcareous; moderately alkaline; clear wavy boundary.

IIC4-28 to 60 inches; sand and gravel; slightly calcareous; many very fine, fine, and medium roots; 15 percent cobbles.

Sand and gravel are at a depth of 20 to 40 inches. The average coarse fragment content between depths of 10 and 40 inches is less than 35 percent. The A horizon is brown, pale brown, or light brownish gray.

Heiseton series

The Heiseton series consists of very deep, moderately well drained soils on river terraces and old lakebeds. These soils formed in alluvium derived from mixed

sources. They are deep over gravel. Slope is 0 to 4 percent.

Typical pedon of Heiseton loam, about 1 1/2 miles south of Menan; 250 feet south and 250 feet east of the northwest corner of sec. 10, T. 5 N., R. 38 E.:

Ap-0 to 7 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine interstitial pores; slightly calcareous; mildly alkaline; abrupt smooth boundary.

C1-7 to 18 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; common very fine, fine, and medium roots; many very fine and fine tubular pores; slightly calcareous; moderately alkaline; clear wavy boundary.

C2-18 to 25 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; few very fine and fine roots; many very fine and fine tubular pores; slightly calcareous; moderately alkaline; clear wavy boundary.

C3-25 to 32 inches; light gray (10YR 7/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores and common medium tubular pores; slightly calcareous; moderately alkaline; clear wavy boundary.

C4-32 to 50 inches; light gray (10YR 7/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; few very fine and fine roots; many very fine and fine tubular pores and common medium tubular pores; slightly calcareous; moderately alkaline.

IIC5-50 to 60 inches; sand and gravel.

A seasonal high water table fluctuates between depths of 3 and 5 feet during April through June. Sand and gravel are at a depth of 40 to 60 inches or more. Some profiles are not stratified below a depth of 7 inches. A few pedons have mottles at a depth of about 3 feet. The A horizon is grayish brown, brown, light brownish gray, or pale brown.

Hovey series

The Hovey series consists of very deep, somewhat poorly drained soils on old lakebeds. These soils formed in lacustrine and alluvial material derived from mixed sources. Slope is 0 to 1 percent.

Typical pedon of Hovey clay, about 1 3/4 miles north of Roberts on the old highway leading to the Market Lake State Wildlife Management Area; 1,000 feet south and 80 feet west of the center of sec. 20, T: 5 N:, R. 37 E.:

Ap-0 to 9 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots and few coarse roots; common very fine and fine tubular pores; slightly calcareous; strongly alkaline; abrupt smooth boundary.

B2-9 to 14 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure that parts to strong very fine subangular blocky; slightly hard, friable, sticky and plastic; many very fine and fine roots; common very fine and fine tubular pores; moderately calcareous; strongly alkaline; clear wavy boundary.

C1ca-14 to 22 inches; white (10YR 8/1) silty clay loam, dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) moist; few fine and faint brown (10YR 5/3) mottles; weak very coarse subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots; many very fine and fine tubular pores; strongly calcareous; strongly alkaline; clear wavy boundary.

IIC2ca-22 to 32 inches; light gray (10YR 7/2) sandy loam, grayish brown (10YR 5/2) moist; few fine faint mottles; massive; slightly hard, friable; few very fine and fine roots; few very fine and fine tubular pores; strongly calcareous; strongly alkaline; clear irregular boundary.

IIC3ca-32 to 60 inches; light brownish gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) moist; few medium distinct mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine tubular pores; strongly calcareous; veins and splotches of lime make up 25 percent of the matrix; strongly calcareous; strongly alkaline; clear smooth boundary.

The part of the profile below a depth of 9 inches is stratified loamy sand to clay. The part of the profile between depths of 10 and 40 inches averages silty clay loam or silt loam. The A horizon is gray or light brownish gray. It has platy, granular, or blocky structure and is moderately alkaline or strongly alkaline. The B horizon, where present, has weak to strong subangular blocky structure and is moderately alkaline or strongly alkaline. The Cca horizon has as much as 25 percent veins and splotches of lime. It is moderately alkaline or strongly alkaline.

Hovey Variant

The Hovey Variant consists of very deep, somewhat poorly drained soils on old lakebeds. These soils formed

in lacustrine and alluvial materials derived. from mixed sources. They are moderately deep over sand and gravel. Slope is 0 to 1 percent.

Typical pedon of Hovey Variant silty clay loam, about 1 mile north of Roberts on the old highway to the Market Lake State Wildlife Management Area; 150 feet west and 40 feet south of the center of sec. 29, T. 5 N., R. 37 E.:

Ap1-0 to 2 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium platy structure parting, to moderate medium granular; slightly hard, friable, sticky and plastic; many very fine and fine roots and few coarse roots; slightly calcareous; strongly alkaline; clear smooth boundary.

Ap2-2 to 6 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots; common very fine and fine tubular pores; slightly calcareous; strongly alkaline; clear smooth boundary.

C1-6 to 11 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots and many coarse roots; common very fine and fine tubular pores; moderately calcareous; strongly alkaline; clear wavy boundary.

C2ca-11 to 20 inches; white (N 8/0) clay loam, pale brown (10YR 6/3) moist; massive; hard, friable, sticky and plastic; few very fine and fine roots; common very fine and fine tubular pores; strongly calcareous; strongly alkaline; clear wavy boundary.

C3ca-20 to 32 inches; light gray (10YR 7/2) sandy loam, grayish brown (10YR 5/2) moist; few fine faint brown (10YR 5/3) mottles; massive; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; few fine tubular pores; strongly calcareous; strongly alkaline; clear wavy boundary.

IIC4-32 to 60 inches; gravelly sand; 30 percent basalt gravel.

Gravelly sand is at a depth of 20 to 40 inches. Most pedons are slightly saline-alkali affected and have as much as 5 percent spots that are strongly saline-alkali affected. The A horizon is light brownish gray, light gray, or gray.

Labenzo series

The Labenzo series consists of very deep, moderately well drained soils on low river terraces. These soils formed in alluvium derived from mixed sources. They are moderately deep over sand and gravel. Slope is 0 to 1 percent.

Typical pedon of Labenzo silt loam, about 3 1/2 miles north of Rigby; 120 feet north and 250 feet east of the southwest corner of sec. 30, T. 5 N., R. 39 E.:

Ap-0 to 13 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; slightly calcareous; moderately alkaline; abrupt smooth boundary.

C1-13 to 17 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine, fine and medium tubular pores; slightly calcareous; moderately alkaline; abrupt smooth boundary.

IIC2-17 to 21 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; few fine faint dark brown (10YR 4/3, moist) mottles; massive; soft, very friable; few very fine and fine roots; many very fine, fine, and medium tubular pores; slightly calcareous; mildly alkaline; abrupt broken boundary.

IIIC3-21 to 24 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; few fine faint dark brown (10YR 4/3, moist) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine tubular pores and fine and medium tubular pores; slightly calcareous; mildly alkaline; abrupt wavy boundary.

IIIC4-24 to 28 inches; mixture of dark gray (10YR 4/1) and light brownish gray (10YR 6/2) silt loam, common medium faint very dark brown (10YR 2/2) and dark grayish brown (10YR 4/2) and few fine faint dark yellowish brown (10YR 4/3) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; slightly calcareous; moderately alkaline; abrupt wavy boundary.

IIIC5-28 to 34 inches; light brownish gray (10YR 6/2) stratified layers that are 80 percent silt loam and 20 percent loamy sand; dark grayish brown (10YR 4/2) moist; few medium faint dark yellowish brown (10YR 4/4) mottles; massive; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; slightly calcareous; moderately alkaline; abrupt wavy boundary.

IVC6-34 to 60 inches; light brownish gray (10YR 6/2) sand and gravel, dark grayish brown (10YR 4/2) moist; single grain; loose dry and moist; few very fine and fine roots; slightly calcareous; moderately alkaline.

Sand and gravel are at a depth of 24 to 36 inches.The A horizon is brown or grayish brown. It is mildly alkaline. or moderately alkaline. It is noncalcareous or slightly calcareous. The C horizon is slightly calcareous or moderately calcareous. Some pedons contain thin layers that are noncalcareous.

Levelton series

The Levelton series consists of very deep, very poorly drained soils on old lakebeds. These soils formed in lacustrine material derived from mixed sources. Slope is 0 to 6 percent.

Typical pedon of Levelton loam, about 5 miles east and 4 miles north of Terreton; 1,350 feet west and 160 feet south of the north quarter corner of sec. 34, T. 7 N., R. 35 E.:

O1-2 inches to 0; gray (10YR 5/1) root mat, very dark gray (10YR 3/1) moist; slightly calcareous; strongly alkaline; clear wavy boundary.

A1-0 to 7 inches; white (10YR 8/2) loam, grayish brown (10YR 5/2) moist; few fine distinct dark brown (10YR 3/3) mottles; weak very fine subangular blocky structure; very hard, very firm, sticky and plastic; many very fine, fine, medium, and coarse roots; slightly calcareous; strongly alkaline; clear wavy boundary.

C1ca-7 to 30 inches; light gray (10YR 7/2) silty clay, gray (10YR 5/1) moist; common medium distinct yellowish brown (10YR 5/4) mottles; moderate thin platy structure parting to strong very fine subangular blocks; very hard, very firm, very sticky and very plastic; common very fine, fine, and medium roots; many very fine and fine interstitial pores; strongly calcareous; strongly alkaline; clear wavy boundary.

C2ca-30 to 37 inches; light gray (10YR 7/2) silty clay, gray (10YR 5/1) moist; common medium distinct yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; hard, firm, very sticky and very plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; strongly calcareous; strongly alkaline; clear wavy boundary.

C3ca-37 to 60 inches; light brownish gray (10YR 6/2) stratified sandy loam to silty clay, gray (10YR 5/1) moist; many, large distinct yellowish brown (10YR 5/ 4, moist) mottles; massive; slightly hard, friable, slightly plastic; common very fine, fine, and medium roots; strongly calcareous; strongly alkaline.

Sand or gravel, or both, is at a depth of 40 inches to 60 inches or more. The profile is moderately alkaline or strongly alkaline. The A horizon is light brownish gray, light gray, or white.

Lidy series

The Lidy series consists of very deep, well drained soils on alluvial fans. These soils formed in alluvium derived from mixed sources. They are moderately deep over gravel. Slope is 0 to 4 percent.

Typical pedon of Lidy sandy loam, 0 to 2 percent slopes, about 1.5 miles north and 3.3 miles west of Monteview; 900 feet east and 75 feet north of the center of sec. 30, T. 8 N., R. 33 E.:

A1-0 to 5 inches; pale brown (10YR 6/3) sandy loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to weak fine granular; slightly hard, very friable; many very fine, fine, and medium roots; many very fine and fine interstitial pores; gravel in places; moderately calcareous; moderately alkaline; clear smooth boundary.

C1ca-5 to 21 inches; light gray (10YR 7/2) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; many very fine, fine, and medium roots; common very fine and fine tubular pores; 10 percent gravel; strongly calcareous; moderately alkaline; clear wavy boundary.

C2ca-21 to 29 inches; light gray (10YR 7/2) sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; few very fine and fine roots; few very fine and fine tubular pores; strongly calcareous; moderately alkaline; abrupt wavy boundary.

IIC3-29 to 60 inches; sand and gravel.

The profile is 20 to 40 inches deep over sand and gravel. The A horizon is brown, pale brown; light brownish gray, or light gray. It has weak platy or granular structure and is slightly calcareous or moderately calcar eous. The C horizon is moderately calcareous or strongly calcareous and moderately alkaline or strongly alkaline. The IIC horizon is 45 to 65 percent gravel.

Malm series

The Malm series consists of moderately deep, well drained soils on basalt plains. These soils formed in wind-laid sandy material. Slope is 1 to 20 percent.

Typical pedon of a Malm extremely stony sandy loam in an area of Malm-Rock outcrop complex, about 2 miles north and 3 miles east of Monteview; 225 feet north and 250 feet east of the center of sec. 20, T. 8 N., R. 34 E.:

A1-0 to 4 inches; brown (10YR 5/3) extremely stony sandy loam, dark brown (10YR 4/3) moist; weak medium platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular pores; 20 percent rock

fragments; moderately calcareous; strongly alkaline; clear wavy boundary.

C1-4 to 12 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular pores; strongly calcareous; strongly alkaline; clear wavy boundary.

C2ca-12 to 24 inches;. white (10YR 8/2) sandy loam, light gray (10YR 7/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; many very fine and fine tubular pores; 10 percent basalt fragments; strongly calcareous; strongly alkaline; abrupt wavy boundary.

IIR-24 inches; basalt.

The profile is 20 to 40 inches deep to bedrock. The substratum contains as much as 15 percent cicada krotovinas. The A horizon is grayish brown, brown, light brownish gray, or pale brown. It is mildly alkaline or moderately alkaline. Some pedons have a weakly expressed B horizon.

Market series

The Market series consists of very deep, well drained soils on old lakebeds. These soils formed in lacustrine clay derived from mixed sources. Slope is 0 to 1 percent. Typical pedon of Market clay, about 5 miles north and 1 mile west of Roberts; 0.1 mile northwest of the south east corner of sec. 36, T. 6 N., R. 36 E.:

Ap-0 to 8 inches; gray (2.5Y 6/0) clay, dark gray (10YR 4/1) moist; strong fine granular structure; extremely hard, extremely firm, very sticky and very plastic; few very fine and fine roots; many very. fine and fine interstitial pores; mildly alkaline; abrupt smooth boundary.

C1-8 to 28 inches; gray (2.5Y 6/0) clay, gray (10YR 5/1) moist; weak medium and thick platy structure parting to moderate fine and medium angular blocky; extremely hard, extremely firm, very sticky and very plastic; few very fine and fine roots; common very fine and fine tubular pores; mildly alkaline; abrupt irregular boundary.

C2-28 to 48 inches; light gray (5Y 7/2) silty clay loam, olive gray (5Y 5/2) moist; moderate thin platy structure parting to moderate fine granular; hard, friable, very sticky and plastic; few very fine and fine roots; many very fine and fine tubular pores; slightly calcareous in 40 percent of matrix; moderately alkaline; abrupt wavy boundary.

IIC3-48 to 54 inches; light gray (10YR 7/1) silt, dark gray (2.5Y 4/0) moist; massive; slightly hard, very friable; few very fine and fine roots; many very fine and fine tubular pores; moderately alkaline; abrupt broken boundary.

IIIC4-54 to 60 inches; light gray (10YR 7/1) silty clay, dark grayish brown (10YR 4/2) moist; common fine prominent mottles; strong thin platy structure parting to moderate very fine angular blocky; hard, firm, very sticky and plastic; few very fine and fine roots; moderately alkaline.

The A horizon is gray, light gray, or light brownish gray. It is noncalcareous or slightly calcareous and is mildly alkaline or moderately alkaline. The IIC horizon is apparently volcanic ash, is discontinuous, and is not present in all places.

Matheson series

The Matheson series consists of very deep, well drained soils on basalt plains. These soils formed in alluvial and wind-laid sandy deposits derived from mixed sources. Slope is 0 to 12 percent.

Typical pedon of Matheson sandy loam, 0 to 2 percent slopes, about 4 miles north and 2 miles west of Monteview; 200 feet east and 60 feet south of the northwest corner of sec. 15, T. 8 N., R. 33 E.:

Ap-0 to 10 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; hard, firm; few very fine, fine, medium, and coarse roots; moderately calcareous; moderately alkaline; abrupt smooth boundary.

C1ca-10 to 24 inches; light brownish gray (10YR 6/2) sandy loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm, slightly plastic; few very fine, fine, medium, and coarse roots; common very fine and fine tubular pores; strongly calcareous; weakly cemented; moderately alkaline; clear broken boundary.

C2ca-24 to 41 inches; light gray (10YR 7/2) sandy loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, very friable; few very fine, fine, and medium roots; common very fine and fine tubular pores; strongly calcareous; moderately alkaline; gradual wavy boundary.

C3ca-41 to 57 inches; light gray (10YR 7/2) sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable; few very fine and fine roots; common very fine and fine tubular pores; strongly calcareous; moderately alkaline; gradual wavy boundary.

C4ca-57 to 60 inches; light gray (10YR 7/2) sandy loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, very friable; few very fine and fine roots; common very fine and fine tubular pores; strongly calcareous; moderately alkaline.

The profile is 40 inches to more than 60 inches deep over sand and gravel, basalt, or cinders. It is as much as

5 percent cinders and basalt rock fragments. The A horizon is light brownish gray, pale brown, or light gray. It is slightly calcareous or moderately calcareous and is mildly alkaline or moderately alkaline. A B horizon is present in places. The C horizon is weakly cemented in some pedons.

Mathon series

The Mathon series consists of very deep, well drained soils on basalt plains. These soils formed in sandy wind-laid deposits. Slope is 2 to 20 percent.

Typical pedon of Mathon loamy sand in an area of Mathon-Rock outcrop complex, 450 feet south and 150 feet east of the north quarter corner of sec. 34, T. 7 N., R. 37 E.:

A1-0 to 5 inches; brown (10YR 5/3) loamy sand, very dark grayish brown (10YR 3/2) moist; single grain; loose when dry and moist; many very fine and fine roots; mildly alkaline; clear wavy boundary.

B2-5 to 25 inches; brown (10YR 5/3) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; common very fine and fine roots; many very fine tubular pores; moderately alkaline; clear wavy boundary.

C1ca-25 to 37 inches; very pale brown (10YR 7/3) sandy loam, grayish brown (10YR 5/2) moist; moderate fine and medium subangular blocky structure; hard, very friable, slightly plastic; many very fine tubular pores; strongly calcareous; common veins and splotches of lime; moderately alkaline; clear wavy boundary.

C2ca-37 to 62 inches; pale brown (10YR 6/3) sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, slightly plastic; few very fine roots; many very fine tubular pores; occasional basalt pebbles and cobbles; strongly calcareous; moderately alkaline; abrupt smooth boundary.

IIR-62 inches; basalt.

Bedrock is at a depth of 40 inches to more than 60 inches. The A and B horizons are brown or yellowish brown. The organic matter content of the upper 5 inches ranges from 1 to 2 percent. The Cca horizon contains as much as 10 percent very hard or hard cylindrical cicada krotovinas. It is moderately alkaline or strongly alkaline.

Medano series

The Medano series consists of very deep, very poorly drained soils on old lakebeds. These soils formed in alluvium and lake-laid sediment derived from mixed sources. Slope is 0 to 2 percent.

Typical pedon of Medano sandy loam in an area of Medano complex, 370 feet west and 100 feet south of the northeast corner of sec. 8, T. 7 N., R. 36 E.:

O1-2 to 0 inches; root mat; slightly calcareous.

A11-0 to 6 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/1) moist; moderate medium and fine granular structure; soft, very friable; many very fine, fine, medium, and coarse roots; slightly calcareous; strongly alkaline; clear smooth boundary.

A12-6 to 11 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; common fine distinct olive (5Y 4/4) mottles; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots, and few very coarse roots; moderately calcareous; moderately alkaline; clear smooth boundary.

A13-11 to 16 inches; dark grayish brown (10YR 4/2) sandy loam, dark grayish brown (10YR 3/2) moist; common medium distinct yellowish brown (10YR 5/6) mottles; massive; soft, very friable; common very fine, fine, medium, and coarse roots and few very coarse roots; moderately alkaline; clear smooth boundary.

C1-16 to 24 inches; brown (10YR 5/3) coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose dry and moist; few very fine, fine, medium, coarse, and very coarse roots; about 10 percent pebbles; moderately alkaline; clear smooth boundary.

C2-24 to 43 inches; gray (10YR 6/1) gravelly coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose dry and moist; few fine, medium, and coarse roots; moderately alkaline; clear wavy boundary.

C3-43 to 60 inches; gray (10YR 6/1) sand, dark gray (10YR 4/1) moist; single grain; loose dry and moist; moderately alkaline.

The root mat is not present in all pedons. Some profiles are as much as 10 percent pebbles.

Minnewaukan series

The Minnewaukan series consists of very deep, poorly drained soils on river terraces. These soils formed in alluvium derived from mixed sources. Slope is 0 to 1 percent.

Typical pedon of a Minnewaukan coarse sandy loam in an area of Minnewaukan soils, about 1 mile north and 1 1/2 miles west of Roberts; about 200 feet west and 25 feet north of the south quarter corner of sec. 19, T. 5 N., R. 37 E.:

O1-2 inches to 0; light olive gray (5Y 6/2) root mat, olive (5Y 4/3) moist; 60 percent live roots, 40 percent silt loam soil material.

A11-0 to 5 inches; light brownish gray (2.5Y 6/2) coarse sandy loam, black (2.5Y 2/0) moist; single grain; loose, dry and moist; many fine and medium

roots and common very fine and coarse roots; many very fine and fine interstitial pores; slightly calcareous; moderately alkaline; abrupt smooth boundary.

A12-5 to 8 inches; light brownish gray (2.5Y 6/2) loamy coarse sand, black (2.5Y 2/0) moist; single grain; loose, dry and moist, many fine and medium roots and common very fine and coarse roots; many very fine, fine, and medium interstitial pores; slightly calcareous; moderately alkaline; clear wavy boundary.

C1-8 to 13 inches; light brownish gray (2.5Y 6/2) loamy coarse sand, black (2.5Y 3/0) moist; many large prominent mottles; single grain; loose, dry and moist; many fine and medium roots and common very fine and coarse roots; many very fine, fine, and medium interstitial pores; moderately alkaline; clear wavy boundary.

C2-13 to 60 inches; gray (2.5Y 5/0) coarse sand, black (2.5Y 2/0) moist, common large prominent mottles; single grain; loose, dry and moist; moderately alkaline.

The A horizon is gray, light gray, light brownish gray, pale brown, or very pale brown. Between depths of 10 and 40 inches the profile is loamy sand or sand. Depth to mottles ranges from 0 to 8 inches.

Modkin series

The Modkin series consists of moderately deep, well drained soils on basalt plains. These soils formed in wind-laid sandy material derived from mixed sources. Slope is 0 to 30 percent.

Typical pedon of Modkin extremely stony sandy loam in an area of Modkin-Rock outcrop complex, about 6 miles south and 6 miles east of Hamer; about 200 feet north-northwest of the southeast corner of sec. 14, T. 6 N., R. 37 E.:

A11-0 to 2 inches; brown (10YR 5/3) extremely stony sandy loam, very dark grayish brown (10YR 3/2) moist; weak thin platy structure parting to weak fine granular; soft, very friable; many very fine, fine, and medium roots; many very fine and fine interstitial pores; 25 percent very dark gray basalt rock fragments; neutral; clear wavy boundary.

A12-2 to 6 inches; brown (10YR 5/3) extremely stony sandy loam, dark brown (10YR 3/3) moist; weak thick platy structure parting to weak fine and medium subangular blocky; slightly hard, friable; many very fine, fine, and medium roots; common very fine and fine tubular pores; 25 percent very dark gray basalt rock fragments; mildly alkaline; clear wavy boundary.

B21-6 to 20 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few very fine, fine, and medium roots; many very fine and fine tubular pores; 25 percent very dark gray basalt pebbles; moderately alkaline; clear wavy boundary.

B22-20 to 28 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few very fine, fine and medium roots; many very fine and fine tubular pores; moderately alkaline; clear wavy boundary.

Cca-28 to 32 inches; white (10YR 8/2) sandy loam, light brownish gray (10YR 6/2) moist; massive; hard, friable; few very fine and fine roots; 10 percent basalt gravel; strongly calcareous; moderately alkaline; abrupt wavy boundary.

IIRca-32 inches; basalt; lime in cracks and pores.

The profile is 20 to 40 inches deep over bedrock. The A horizon is grayish brown, brown, light brownish gray, or pale brown. It is neutral or mildly alkaline. The B horizon is sandy loam or fine sandy loam and is gravelly in some pedons. It has weak or moderate, fine or medium, angular blocky, subangular blocky, or prismatic structure. The C horizon is sandy loam or fine sandy loam, and in some pedons it contains 5 to 15 percent cicada krotovinas.

Montlid series

The Montlid series consists of very deep, moderately well drained soils on old lakebeds. These soils formed in lacustrine material derived from mixed sources. Slope is 0 to 1 percent.

Typical pedon of Montlid silty clay loam, about 4 miles north of Monteview; 60 feet north and 100 feet east of the southwest corner of sec. 12, T. 8 N., R. 33 E.:

Ap-0 to 8 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; strong medium and thick platy structure; hard, friable, sticky and plastic; many very fine and fine roots; moderately calcareous; moderately alkaline; abrupt smooth boundary.

C1-8 to 18 inches; variable light gray (10YR 7/2) and gray (10YR 5/1) silty clay loam, brown (10YR 5/3) moist; strong medium platy structure; slightly hard, friable, very sticky and plastic; common very fine and fine roots; few very fine and fine pores; strongly calcareous; moderately alkaline; clear wavy boundary.

C2-18 to 34 inches; light gray (10YR 7/1) silty clay loam, grayish brown (10YR 5/2) moist; weak fine prismatic structure parting to weak thin platy; slightly hard, firm, very sticky and plastic; common very fine and fine roots; few very fine pores; strongly calcareous; moderately alkaline; clear wavy boundary.

C3-34 to 52 inches; gray (10YR 6/1) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; slightly hard, firm, very sticky and very plastic; few very fine and fine roots; common

very fine pores; moderately calcareous; moderately alkaline; clear wavy boundary.

C4-52 to 60 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; few fine faint dark yellowish brown (10YR 4/4) mottles; massive; hard, firm, sticky and plastic; moderately calcareous; moderately alkaline.

The water table is at a depth of 2 to 5 feet. The profile is moderately calcareous or strongly calcareous. Between depths of 10 and 40 inches the profile is silt loam or silty clay loam. The profile is slightly or moderately saline or alkali affected. The A horizon is very pale brown, light brownish gray, or light gray.

Paesl series

The Paesl series consists of very deep, well drained soils on river terraces. These soils formed in alluvium derived from mixed sources. They are moderately deep over sand and gravel. Slope is 0 to 1 percent.

Typical pedon of Paesl loam, about 3 miles south and 4 miles east of Rigby; 1,150 feet south and 1,370 feet east of the center of sec. 34, T. 4 N., R. 39 E.:

Ap-0 to 8 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; slightly calcareous; moderately alkaline; abrupt smooth boundary.

B2-8 to 13 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium and coarse roots; slightly calcareous; moderately alkaline; clear smooth boundary.

C1ca-13 to 18 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; strongly calcareous; moderately alkaline; clear smooth boundary.

C2ca-18 to 27 inches; light gray (10YR 7/1) silt loam, light brownish gray (10YR 6/2) moist; moderate medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; strongly calcareous; moderately alkaline; clear smooth boundary.

C3ca-27 to 34 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline; abrupt smooth boundary.

IIC4-34 to 60 inches; sand and gravel; 15 percent cobbles.

Sand and gravel are at a depth of 20 to 40 inches. The profile is noncalcareous through the B horizon in many pedons. It is mildly alkaline or moderately alkaline. The A horizon is brown or dark brown. The B horizon is loam or silt loam. The C horizon in some pedons is sandy loam that is less than 5 inches thick over sand and gravel.

Pancheri series

The Pancheri series consists of very deep, well drained soils on basalt plains. These soils formed in wind-laid silty material derived from mixed sources. Slope is 0 to 30 percent.

Typical pedon of Pancheri silt loam, 2 to 4 percent slopes, about 6 miles south and 2 miles west of Roberts; 50 feet north and 35 feet west of the southeast corner of sec. 35, T. 4 N., R. 36 E.:

Ap-0 to 8 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse granular structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular pores; slightly calcareous; strongly alkaline; abrupt smooth boundary.

C1ca-8 to 15 inches; pale brown (10YR 6/3) silt loam, grayish brown (10YR 5/2) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular pores; 20 percent cicada krotovinas 3/4 inch by 1 inch; 5 percent faint veins and splotches of lime; strongly calcareous; strongly alkaline; clear wavy boundary.

C2ca-15 to 22 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; strong medium and fine subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular pores; about 60 percent cicada krotovinas 3/4 inch by 1 inch; 10 percent distinct veins and splotches of lime; strongly calcareous; strongly alkaline; clear wavy boundary.

C3ca-22 to 35 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; moderate medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular pores; about 60 percent cicada krotovinas; 10 percent faint veins of lime; moderately calcareous; strongly alkaline; clear wavy boundary.

C4-35 to 60 inches; very pale brown (10YR 7/3) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular pores; moderately calcareous; strongly alkaline.

Depth to basalt is more than 60 inches. Pedons near areas of Rock outcrop have 0 to 15 percent basalt, stones, cobbles, or gravel on the surface. The A horizon is pale brown, light brownish gray, very pale brown, or light gray. It is slightly calcareous or moderately calcareous. Some pedons have a weak B horizon that has moderate, fine or medium, angular or subangular blocky structure. In most pedons the C horizon is massive or has subangular blocky structure, and it has cylindrical nodules associated with cicada nymph burrowing.

Psammaquents

Psammaquents consist of very deep, sandy, very poorly drained soils on old lakebeds covered with alluvial outwash. They are marsh areas and are inundated most of the time between May and October. The vegetation is mostly cattails and other water-tolerant plants.

Reference pedon of Psammaquents in an area of Medano-Psammaquents complex, 50 feet north of the center of sec. 24, T. 7 N., R. 35 E.:

A1g-0 to 12 inches; greenish gray (5GY 6/1) loamy sand, greenish gray (5GY 5/1) moist; single grain; loose, dry and moist; strongly alkaline; clear wavy boundary.

C1g-12 to 25 inches; gray (5Y 6/1) sand, gray (5Y 5/1) moist; single grain; loose, dry and moist; strongly alkaline; clear wavy boundary.

C2g-25 to 60 inches; gray (5Y 6/1) sand, gray (5Y 5/1) moist; single grain; loose, dry and moist; strongly alkaline.

Typically, a mat of roots and plant parts 2 to 4 inches thick covers the surface. The profile is stratified sand and loamy sand to a depth of 60 inches or more. Some pedons have thin layers of silty clay below a depth of 40 inches.

Rexburg series

The Rexburg series consists of very deep, well drained soils on loess plains. These soils formed in wind-laid silty material derived from mixed sources. Slope is 4 to 60 percent.

Typical pedon of Rexburg silt loam, 4 to 8 percent slopes, about 1 mile north and 1 mile west of Kelly Canyon Ski Resort; 300 feet south and 225 feet east of the northwest corner of sec. 29, T. 4 N., R. 41 E.:

A1-0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, very friable; many very fine and fine roots and common medium roots; many very fine and fine interstitial pores; 10 percent pockets of slightly calcareous material introduced by rodent activity; mildly alkaline; clear wavy boundary.

B2-8 to 19 inches; brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure; slightly hard, very friable; common very fine and fine roots and few medium roots; many very fine and fine tubular pores; 10 percent pockets of slightly calcareous material introduced by rodent activity; mildly alkaline; clear wavy boundary.

C2ca-19 to 24 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; strong fine subangular blocky structure; very hard, firm, slightly plastic; few very fine and fine roots; many very fine. and fine tubular pores; 25 percent cicada krotovinas; 20 percent fine faint veins of lime; strongly calcareous; mildly alkaline; clear wavy boundary.

C3ca-24 to 40 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; hard, friable, slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; about 15 percent cicada krotovinas; 20 percent fine faint veins of lime; strongly calcareous; mildly alkaline; clear wavy boundary.

C4ca-40 to 60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; .slightly hard, very friable, slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; 5 percent fine faint veins of lime; strongly calcareous; mildly alkaline.

Depth to rhyolite is 60 inches or more. The A horizon is, brown or grayish brown. It is noncalcareous and is mildly alkaline or moderately alkaline. The upper part, between depths of 0 and 4 inches, generally has weak, very thin, platy structure. The B horizon, where present, is noncalcareous or slightly calcareous and is mildly alkaline or moderately alkaline. Depth to the calcic horizon is 18 to 25 inches.

Terreton series

The Terreton series consists of very deep, well drained soils on old lakebeds. These soils formed in lacustrine material derived from mixed sources. Slope is 0 to 4 percent.

Typical pedon of Terreton silty clay loam, about 4 miles east and 2 miles north of Terreton; 528 feet east of the southwest corner of sec. 3, T. 6 N., R. 33 E.:

Ap-0 to 6 inches; light brownish gray (10YR 6/2) silty clay loam, olive brown (2.5Y 4/3) moist; very weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many very fine roots and few fine and medium roots; common very fine and fine tubular pores; moderately calcareous; moderately alkaline; abrupt smooth boundary.

C1-6 to 10 inches; light brownish gray (10YR 6/2) clay, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to weak medium and fine

subangular blocky; hard, friable, sticky and plastic; common very fine roots and few fine and medium roots; many very fine and fine tubular pores; few veins and splotches of lime in lower part; strongly calcareous; moderately alkaline; clear smooth boundary.

C2-10 to 31 inches; light gray (10YR 6/1) clay, light olive brown (2.5Y 5/3) moist; platy structure parting to weak medium and fine subangular blocky; hard, firm, sticky and plastic; common very fine and few fine roots; many dead roots between peds; many very fine and fine tubular pores; common veins and splotches of lime; strongly calcareous; moderately alkaline; gradual smooth boundary.

C3-31 to 51 inches; light brownish gray (2.5Y 6/2) silty clay loam, light olive brown (2.5Y 5/3) moist; common very fine mottles and few fine faint brown (10YR 5/3) mottles; massive; hard, firm, sticky and plastic; common very fine roots and few fine roots; many very fine and fine tubular pores; strongly calcareous; moderately alkaline; gradual smooth boundary.

C4-51 to 60 inches; light gray (2.5Y 7/2) clay with spots of gray (N 6/0), light olive brown (2.5Y 5/3) moist; massive; hard, firm, sticky and very plastic; 1- to 3-inch-thick lenses of sandy loam and loam that are gray (10YR 5/1) and grayish brown (2.5Y 5/2) moist; strongly calcareous; moderately alkaline.

The A horizon is pale brown, light brownish gray, light gray, or very pale brown. The upper 0 to 2 inches in many pedons has moderate thin platy structure. The lower part of the profile is commonly stratified. Mottles are not present in all pedons.

Wardboro series

The Wardboro series consists of very deep, somewhat excessively drained soils on river terraces. These soils formed in alluvium derived from mixed sources. Slope is 0 to 1 percent.

Typical pedon of Wardboro sandy loam, about 2 miles east and 1 1/2 miles north of Rigby; 840 feet west and 730 feet north of the east quarter corner of sec. 9, T. 4 N., R. 39 E.:

A1-0 to 2 inches; light brownish gray (10YR 6/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; slightly calcareous; moderately alkaline; clear smooth boundary.

C1-2 to 5 inches; light gray (10YR 7/2) very gravelly sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable; common very fine, fine, and medium roots; many very fine and fine interstitial pores; 40 percent pebbles and 5 percent cobbles; slightly calcareous; moderately alkaline; clear wavy boundary.

C2-5 to 12 inches; pale brown (10YR 6/3) very gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; few medium and coarse roots; many very fine and fine interstitial pores; 50 percent pebbles and 5 percent cobbles; slightly calcareous; moderately alkaline; clear wavy boundary.

C3-12 to 60 inches; very gravelly sand that includes 15 percent cobbles.

Depth to very gravelly sand is 10 to 20 inches. The A horizon is pale brown, brown, or light brownish gray. The C horizon is as much as 80 percent gravel and 15 percent cobbles. There is generally no accumulation of lime, but many pedons have lime coats on pebbles.

Whiteknob series

The Whiteknob series consists of very deep, well drained soils on alluvial fans. These soils formed in allu vium derived from mixed sources. Slope is 0 to 1percent. .

Typical pedon of Whiteknob gravelly loam, 140 feet south and 60 feet east of the highway across the road from milepost 28 on Highway 28, northwest of Terreton; 480 feet south and 590 feet east of the west quarter corner of sec. 3, T. 7 N., R. 32 E.:

A1-0 to 5 inches; very pale brown (10YR 7/3) gravelly loam, dark brown (10YR 4/3) moist; weak medium platy structure parting to moderate fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine, fine, and medium tubular pores; slightly calcareous; moderately alkaline; clear smooth boundary.

C1-5 to 9 inches; very pale brown (10YR 7/3) gravelly loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; common very fine and fine tubular pores; moderately calcareous; moderately alkaline; clear smooth boundary.

C2-9 to 14 inches; very pale brown (10YR 7/3) gravelly loam, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; common very fine and fine tubular pores; moderately calcareous; moderately alkaline; abrupt smooth boundary.

C3ca-14 to 20 inches; very pale brown (10YR 8/3) very gravelly sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; common very fine and fine roots; common very fine and fine tubular pores; strongly calcareous; moderately alkaline; abrupt smooth boundary.

IIC4-20 to 60 inches; very gravelly sand; common very fine and fine roots; moderately calcareous.

Depth to very gravelly sand is 10 to 25 inches. Depth to the calcic horizon is 10 to 15 inches. The A horizon is pale brown or very pale brown.

Wolverine series

The Wolverine series consists of very deep, excessively drained soils on old lakebeds and river terraces. These soils formed in wind-laid and alluvial sands derived from mixed sources. Slope is 0 to 30 percent.

Typical pedon of Wolverine sand, 0 to 30 percent slopes, about 2 3/4 miles north of Roberts on the old highway to the Market Lake State Wildlife Management Area; 1,070 feet west of the center of sec. 17, T. 5 N., R. 37 E.:

A1-0 to 6 inches; light brownish gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose dry and moist; many very fine and fine roots and few medium and coarse roots; many very fine, fine, and medium interstitial pores; mildly alkaline; clear wavy boundary.

C1-6 to 17 inches; light brownish gray (10YR 6/2) loamy coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose dry and moist; few very fine, fine, medium, and coarse roots; many very fine, fine, and medium interstitial pores; mildly alkaline; clear wavy boundary.

C2-17 to 30 inches; variably colored but primarily dark gray (7.5YR 4/0) coarse sand in upper part grading to sand, black (7.5YR 2/0) moist; single grain; loose dry and moist; few very fine, fine, medium, and coarse roots; many very fine, fine, and medium interstitial pores; mildly alkaline; clear irregular boundary.

IIC3-30 to 60 inches; light gray (10YR 7/2) fine sand, variable colors that average very dark gray (10YR 3/2) moist; common fine distinct mottles; single grain; loose dry and moist; few very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; mildly alkaline.

The profile is noncalcareous or slightly calcareous and mildly alkaline or moderately alkaline. Many pedons have mottles because of a relict water table. The A horizon is gray, light gray, or light brownish gray.

Xeric Torrifluvents

Xeric Torrifluvents are very deep, well drained gravelly soils on river terraces. These soils formed in alluvium derived from mixed sources. Slope is 0 to 1 percent.

Reference pedon of Xeric Torrifluvents, 150 feet south of the north quarter corner of sec. 29, T. 4 N., R. 39 E.:

A11-0 to 2 inches; light brownish gray (10YR 6/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable; many fine roots; mildly alkaline; abrupt smooth boundary.

A12-2 to 9 inches; pale brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 3/3) moist; weak fine and very fine subangular blocky structure; slightly hard, friable; many fine roots; flat pebbles have thin spotty accumulation of lime on underside; mildly alkaline; abrupt wavy boundary.

C1-9 to 18 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable; common fine roots; flat pebbles have spotty accumulation of lime on underside; mildly alkaline; clear wavy boundary.

C2ca-18 to 60 inches; pale brown (10YR 6/3) sand and gravel; slightly calcareous; pebbles have thick coating of lime on underside; mildly alkaline.

The A horizon is loamy sand, sandy loam, or loam and is gravelly, very gravelly, cobbly, or very cobbly. It is light brownish gray or pale brown.

Zwiefel series

The Zwiefel series consists of very deep, well drained soils on old lakebeds. These soils formed in lacustrine sediment and wind-laid sand derived from mixed sources. Slope is 0 to 20 percent.

Typical pedon of Zwiefel fine sand, 0 to 2 percent slopes, about 4 miles east and 2 miles south of Terreton; 350 feet south and 195 feet east of the northwest corner of sec. 28, T. 6 N., R. 35 E.:

A1-0 to 3 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose dry and moist; many very fine and fine roots; many very fine and fine interstitial pores; moderately calcareous; moderately alkaline; abrupt wavy boundary.

C1-3 to 13 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; many very fine and fine roots; few very fine and fine tubular pores; strongly calcareous; moderately alkaline; clear wavy boundary.

C2-13 to 21 inches; grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; single grain; loose dry and moist; few very fine and fine roots; many very fine and fine interstitial pores; slightly calcareous; moderately alkaline; clear wavy boundary.

IIC3-21 to 28 inches; light brownish gray (2.5Y 6/2) sandy clay, grayish brown (2.5Y 5/2) moist; weak thin platy structure; very hard, firm, very sticky and very plastic; few very fine and fine roots; many very fine and fine tubular pores; strongly calcareous; moderately alkaline; clear wavy boundary.

IIC4ca-28 to 36 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate

thin platy structure parting to moderate very fine angular blocks; very hard, firm, very sticky and very plastic; few very fine and fine roots; many very fine and fine tubular pores; 15 percent fine splotches of lime; strongly calcareous; strongly alkaline; gradual wavy boundary.

IIC5ca-36 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; strong thin platy structure parting to strong very fine angular blocks; very hard, firm, very sticky and very plastic; few very fine and fine roots; many very fine and fine tubular pores; 15 percent fine splotches of lime; strongly calcareous; strongly alkaline.

Depth to lake sediment is 15 to 30 inches. The A horizon is brown, grayish brown, light brownish gray, or pale brown. It is noncalcareous to moderately calcareous.

Classification

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (6).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 16, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in sol. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (Agu, meaning water, plus ent, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identifed by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquents (*Hapl*, meaning simple horizons, plus *aquent,* the suborder of Entisols that has an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective Typic identifies the subgroup that is thought to typify the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed,, nonacid, mesic, Typic Haplaquents.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

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(3) Critchfield, Howard J. 1966. General climatology. Ed. Prentice-Hall, Inc., Englewood Cliffs, N.J., pp.192-95.

(4) Idaho Conservation Needs Inventory Committee. 1971. Idaho Soil and Water Conservation Needs Inventory. 1967. 187 pp., illus.

(5) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. (Supplements replacing pp. 173-188 issued May 1962)

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Glossary

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. A body of alluvium, with or without debris flow deposits, whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley onto a plain.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as-

	Inches
Low	Less than 4 inches
Moderate	4 to 7
High	7 to 11
Very high	More than 11

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diamater.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. The ratings used in this survey are as follows: slightly calcareous-1 to 3 percent calcium carbonate equivalent; moderately calcareous3 to 15 percent; strongly calcareous-15 to 30 percent; very strongly calcareous-more than 30 percent.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Cement rock. (Local) Shaly limestone used in the manufacture of cement.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

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.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are-

Loose.-Noncoherent when dry or moist; does not hold together in a mass.

Friable.-When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.-When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.-When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.-When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.-When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.-When dry, breaks into powder or individual grains under very slight pressure.

Cemented.-Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

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 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.-Water is removed from the soil very rapidly. Excessively drained soils are com monly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.-Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well *drained.*-Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.-Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.-Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artifi-

cial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.-Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.-Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

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.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as very *brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; No*vember-May,* for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

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.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O *horizon.*-An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.-The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.-A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.-The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.-The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.-Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface.

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.

Krotovinas. Irregular tubular streaks within one horizon of material transported from another horizon. These streaks are caused by filling of channels made by insects or other burrowing animals.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

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. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) *soil*. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor

aeration and impeded drainage. Descriptive terms are as follows: abundance-*few, common*, and *many*, size-*fine, medium*, and *coarse*; and contrast-*faint*, *distinct, and prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables-hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan*, and *traffic pan.*

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

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. The slow movement of water through the soil adversely affecting the specified use.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipe-like cavities in the soil.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are-excellent, good, fair, and poor. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as-

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

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. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

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.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by

100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow Intake. The slow movement of water into the soil.

Soil. A natural, three-dimensional body at the earth's surface that 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.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are platy (laminated), pris*matic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), blocky (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface soil. 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."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil: The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam,* clay *loam, silty* clay *loam, sandy clay, silty clay,* and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water. Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

ILLUSTRATIONS

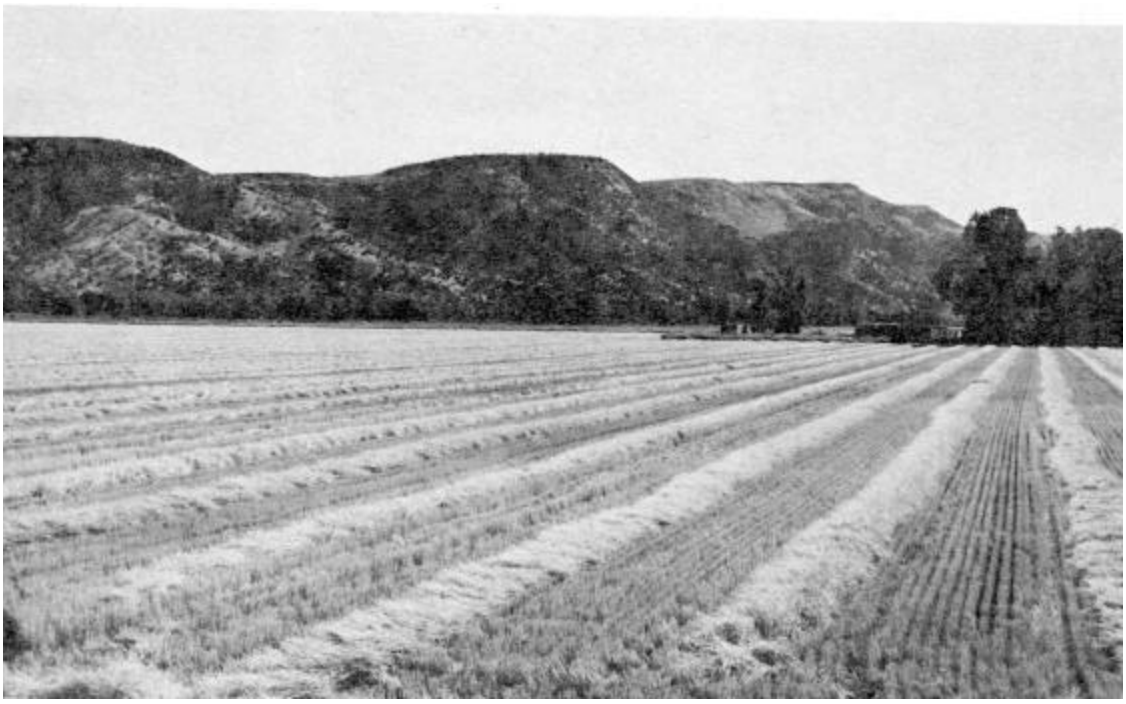

Figure 1.-Wheat in an area of Blackfoot silt loam, drained, in foreground. Hayeston and Heiseton soils are near trees in background. Rexburg-Rock outcrop complex and Rock outcrop-Rexburg complex are on mountain in background.

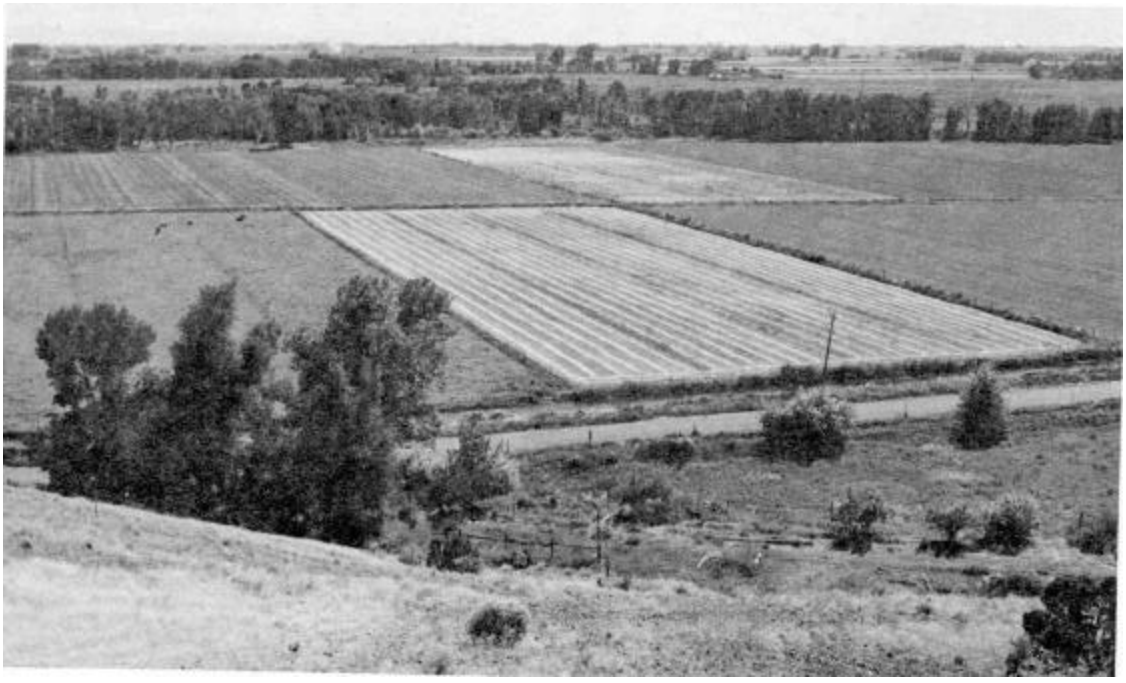

Figure 2.-Typical area of Jefferson County. Annis silty clay loam, in background, is used for irrigated crops; Grassy Butte loamy sand, 2 to 20 percent slopes, in foreground, is used for grazing.

Figure 3.-Sugar beets on Blackfoot silt loam, drained. Siphon tubes are used to take water from the head ditch, thereby reducing erosion of ditchbanks and controlling the application of water.

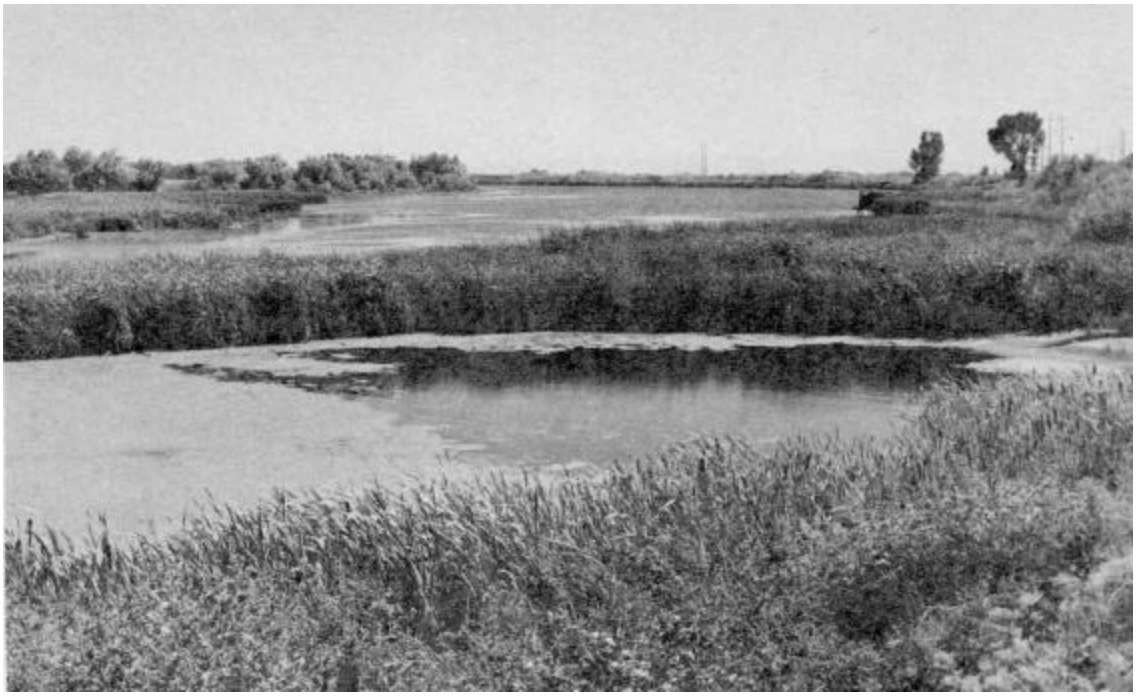

Figure 4.-Area of water and of Fluvaquents, nearly level, on the oxbow near Roberts. Trees in background are on Blackfoot silt loam, drained. The cattails and rushes provide good habitat for waterfowl.

Figure 5.-Area of Grassy Butte loamy sand, 2 to 20 percent slopes, recently converted from range. Irrigation is by sprinklers.

Figure 6.-Area of Rock outcrop-Bondfarm complex Bondfarm soils are on the convex slopes leading up to the outcrop.

Figure 7.-Stand of barley on Terreton silty clay loam.

Figure 8.-Area of Wardboro sandy loam on channeled slopes. The trees are cottonwood.

Figure 9.-Water lift on a canal west of Mud Lake. The soil is Terreton silty clay loam.

Figure 10.-Area of Blackfoot silt loam, drained, in foreground, is in capability class II. Grassy Butte sand, 2 to 20 percent slopes, and Grassy Butte-Rock outcrop complex on hills in background are in class VII.

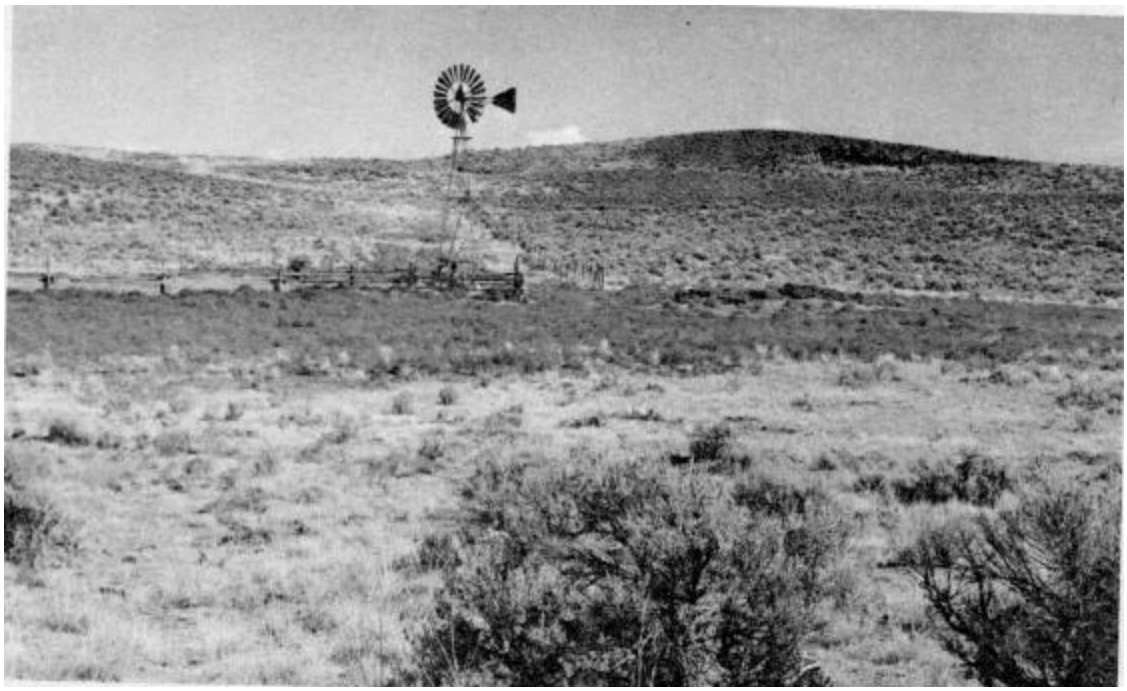

Figure 11.-Area of Grassy Butte-Matheson complex that is subject to heavy use because of the availability of water. Most water for livestock is derived from deep wells.

Figure 12-Area of Stony, 8 to 12 inches precipitation, range site on Modkin-Rock outcrop complex. Bluebunch wheatgrass and big sagebrush are the main kinds of vegetation on this site.

Figure 13.-Area of Sandy, 8 to 12 inches precipitation, range site in good or excellent condition. The soils are in the Grassy Butte-Matheson complex. The dominant grasses are needleandthread and Indian ricegrass. The scattered shrubs are big sagebrush.