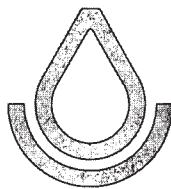


**SOIL SURVEY OF**  
**Bingham Area, Idaho**



**United States Department of Agriculture**  
**Soil Conservation Service**  
In cooperation with  
**University of Idaho**  
**Idaho Agricultural Experiment Station**

**Issued October 1973**

Major fieldwork for this soil survey was done in the period 1956-1965. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1968. This survey was made cooperatively by the Soil Conservation Service and the University of Idaho, Idaho Agricultural Experiment Station. It is part of the technical assistance furnished to the South Bingham, Central Bingham, and North Bingham Soil Conservation Districts, parts of the East Side Soil and Water Conservation District, and parts of the Caribou Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

## HOW TO USE THIS SOIL SURVEY

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

### Locating Soils

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

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

### Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site. The "Guide to Mapping Units" also gives the windbreak suitability group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show

soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

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

*Foresters and others* can refer to the section "Management of the Soils for Woodland," where the soils of the county are grouped according to their suitability for trees.

*Game managers, sportsmen, and others* can find information about soils and wildlife in the section "Management of the Soils for Wildlife."

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

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

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

*Newcomers in the Bingham Area* may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the area given in the section "General Nature of the Area."

**Cover picture:** Hereford cattle grazing irrigated alfalfa-grass pasture. This is an area of Bannock loam, near Pingree.



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# SOIL SURVEY OF BINGHAM AREA, IDAHO

BY RICHARD A. SALZMANN AND JACK O. HARWOOD, SOIL CONSERVATION SERVICE<sup>1</sup>

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNIVERSITY OF IDAHO, IDAHO AGRICULTURAL EXPERIMENT STATION

**T**HE BINGHAM AREA is in the southeastern part of Idaho (fig. 1). It covers most of the privately owned land in Bingham County and parts of Bonneville County. The Area covers 888,343 acres, or about 1,388 square

miles. It has a population of about 28,225 most of which is concentrated in the Snake River Valley. Blackfoot, Shelley, and Aberdeen are the main shopping areas and centers of population.

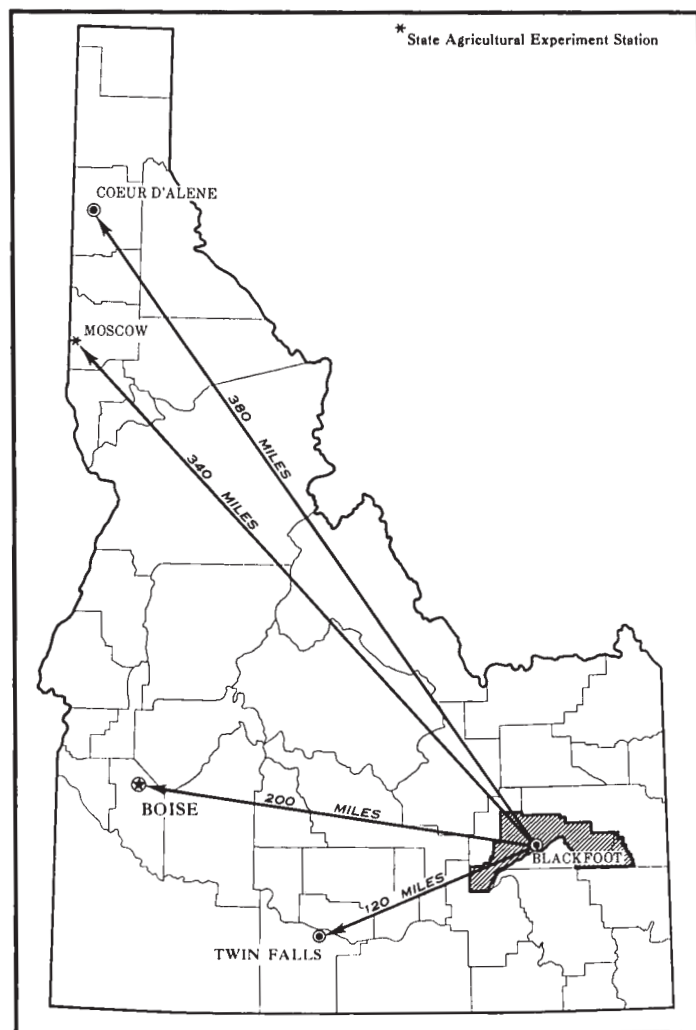


Figure 1.—Location of the Bingham Area in Idaho.

<sup>1</sup> DARWIN THOMPSON, JACK PETERSON, GEORGE STUIT, FRANK DICKSON, MARLOW FRECKLETON, and JACK JIBSON, Soil Conservation Service, assisted in the fieldwork.

## *How This Survey Was Made*

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

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series (7)<sup>2</sup> and the soil phase are the categories of soil classification most used in a local survey.

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

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Ammon silt loam, 2 to 4 percent slopes, is one of several phases within the Ammon series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photo-

<sup>2</sup> Italic numbers in parentheses refer to Literature Cited, p. 122.

graphs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

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

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of the Bingham Area: soil complexes and soil associations.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Polatis-Tenno complex, undulating, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Robin-Swanner association, steep, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Terrace escarpments is a land type in the Bingham Area.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

The kind of use anticipated for soils of the Survey Area determines the amount of detail that is shown on the soil map. In the Bingham Area the soils were mapped at three intensities. Soils suitable for irrigated crops were mapped at high intensity, and slope breaks of 0 to 2, 2 to 4, 4 to 8, 8 to 12, and 12 to 20 percent were used. Soils suitable for dryland cropping were mapped at medium intensity, and slope breaks of 0 to 4, 4 to 12, and 12 to 20 percent were used. The soils used for and mostly suitable only for range, woodland, wildlife habitat, and watershed were mapped at low intensity. Slope breaks of 0 to 30, 30 to 60, and 60 to 80 percent were used.

Where large tracts of soils in the Bingham Area are used under intensive management, the soil scientist drew lines on the map between the kinds of soil having different properties or qualities that are important if the soils are

used intensively. Thus, two soils that have slight differences in percent of slope, salt content, depth, permeability, or some other property are differentiated. These properties influence the kind of irrigation system used, suitability for leveling, crop suitability, water management, or other factors important on irrigated cropland. Such soils were mapped at high intensity. Ammon silt loam, 0 to 2 percent slopes, is an example. Most of the areas mapped at high intensity are in the Snake River Plains part of the Survey Area.

Where irrigation water is not available and natural precipitation is sufficient for dryland cultivated crops, the properties affecting use of the soils are less critical and slope groups are generally broader. In these areas the soils were mapped at medium intensity. Newdale silt loam, 0 to 4 percent slopes, is an example of a mapping unit within the medium-intensity survey. Most of the areas mapped at medium intensity are in the foothills of the Blackfoot Mountains.

Where soils are used only for range or woodland, soil boundaries may encompass more than one named soil (complexes or undifferentiated units) or more than one phase of a named soil. Slight differences in soil properties, such as slope, are less important in areas used for range than in areas used for irrigated crops. In these areas the soils were mapped at low intensity. Sheege-Robin association, hilly (0 to 30 percent slopes), is an example of soils mapped at low intensity.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and range, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

## General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Bingham Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or



for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The nine soil associations in the Bingham Area are discussed in the following pages.

### 1. Bannock-Bock association

*Nearly level to moderately sloping, well-drained, deep, medium-textured soils on alluvial terraces*

This association (fig. 2) is on terraces of the Snake and Blackfoot Rivers, in the central part of the Survey Area. The natural vegetation is mostly sagebrush and bunchgrass.

Elevations range from 4,300 to 4,700 feet. The annual precipitation is 11 to 13 inches, the mean annual temperature is 44° to 48° F., and there are 110 to 130 frost-free days.

This association makes up about 9 percent of the Survey Area. Of this, 30 percent is Bannock soils; 25 percent, Bock soils; 10 percent, Hayeston soils; and 10 percent, Heiseton soils. The remaining 25 percent consists of Blackfoot, Packham, Wardboro, Polatis, and Declo soils.

Bannock and Bock soils are on the older and higher terraces. Bannock soils are nearly level to moderately sloping. They have a surface layer of grayish-brown loam underlain by gravel and sand at a depth of 20 to 40 inches. Bock soils are nearly level to very gently sloping. They have a surface layer of grayish-brown loam and a subsoil of brown loam, underlain by sand and gravel at a depth of more than 40 inches.

Nearly all of the acreage of the major soils is used for irrigated potatoes, sugar beets, wheat, alfalfa, and pasture. Many of the soils of this association are a good source of gravel and sand.

Waterfowl, pheasants, gray partridges, mourning doves, and nongame birds are the main wildlife in the associa-

tion. Ducks and geese nest and feed along the rivers and drainageways and in the fields. Fish are stocked in the larger streams and ponds.

### 2. Declo-Fingal association

*Nearly level to strongly sloping, well drained and moderately well drained, deep, medium-textured and moderately coarse textured soils on lake terraces*

This association (fig. 3) is on a terrace above the Snake River and the American Falls Reservoir, in the southwestern part of the Survey Area. The soils of this association formed in a lacustrine terrace that has shallow, broad drainageways, some of which are wet. The natural vegetation is mostly sagebrush and bunchgrass.

Elevations range from about 4,200 to 4,600 feet. The annual precipitation ranges from 8 to 13 inches. The mean annual temperature is about 45° to 47° F., and there are about 110 to 130 frost-free days.

This association makes up about 7 percent of the Survey Area. Of this, about 80 percent is Declo soils; 10 percent is Fingal soils; and the remaining 10 percent is Fulmer, LaJara, and Paniogue soils.

Declo and Fingal soils are the major soils of the association. Declo soils are nearly level to strongly sloping and well drained. They consist of more than 40 inches of light brownish-gray loam and silt loam over sand and gravel. Fingal soils are nearly level to gently sloping and moderately well drained. They have a gray loam surface layer and a grayish-brown loam and clay loam subsoil that is underlain at a depth of about 22 inches by a light-gray silty clay and silty clay loam substratum.

The well-drained soils of this association are used for irrigated sugar beets, potatoes, alfalfa, and small grain. In areas where salinity is not a problem and drainage is provided, the moderately well drained Fingal soils are used for the same irrigated crops as the well drained soils.

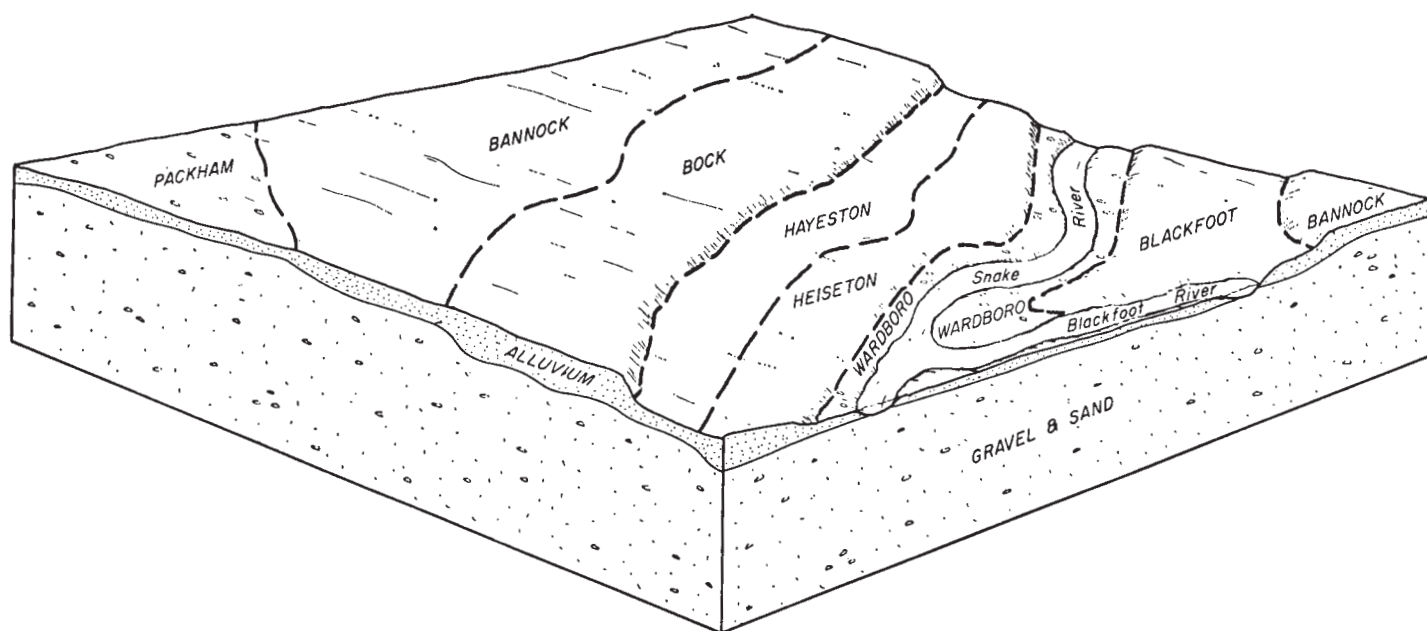


Figure 2.—Representative pattern of soils in association 1.



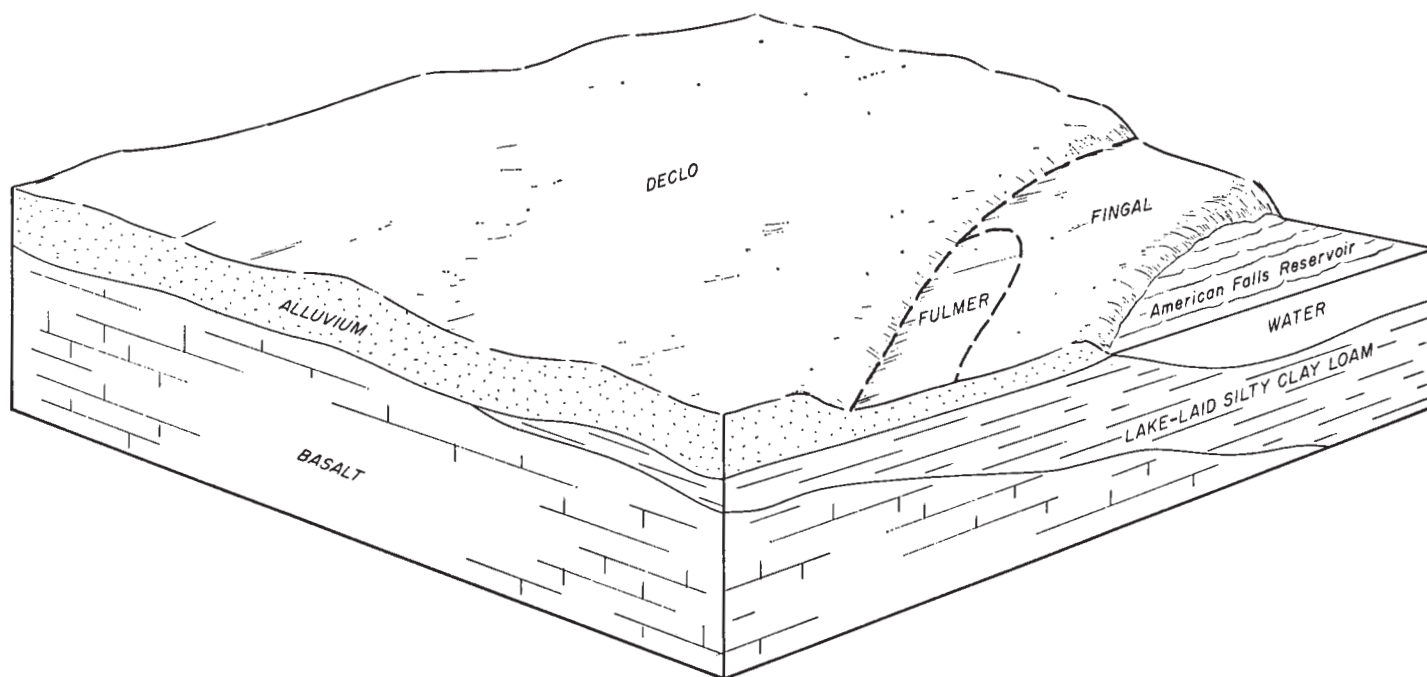


Figure 3.—Representative pattern of soils in association 2.

As salinity increases, the selection of crops is restricted and the strongly saline areas are used mainly for irrigated pasture.

Pheasants, gray partridges, mourning doves, and non-game birds are common in the association. Ducks and geese nest and feed along the streams and drainageways and in the fields. Fish are stocked in the larger streams and ponds.

### 3. *Pancheri-Polatis association*

*Nearly level to moderately sloping, well-drained, deep and moderately deep, medium-textured soils on basalt plains*

This association (fig. 4) is on basalt plains in the western part of the Survey Area. The soils have a poorly defined drainage pattern. They formed mainly in loess, but some soils formed in eolian sands. The natural vege-

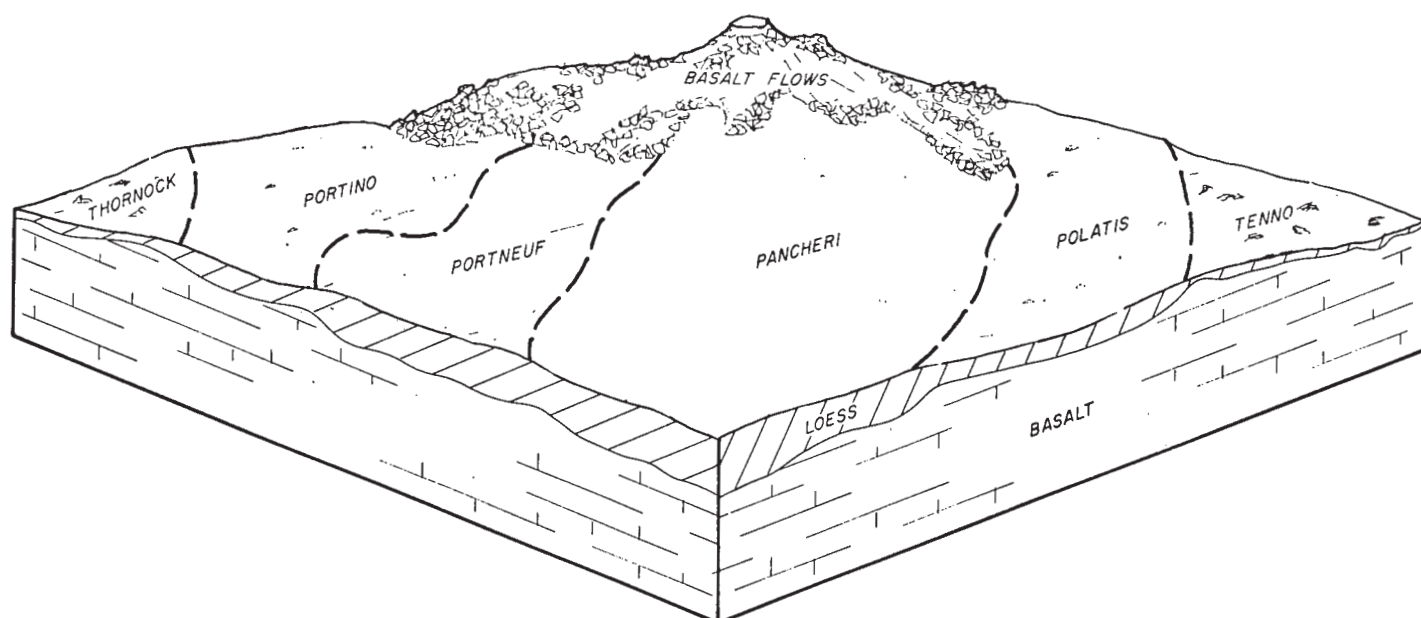


Figure 4.—Representative pattern of soils in association 3.

tation consists mainly of big sagebrush, rabbitbrush, cheatgrass, Sandberg bluegrass, squirreltail, bluebunch wheatgrass, and streambank wheatgrass.

Elevations range from 4,200 to 5,500 feet. The annual precipitation is 8 to 11 inches. The mean annual temperature is 45° to 49° F., and there are 110 to 130 frost-free days.

This association makes up about 39 percent of the Survey Area. Of this, 30 percent is Pancheri soils; 15 percent, Polatis soils; 10 percent, Portino soils; 10 percent, Portneuf soils; and the remaining 35 percent, the miscellaneous land types Lava flows and Lava rock land and soils of the Tenno, Thornock, Kimama, Bondranch, Matheson, and Malm series.

Pancheri and Polatis soils are the major soils of the association. Pancheri soils are light brownish-gray, pale-brown, and light-gray silt loam that extends to a depth of more than 40 inches. Polatis soils are light brownish-gray, pale-brown, and light-gray silt loam that is underlain by basalt bedrock at a depth of about 28 inches.

The major soils of this association are used for irrigated potatoes, sugar beets, alfalfa, and small grain. Where irrigated, the shallow soils included in this association are used mainly for pasture and hay crops. Rainfall alone, without additions of irrigation water, is insufficient for the production of cultivated crops. In areas where irrigation water is not available, the soils are used for range. The land types Lava flows and Lava rock land are too stony and too shallow to produce much vegetation and are used for wildlife habitat, recreational areas, and some grazing.

Upland birds are the main wildlife in this association. Sage grouse use the area as one of their chief sources of

food and cover. Pheasants, gray partridges, mourning doves, and other birds also use it. Ducks and geese use the area for food. Bobcats and coyotes inhabit the area.

#### 4. Robin-Lanark association

*Nearly level to steep, well-drained, deep, medium-textured soils on loess-covered uplands*

This association (fig. 5) consists of soils that formed in losses on uplands. The uplands have shallow drainageways and basins that are somewhat poorly drained. Basalt outcrops occur throughout the association. The vegetation consists mainly of Idaho fescue, streambank wheatgrass, Columbia needlegrass, Nevada bluegrass, three-tip sagebrush, and aspen in the uplands, and Kentucky bluegrass, timothy, tufted hairgrass, wiregrass, Carex, and silver sagebrush in the lower areas.

Elevations range from 5,000 to 7,000 feet. The annual precipitation is 13 to 19 inches, the mean annual temperature is 36° to 43° F., and there are 80 to 110 frost-free days. In parts of the association frost can occur at any time during the year.

This association makes up about 15 percent of the Survey Area. Of this, 55 percent is Robin soils; 15 percent, Lanark soils; 10 percent, Gilispie soils; 10 percent, Outlet soils; and the remaining 10 percent, Tetonia and Enochville soils and Lava rock land.

Robin and Lanark soils are the major soils of the association. Robin soils are nearly level to steep. These are dark grayish-brown, grayish-brown, and pale-brown silt loams that are more than 6 feet deep to bedrock. Lanark soils are nearly level to moderately steep. These are grayish-brown, dark grayish-brown, and brown silt loam

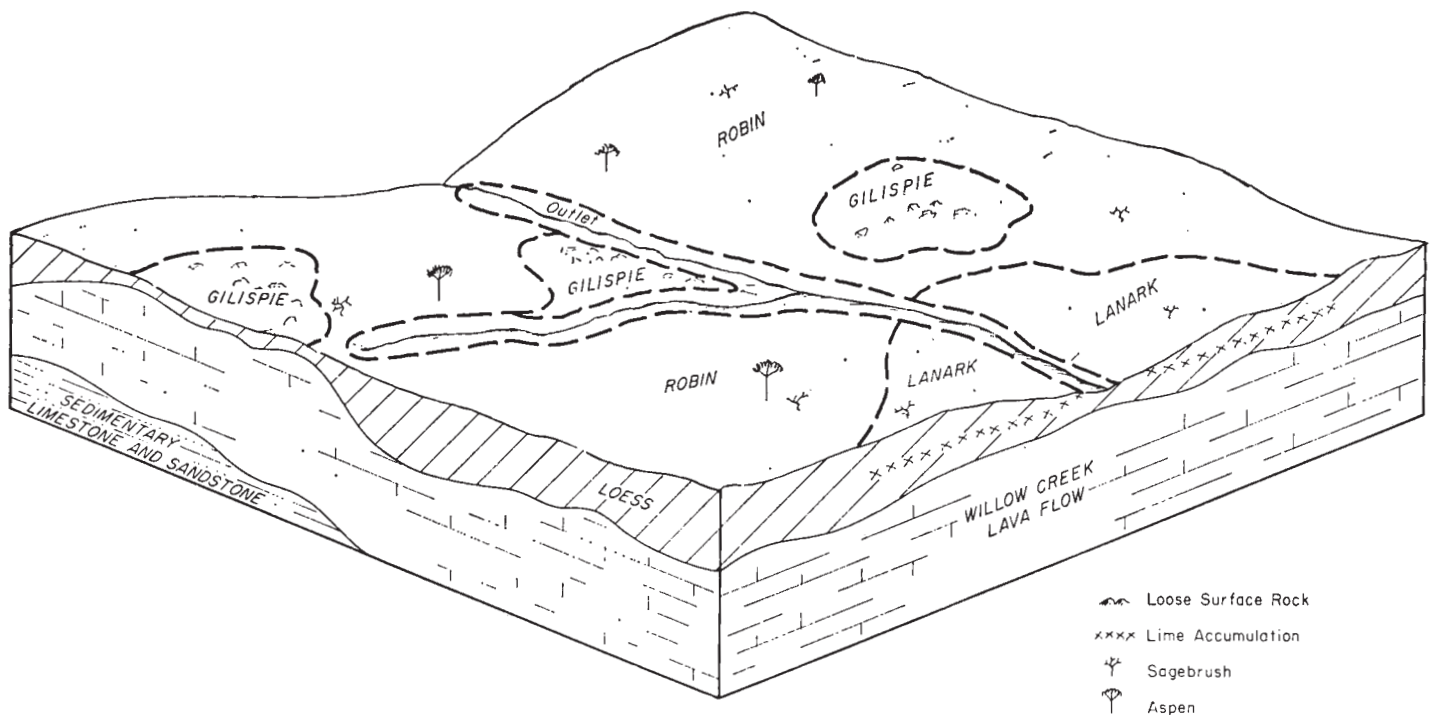


Figure 5.—Representative pattern of soils in association 4.



and light silty clay soils that are more than 5 feet deep to bedrock.

Robin and Lanark soils are used for cultivated crops in areas where the temperature is high enough. In areas where the soils are shallow, stony, and somewhat poorly drained, and in frosty areas, the soils are used mainly for grazing.

This association is used mainly for summer grazing by livestock and for dryland small grain.

Deer, elk, and waterfowl are the main wildlife in the association. Deer and elk use the association mainly for summer grazing and cover. Sage grouse, gray partridge, and mourning doves also inhabit the association. The adjacent Grays Lake and Blackfoot River Reservoir are important nesting areas for waterfowl, and the soils in the association provide an abundance of food and cover within relatively short distances. This association is one of the favorite nesting and feeding areas for a large concentration of sandhill cranes. The streams are stocked with trout.

### 5. Wolverine-Sasser-Stan association

*Nearly level to moderately steep, excessively drained and well drained, deep, coarse textured and moderately coarse textured soils on terraces*

This association (fig. 6) parallels the Snake River in the central part of the Survey Area. It consists mainly of soils that formed in sandy alluvium and eolian sand. The natural vegetation consists mainly of big sagebrush, rabbitbrush, basin wildrye, sand dropseed, and Indian ricegrass.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 11 to 13 inches. The mean annual temperature is 42° to 45° F., and there are 110 to 130 frost-free days.

This association makes up about 4 percent of the Survey Area. Of this, 20 percent is Wolverine soils; 15 percent,

Sasser soils; 15 percent, Stan soils; 10 percent, Firth soils; and 10 percent, Wapello soils. The remaining 30 percent consists of Weeding, Presto, Paesl, and Ammon soils.

Wolverine, Sasser, and Stan soils are the major soils of the association. Wolverine soils are nearly level to moderately steep. These soils formed in long, narrow dunes. They are excessively drained, light brownish-gray sand to a depth of more than 60 inches. Sasser soils are well drained and nearly level to gently sloping. They are fine sandy loams underlain by sand and gravel at a depth of about 38 inches. Stan soils are well drained and very gently sloping. They are fine sandy loams underlain by sand and gravel at a depth of about 40 to 50 inches.

The Wolverine soils are not irrigated and are used only for grazing. The other soils of the association are mostly irrigated and are used for potatoes, alfalfa, small grain, sugar beets, and pasture.

Waterfowl and upland game birds are the main wildlife in the association. Ducks and geese nest and feed in and along the streams and canals. Pheasants, gray partridge, and mourning doves use the association for food and cover.

### 6. Newdale-Swanner-Tetonia association

*Nearly level to steep, well-drained, deep and shallow, medium-textured soils on uplands*

This association (fig. 7) is on the western slopes of the Blackfoot Mountains in the central part of the Survey Area. It consists mainly of silt loams and loams that formed in loess. These are nearly level to moderately sloping soils on fans and nearly level to steep soils on upland ridges, plateaus, and mountain slopes. The association is deeply entrenched with drainageways. Shallow, extremely stony areas are common. The natural vegetation consists mostly of bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, three-tip sagebrush, and serviceberry.

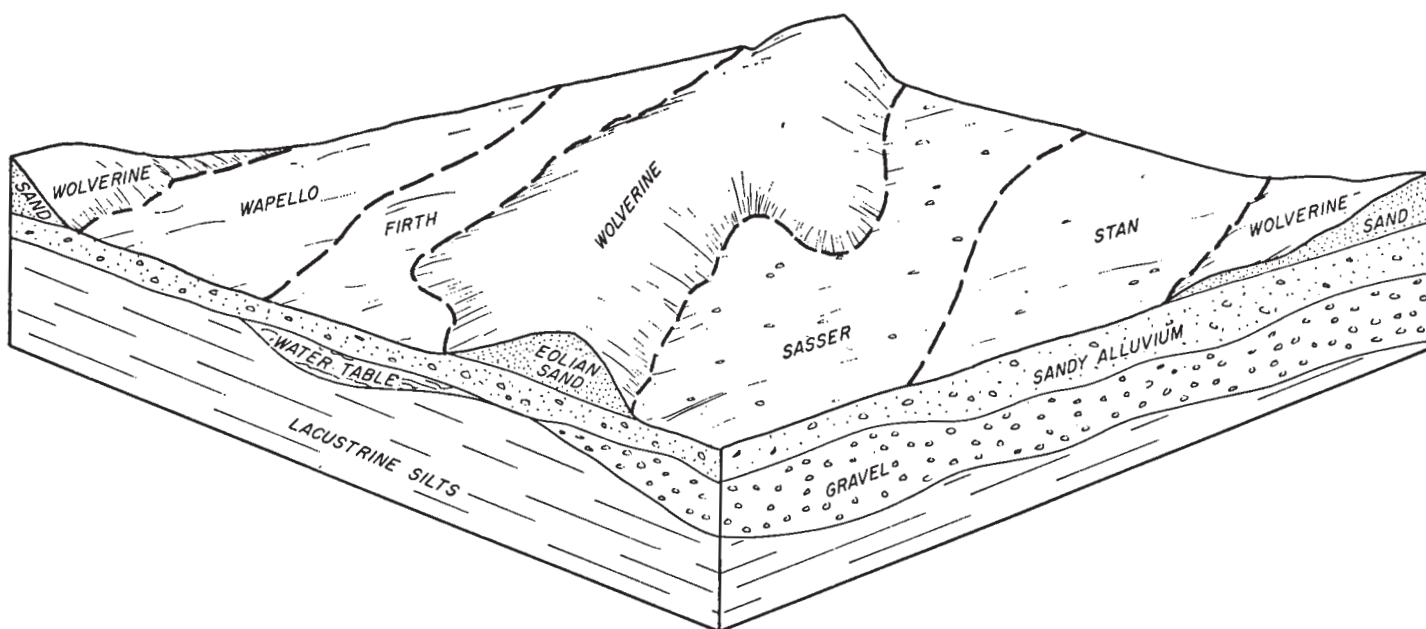


Figure 6.—Representative pattern of soils in association 5.



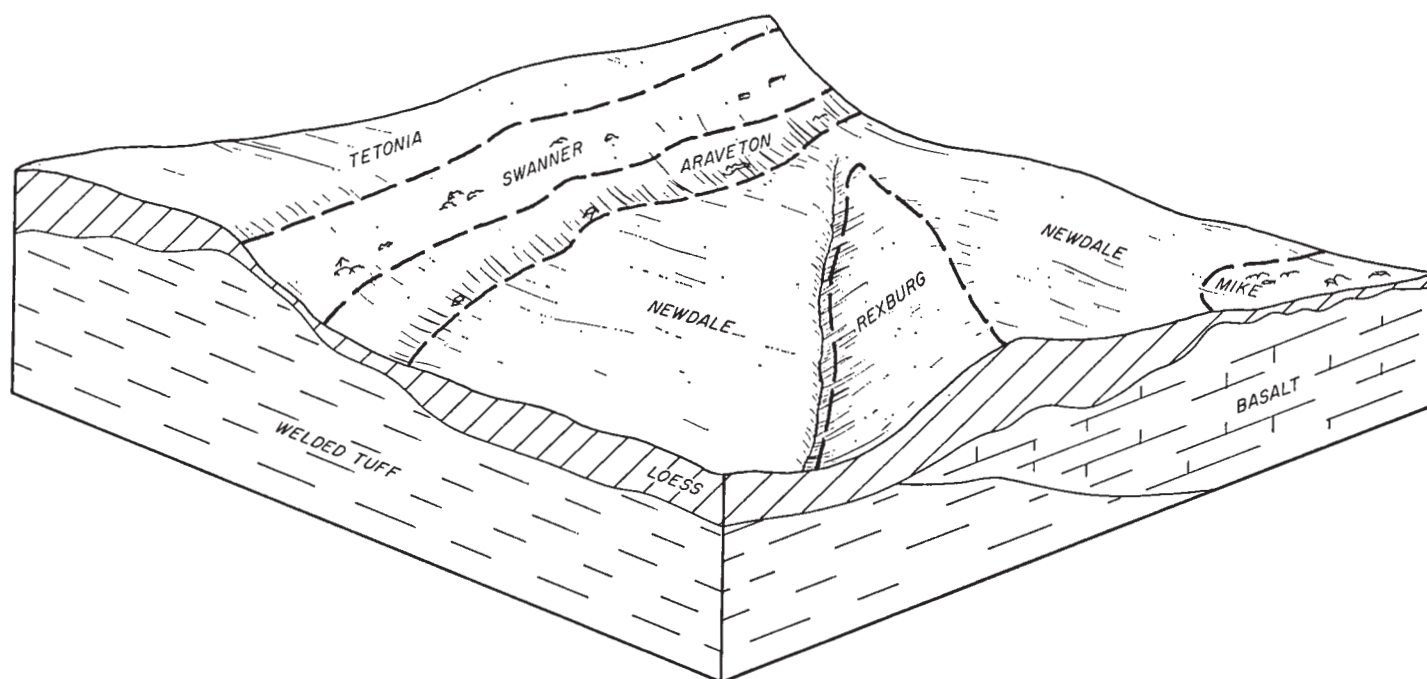


Figure 7.—Representative pattern of soils in association 6.

Elevations range from 4,400 to 6,500 feet. The annual precipitation is 11 to 16 inches. The mean annual temperature is 40° to 45° F., and the frost-free season is generally 80 to 110 days, except for frosty areas where frost can occur at any time.

This association makes up about 8 percent of the Survey Area. Of this, 45 percent is Newdale soils; 15 percent, Swanner soils; 15 percent, Tetonia soils; 10 percent, Rexburg soils; 10 percent, Araveton soils; and the remaining 5 percent, Mike, Wahtigup, and Robin soils.

Newdale, Swanner, and Tetonia soils are the major soils of the association. Newdale and Tetonia soils are silt loam. They are more than 60 inches deep to bedrock. Swanner soils are extremely stony loam underlain by bedrock within 20 inches of the surface. Tetonia soils have a dark grayish-brown silt loam surface layer and a grayish-brown silt loam subsoil. The substratum is silt loam to a depth of more than 60 inches.

The deep soils of this association are dryfarmed to small grain where slopes are not too steep and the temperature is high enough. The shallow and stony soils and those soils in frosty areas are used mainly for grazing.

Deer and elk are the main big game in this association. The association is one of the main wintering areas for deer. Pheasants, gray partridge, chukars, ducks, and geese use the association for food and cover. Fish are stocked in the larger streams.

#### 7. Wahtigup-Ricrest-Hymas association

*Moderately sloping to very steep, somewhat excessively drained and well drained, deep and shallow, gravelly, stony and extremely stony, medium-textured soils on mountain slopes and ridges*

This association (fig. 8) is on the higher parts of the west-facing slopes of the Blackfoot Mountains, in the

central part of the Survey Area. It consists mainly of gravelly, stony, and extremely stony loam soils that formed in loess, colluvium, and residuum weathered from limestone. Limestone rock land and rock outcrops are on ridgetops and ledges. The area is deeply entrenched with intermittent drainageways. The vegetation consists mainly of bunchgrass, big sagebrush, bitterbrush, aspen, and scattered Douglas-fir.

Elevations range from 4,800 to 7,000 feet. The annual precipitation is 11 to 19 inches. The mean annual temperature is 36° to 45° F., and there are 50 to 110 frost-free days.

The association makes up about 4 percent of the Survey Area. Of this, 35 percent is Wahtigup soils; 25 percent, Ricrest soils; 20 percent, Hymas soils; and the remaining 20 percent, Limestone rock land and small acreages of other soils.

Wahtigup, Ricrest, and Hymas soils are the major soils of the association. Wahtigup soils are moderately steep and steep, somewhat excessively drained stony and gravelly loams that rest on limestone gravel and bedrock at a depth of about 45 inches. Ricrest soils are moderately to steep to very steep and well drained. They are more than 40 inches deep to bedrock. These soils have a stony loam surface layer, a light clay loam subsoil, and a gravelly loam substratum. Hymas soils are moderately sloping to steep extremely stony loam that is underlain by limestone bedrock.

The soils of this association are used mainly for grazing. Limestone rock land is suitable only for use as a watershed.

Deer use this association as a wintering area. Partridge and chukars are common in the association and use it for food and cover. Streams and ponds are stocked with fish.

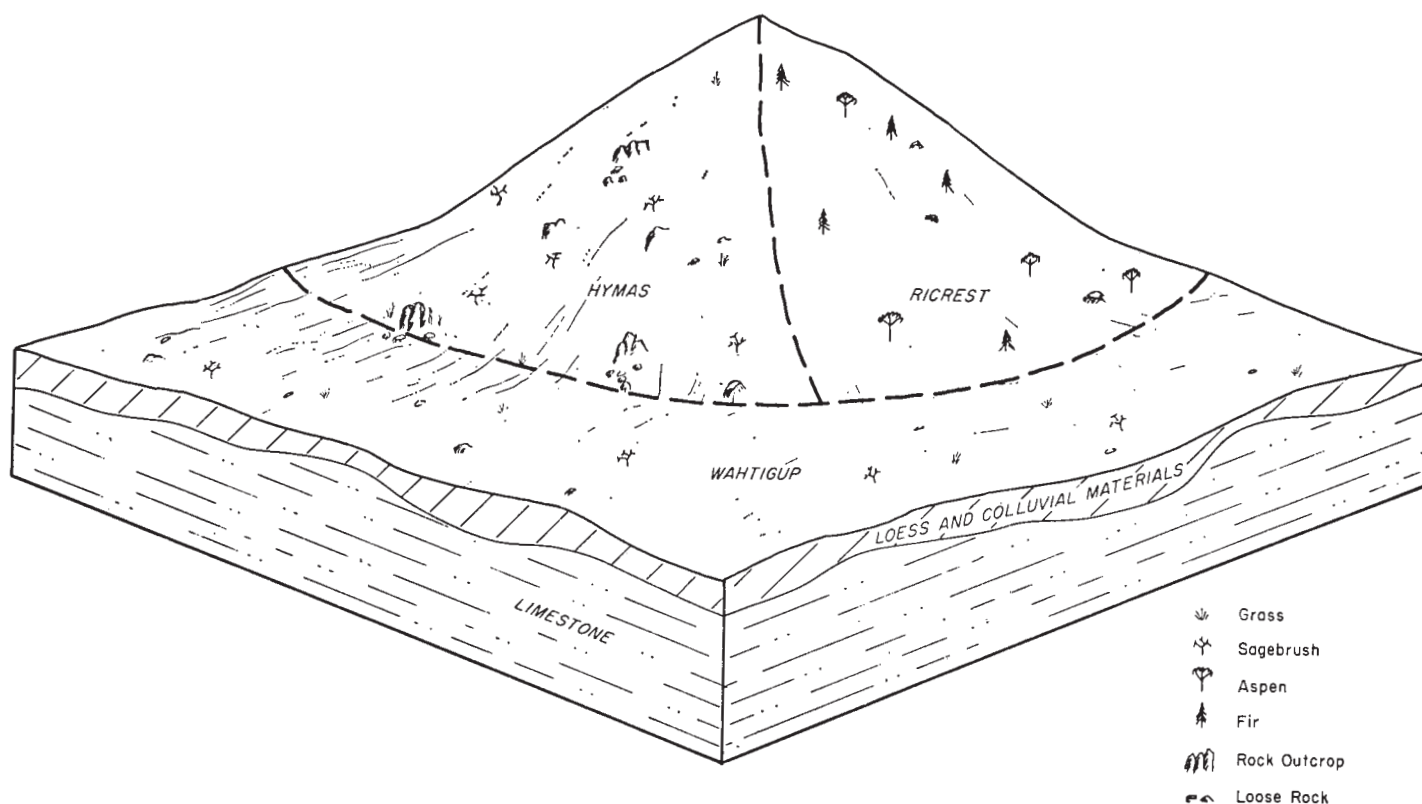


Figure 8.—Representative pattern of soils in association 7.

#### 8. Dranyon-Sessions-Nielsen association

*Nearly level to steep, well-drained, deep and shallow, medium-textured soils on mountains and foot slopes*

This association (fig. 9) is on the eastern slopes of the Blackfoot Mountains and the western foot slopes of the Caribou Range, in the eastern part of the Survey Area. It consists of soils that formed in loess and residuum weathered from sandstone and extremely sandy loam. These soils are mostly on mountain ridges, side slopes, and foot slopes. Small areas of somewhat poorly drained soils are in the drainageways. Extremely stony areas and sandstone outcrops are common on ridges and some foot slopes. The vegetation consists mainly of Idaho fescue, slender wheatgrass, mountain brome, Columbia needlegrass, pinegrass, aspen, Douglas-fir, subalpine fir, and lodgepole pine.

Elevations range from 5,400 to 8,000 feet. The annual precipitation ranges from 16 to 24 inches. The mean annual temperature is 35° to 45° F., and there are 50 to 80 frost-free days. In some areas of the association, frost can occur at any time during the year.

This association makes up about 10 percent of the Survey Area. Of this, 30 percent is Dranyon soils; 30 percent, Sessions soils; 15 percent, Nielsen soils; and 5 percent, Alpon soils. The remaining 20 percent consists of Turner-ville, Outlet, and Gilispie soils.

Dranyon, Sessions, and Nielsen soils are the major soils of the association. Dranyon soils are nearly level to steep. They have a silt loam surface layer, a clay loam subsoil that extends to a depth of about 52 inches, and a clay

loam or loam substratum. Sessions soils are nearly level to moderately steep. They have a loam surface layer, a silty clay subsoil that extends to a depth of 71 inches, and a clay loam substratum. Nielsen soils consist of nearly level to steep, extremely stony loam that is less than 20 inches deep to sandstone bedrock.

These soils are used for summer grazing of livestock, for timber production, and for dryfarmed crops. The short growing season makes farming risky, but some ranches have summer headquarters in the area. The association is important for summer grazing, but livestock are moved to lower valleys in winter because of the cold, snowy weather.

Deer and elk are the main wildlife in the association. Blue grouse and Franklin grouse are in the timbered areas. Ducks and geese use the streams and fields for nesting and feeding areas. Bear, beaver, and muskrats are common in the association. The streams of the area provide good trout fishing.

#### 9. Sheege-Pavohroo association

*Nearly level to steep, well-drained, shallow and deep, medium-textured soils on mountains*

This association (fig. 10) is on the east side of the Blackfoot Mountains, in the eastern part of the Survey Area. It consists of soils that formed in loess, colluvium, and residuum weathered from limestone. The steep soils are on mountain ridges and side slopes, and the more gently sloping soils are on ridgetops and foot slopes.

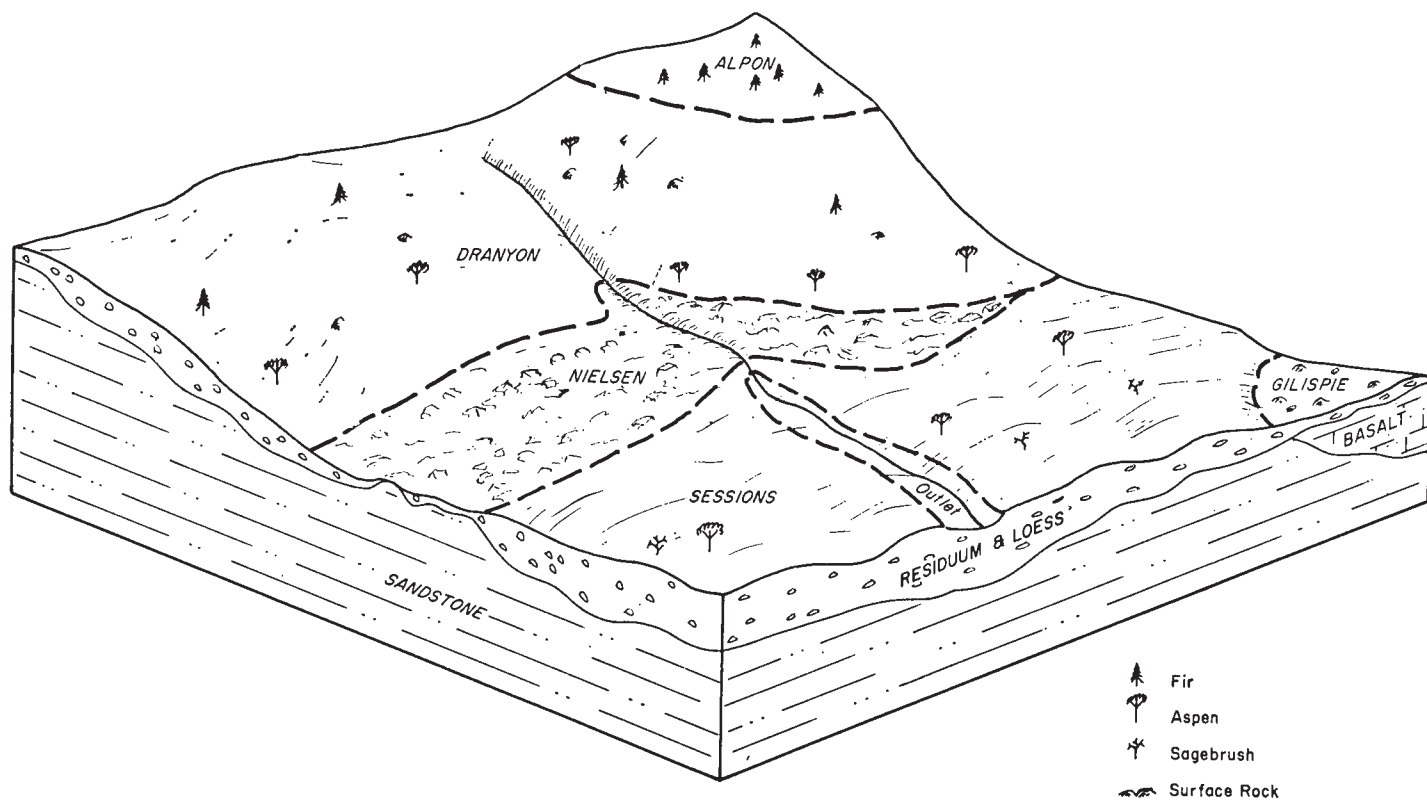


Figure 9.—Representative pattern of soils in association 8.

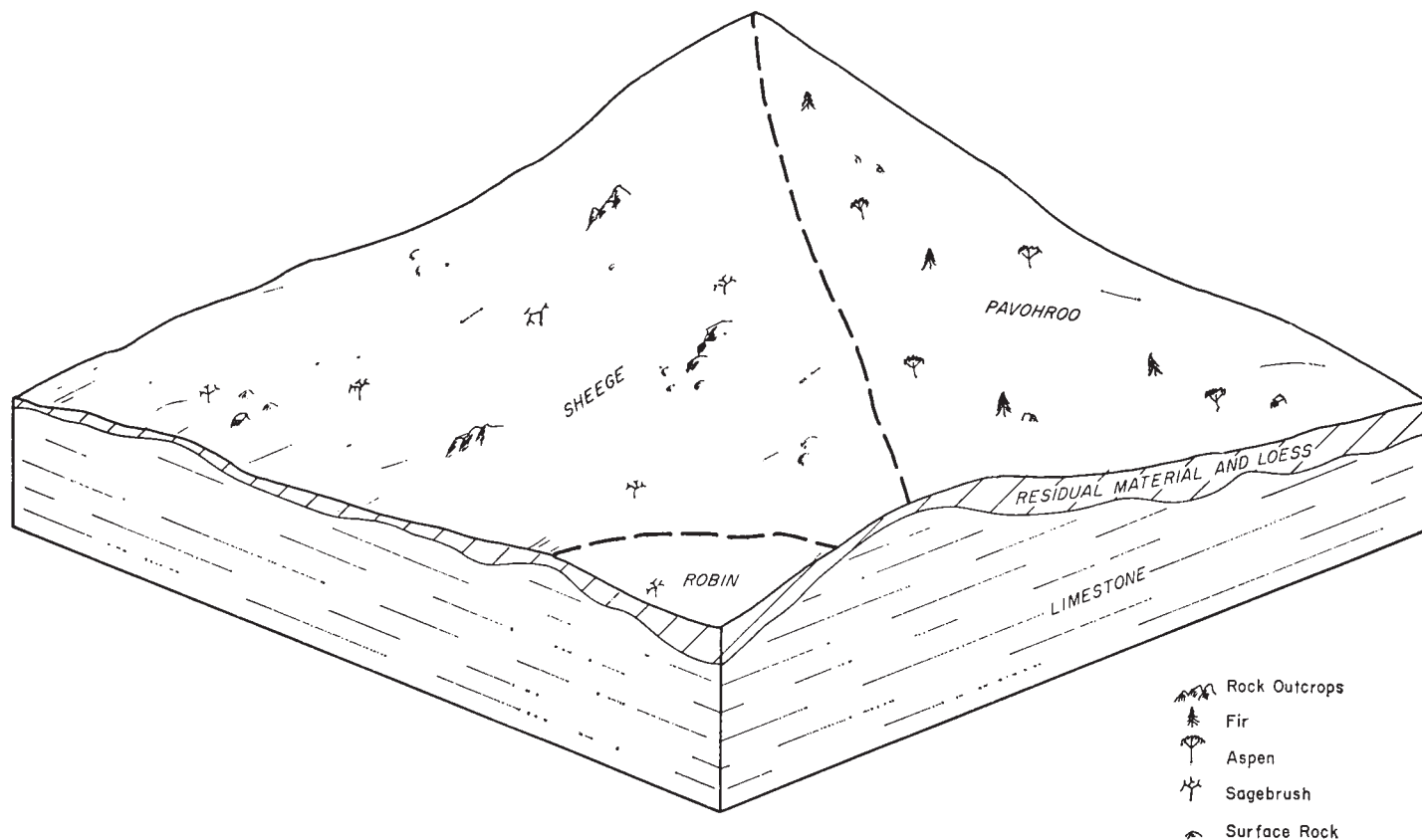


Figure 10.—Representative pattern of soils in association 9.



South slopes and ridgetops are occupied by Sheege soils, and the north slopes principally by Pavohroo soils. The vegetation consists mainly of Douglas-fir, aspen, pinegrass, slender wheatgrass, mountain brome, myrtle boxleaf, and snowberry on the north slopes and big sagebrush, snowberry, western wheatgrass, yarrow, and wyethia on the south slopes.

Elevations range from 5,500 to 7,500 feet. The mean annual precipitation ranges from 16 to 22 inches. The mean annual temperature ranges from 40° to 45° F., and there are about 50 to 80 frost-free days. In some areas, however, frost can occur any day of the year.

The association makes up about 4 percent of the Area. Of this, 55 percent is Sheege soils, 35 percent is Pavohroo soils, and 10 percent is Limestone rock land and Robin soils. Sheege and Pavohroo are the major soils in the association. Sheege soils consist of extremely stony loam that is underlain by limestone bedrock at a depth of about 17 inches. In Pavohroo soils the surface layer is loam or silt loam, the subsoil is brown clay loam that extends to a depth of 44 inches, and the substratum is brown very gravelly loam underlain by limestone bedrock at a depth of about 60 inches.

Limitations to the use of this association are the short growing season, stones, and steep slopes. The soils of this association are used mainly for summer grazing and timber production.

Deer and elk are the main wildlife, and the area is important summer range. Blue grouse and Franklin grouse frequent the timbered areas. Bear, beaver, and muskrat also frequent the area in small numbers.

## Descriptions of the Soils

In this section the soil series and mapping units of the Bingham Area are described. The approximate acreage and proportionate extent of each mapping unit are given in table 1.

The series descriptions are in alphabetic order. Following each series description is a fairly detailed description of one mapping unit of the series. This detailed description is followed by brief descriptions of the rest of the mapping units in the series.

In each series description is a short narrative description of a profile representative of the series. In the first mapping unit description is a much more detailed description of the same profile, which can be used by scientists, engineers, and others in making highly technical interpretations. The descriptions of the rest of the mapping units tell mainly how these units differ from the one described in detail. Unless otherwise stated, the color names and color symbols given are for dry soils. The available water capacity is given to a depth of 5 feet or to the depth of bedrock, whichever is less.

As mentioned in "How This Survey Was Made," not all mapping units are members of a soil series. Gravel pit, for example, does not belong to a series; nevertheless, it is listed in alphabetic order along with the soil series.

This Survey Area was mapped according to the intensity of use. The intensity of the mapping for the units described in the following pages is indicated by the soil symbol in parentheses after the name of each mapping unit. This symbol also identifies the mapping unit on the detailed soil map. If the second letter of a symbol is a small letter, the unit was mapped at high or medium intensity; if it is a capital, the unit was mapped at low intensity. The composition of units mapped at low intensity is more variable than others in the Survey Area but has been controlled well enough to be interpreted for the expected uses.

At the end of the description of each mapping unit are listed the capability unit, the windbreak or woodland suitability group, and the range site in which the mapping unit has been placed. The absence of a range site designation means that the soil generally is not used for range. The pages where the interpretive groups are described can be readily learned by referring to the "Guide to Mapping Units."

TABLE 1.—Approximate acreage and proportionate extent of the soils

Soil	Acres	Percent	Soil	Acres	Percent
Alpon silt loam, steep-----	4, 633	0. 5	Declo loam, 2 to 4 percent slopes-----	6, 600	. 8
Alpon silt loam, hilly-----	909	. 1	Declo loam, 4 to 8 percent slopes-----	2, 944	. 3
Ammon silt loam, 0 to 2 percent slopes-----	2, 562	. 3	Declo loam, 8 to 12 percent slopes-----	1, 160	. 1
Ammon silt loam, 2 to 4 percent slopes-----	656	. 1	Declo loam, 12 to 20 percent slopes, eroded-----	237	( <sup>1</sup> )
Araveton extremely stony loam, hilly-----	2, 825	. 3	Declo fine sandy loam, 0 to 2 percent slopes-----	2, 535	. 3
Araveton extremely stony loam, steep-----	2, 126	. 2	Declo fine sandy loam, 2 to 4 percent slopes-----	847	. 1
Araveton loam, 4 to 12 percent slopes-----	799	. 1	Declo fine sandy loam, 4 to 8 percent slopes-----	269	( <sup>1</sup> )
Bannock loam, 0 to 2 percent slopes-----	21, 551	2. 4	Dranyon silt loam, hilly-----	22, 898	2. 6
Bannock loam, 2 to 4 percent slopes-----	2, 174	. 2	Dranyon silt loam, steep-----	3, 983	. 5
Bannock loam, 4 to 8 percent slopes-----	426	( <sup>1</sup> )	Dranyon-Gilispie complex, hilly-----	1, 240	. 1
Blackfoot loam-----	1, 236	. 1	Enochville silt loam-----	2, 911	. 3
Blackfoot loam, drained-----	4, 463	. 5	Fingal loam, 0 to 2 percent slopes-----	1, 418	. 2
Blackfoot loam, saline-----	280	( <sup>1</sup> )	Fingal loam, 2 to 4 percent slopes-----	207	( <sup>1</sup> )
Blackfoot silty clay loam-----	330	( <sup>1</sup> )	Fingal loam, saline, 0 to 2 percent slopes-----	1, 122	. 1
Bock loam, 0 to 2 percent slopes-----	19, 920	2. 3	Fingal loam, saline, 2 to 4 percent slopes-----	284	( <sup>1</sup> )
Bock loam, 2 to 4 percent slopes-----	1, 230	. 1	Fingal loam, strongly saline, 0 to 2 percent slopes-----	1, 405	. 2
Bondbranch sandy loam, undulating-----	856	. 1	Fingal clay loam, 0 to 2 percent slopes-----	853	. 1
Declo loam, 0 to 2 percent slopes-----	40, 748	4. 6			

See footnote at end of table.

TABLE 1.—Approximate acreage and proportionate extent of the soils—Continued

Soil	Acres	Percent	Soil	Acres	Percent
Firth sandy loam	662	.1	Portino stony silt loam, 8 to 12 percent slopes	226	( <sup>1</sup> )
Firth sandy loam, drained	3,425	.4	Portino-Knull silt loams, 0 to 2 percent slopes	425	( <sup>1</sup> )
Fulmer loam	2,468	.3	Portino-Knull silt loams, 2 to 4 percent slopes	560	.1
Fulmer loam, drained	812	.1	Portino-Thornock complex, undulating	2,331	.3
Gilispie extremely stony loam, hilly	11,801	1.3	Portneuf silt loam, 2 to 4 percent slopes	24,045	2.7
Gilispie extremely rocky loam, hilly	3,942	.5	Portneuf silt loam, 0 to 2 percent slopes	10,057	1.1
Gravel pit	281	( <sup>1</sup> )	Portneuf silt loam, 4 to 8 percent slopes	7,016	.8
Hayeston sandy loam, 0 to 2 percent slopes	4,460	.5	Portneuf silt loam, 8 to 12 percent slopes	361	( <sup>1</sup> )
Hayeston sandy loam, 2 to 4 percent slopes	461	.1	Presto loamy sand	2,544	.3
Hayeston loam, 0 to 2 percent slopes	4,485	.5	Rexburg silt loam, 4 to 12 percent slopes	3,860	.4
Heiseton sandy loam, 0 to 2 percent slopes	2,795	.3	Rexburg silt loam, 12 to 20 percent slopes	1,957	.2
Heiseton sandy loam, 2 to 4 percent slopes	1,221	.1	Rexburg-Wahtigup association, hilly	2,641	.3
Heiseton loam, 0 to 2 percent slopes	4,583	.5	Rexburg-Wahtigup association, steep	1,436	.2
Hymas extremely stony loam, hilly	1,389	.2	Ricrest stony loam, steep	5,222	.6
Hymas extremely stony loam, steep	6,205	.7	Ricrest stony loam, hilly	772	.1
Kimama silt loam	2,419	.3	Ricrest extremely stony loam, very steep	378	( <sup>1</sup> )
LaJara sandy loam	1,596	.2	Ricrest-Wahtigup stony loams, hilly	972	.1
LaJara sandy loam, drained	216	( <sup>1</sup> )	Ricrest-Wahtigup stony loams, steep	2,782	.3
Lanark silt loam, 4 to 12 percent slopes	6,532	.7	Riverwash	446	.1
Lanark silt loam, 0 to 4 percent slopes	967	.1	Robin silt loam, 0 to 4 percent slopes	3,011	.3
Lanark silt loam, 12 to 20 percent slopes	1,505	.2	Robin silt loam, 4 to 12 percent slopes	18,643	2.1
Lanark silt loam, rolling	7,074	.8	Robin silt loam, 12 to 20 percent slopes	1,059	.1
Lanark-Robin silt loams, rolling	1,092	.1	Robin silt loam, rolling	39,486	4.5
Lava flows	42,272	4.8	Robin silt loam, steep	1,507	.2
Lava rock land	17,514	2.0	Robin-Gilispie complex, rolling	16,415	1.9
Limestone rock land	5,534	.6	Robin-Gilispie complex, steep	983	.1
Malm fine sandy loam, 0 to 2 percent slopes	468	.1	Robin-Swanner association, hilly	1,471	.2
Malm fine sandy loam, 2 to 4 percent slopes	598	.1	Robin-Swanner association, steep	1,866	.2
Marsh	951	.1	Sasser fine sandy loam, 0 to 2 percent slopes	3,496	.4
Matheson fine sandy loam, 2 to 4 percent slopes	2,140	.2	Sasser fine sandy loam, 2 to 4 percent slopes	996	.1
Matheson fine sandy loam, 0 to 2 percent slopes	870	.1	Sasser fine sandy loam, 4 to 8 percent slopes	311	( <sup>1</sup> )
Matheson fine sandy loam, 4 to 8 percent slopes	820	.1	Sessions silt loam, 4 to 12 percent slopes	5,240	.6
Matheson-Bondbranch complex, undulating	990	.1	Sessions silt loam, 12 to 20 percent slopes	703	.1
Mike extremely stony silt loam, 0 to 30 percent slopes	3,331	.4	Sessions silt loam, rolling	5,279	.6
Newdale silt loam, 4 to 12 percent slopes	12,273	1.4	Sessions-Nielsen complex, hilly	22,895	2.6
Newdale silt loam, 0 to 4 percent slopes	4,345	.5	Sessions-Nielsen complex, hilly, eroded	595	.1
Newdale silt loam, 12 to 20 percent slopes	10,765	1.2	Sheege extremely stony loam, hilly	6,213	.7
Newdale silt loam, hilly	1,994	.2	Sheege extremely stony loam, steep	10,171	1.2
Newdale silt loam, steep	2,897	.3	Sheege-Pavohroo association, hilly	1,927	.2
Nielsen extremely stony loam, hilly	5,530	.6	Sheege-Robin association, hilly	1,727	.2
Nielsen extremely stony loam, steep	474	.1	Sheege-Robin association, steep	1,308	.1
Outlet silty clay loam	21,395	2.5	Spaa extremely rocky loam	461	.1
Outlet loam, noncalcareous variant	248	( <sup>1</sup> )	Stan fine sandy loam, 0 to 2 percent slopes	3,900	.4
Packham gravelly loam, 0 to 2 percent slopes	5,231	.6	Stan fine sandy loam, 2 to 4 percent slopes	454	.1
Packham gravelly loam, 2 to 4 percent slopes	330	( <sup>1</sup> )	Stony rock land	3,528	.4
Paesl silt loam	1,813	.2	Swanner extremely stony loam, hilly	2,043	.2
Paesl fine sandy loam	524	.1	Swanner extremely stony loam, steep	6,710	.8
Pancheri silt loam, 2 to 4 percent slopes	67,416	7.6	Tenno stony loam, 0 to 4 percent slopes	1,816	.2
Pancheri silt loam, 0 to 2 percent slopes	37,679	4.3	Tenno stony loam, 4 to 8 percent slopes	320	( <sup>1</sup> )
Pancheri silt loam, 4 to 8 percent slopes	5,091	.6	Tenno extremely stony loam, undulating	16,267	1.8
Pancheri silt loam, 8 to 12 percent slopes	269	( <sup>1</sup> )	Terrace escarpments	314	( <sup>1</sup> )
Panogue loam, 0 to 2 percent slopes	410	( <sup>1</sup> )	Tetonia silt loam, rolling	3,837	.4
Pavohroo loam, steep	7,413	.8	Tetonia silt loam, steep	3,031	.3
Pavohroo loam, hilly	4,613	.5	Tetonia-Gilispie association, hilly	5,037	.6
Polatis silt loam, 2 to 4 percent slopes	11,094	1.3	Tetonia-Gilispie association, steep	495	.1
Polatis silt loam, 0 to 2 percent slopes	4,406	.5	Thornock stony loam, 0 to 4 percent slopes	1,901	.2
Polatis silt loam, 4 to 8 percent slopes	2,993	.3	Thornock stony loam, 4 to 8 percent slopes	350	( <sup>1</sup> )
Polatis stony silt loam, 0 to 2 percent slopes	595	.1	Thornock extremely stony loam, undulating	9,077	1.0
Polatis stony silt loam, 2 to 4 percent slopes	6,715	.8	Turnerville silt loam, hilly	2,149	.2
Polatis stony silt loam, 4 to 8 percent slopes	1,007	.1	Wahtigup stony loam, hilly	6,213	.7
Polatis-Tenno complex, undulating	44,496	5.0	Wahtigup stony loam, steep	3,831	.4
Portino silt loam, 2 to 4 percent slopes	6,966	.8	Wapello fine sandy loam, 0 to 2 percent slopes	3,055	.3
Portino silt loam, 0 to 2 percent slopes	4,308	.5	Wapello fine sandy loam, 2 to 4 percent slopes	241	( <sup>1</sup> )
Portino silt loam, 4 to 8 percent slopes	2,305	.3	Wardboro soils	4,005	.5
Portino stony silt loam, 0 to 2 percent slopes	404	( <sup>1</sup> )	Waycup extremely stony loam, 0 to 12 percent slopes	503	.1
Portino stony silt loam, 2 to 4 percent slopes	4,654	.5	Weeding loamy sand	1,985	.2
Portino stony silt loam, 4 to 8 percent slopes	1,004	.1	Wolverine sand, rolling	7,314	.8
			Total	888,343	100.0

<sup>1</sup> Less than 0.05 percent.



## Alpon Series

The Alpon series consists of well-drained, moderately steep to steep, loamy soils on mountain slopes. These soils formed in very deep loess, influenced partly by sandstone residuum and colluvium. The vegetation consists of subalpine fir, Douglas-fir, lodgepole pine, aspen, and pinegrass. Alpon soils are associated with Dranyon, Pavohroo, and Sheege soils.

Elevations range from 6,000 to 8,000 feet. The mean annual precipitation ranges from 22 to 24 inches. The mean annual soil temperature ranges from 35° to 45° F., and the frost-free season is 50 to 80 days.

In a representative profile the surface layer is overlain by an organic layer one-half inch thick. The surface layer is grayish-brown silt loam about 12 inches thick. The subsurface layer is light-brown, pink, and very pale brown silt loam about 33 inches thick. The subsoil is dominantly light-brown clay loam about 21 inches thick. Weathered sandstone begins at a depth of about 66 inches.

Alpon soils are used for timber, limited grazing, water supply, and wildlife habitat.

**Alpon silt loam, steep** (30 to 60 percent slopes) (AlG).—This soil is on mountains.

Representative profile: 300 feet south and 500 feet west of the center of sec. 1, T. 3 S., R. 39 E., in a forested area:

01—½ inch to 0, very dark grayish-brown (10YR 3/2) slightly decomposed needles and twigs; medium acid; abrupt, wavy boundary.

A1—0 to 12 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine, granular structure; slightly hard, very friable, nonsticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; 5 percent of horizon is sandstone gravel that has some manganese stains; strongly acid; gradual, smooth boundary.

A21—12 to 22 inches, light-brown (7.5YR 6/4) silt loam, dark brown (7.5YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; many partly coated, and common uncoated silt particles; 5 percent of horizon is sandstone gravel; medium acid; gradual, smooth boundary.

A22—22 to 34 inches, pink (7.5YR 7/4) silt loam, brown (7.5YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common, very fine and fine, tubular pores; many uncoated, and common partly coated silt particles; 5 percent of horizon is sandstone gravel; neutral; gradual, wavy boundary.

A23—34 to 45 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common, very fine and fine, tubular pores; many uncoated silt particles; 3 percent of horizon is sandstone gravel; slightly acid; clear, wavy boundary.

B21t—45 to 57 inches, light-brown (7.5YR 6/4) and light yellowish-brown (10YR 6/4) light clay loam, dark brown (7.5YR 4/4) and dark yellowish brown (10YR 4/4) when moist; moderate, fine and medium, subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; many, very fine and fine, tubular pores; medium continuous clay films on ped surfaces; many, bleached, light-gray (10YR 7/2) silt coatings on ped faces; 5 percent of horizon is fine angular gravel; slightly acid; gradual, wavy boundary.

R22t—57 to 63 inches, light-brown (7.5YR 6/4) clay loam, dark brown (7.5YR 4/4) when moist; interiors of some peds are light gray (10YR 7/2) and brown (10YR 4/3) when moist; moderate, fine and medium, subangular blocky structure; hard, friable, sticky and plastic; few

very fine, fine, and medium roots; common, very fine and fine, tubular pores; medium and thick, continuous, reddish-brown (5Y 4/4) clay films on ped surfaces and in pores; common bleached silt coatings on peds; 12 percent of horizon is weathered sandstone gravel; slightly acid; gradual, wavy boundary.

B3t—63 to 66 inches, light-gray (2.5Y 7/2) heavy loam, light brownish gray (2.5Y 6/2) when moist; weak, coarse, subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few very fine and very coarse roots; few, very fine, tubular pores; patchy medium clay films on ped surfaces and in pores; 15 percent of horizon is weathered sandstone gravel; slightly acid; abrupt, wavy boundary.

C1—66 to 69 inches, light reddish-brown (2.5YR 6/4) weathered fine-grained sandstone, reddish brown (2.5YR 4/4) when moist; patchy medium clay films along cracks; slightly acid; abrupt, smooth boundary.

R—69 inches, pale-red (10R 6/3) and 2.5YR 6/2) fine-grained sandstone, reddish brown (2.5YR 4/4) when moist; moderately alkaline.

The organic surface layer is ½ inch to 1½ inches thick. The A1 horizon ranges from 12 to 15 inches in thickness and from 2 to 3 in chroma. The A2 horizon ranges from 30 to 40 inches in thickness, and the B2t horizon ranges from 12 to 24 inches.

Included are small areas where the slope is 0 to 30 percent, areas of Dranyon silt loam and Pavohroo loam, and small areas where the subsoil is heavy clay loam.

Permeability is moderately slow, and the available water capacity is 11 to 12 inches. Surface runoff is rapid, and the hazard of water erosion is severe or very severe. Roots can penetrate to a depth of more than 60 inches.

This soil is used mainly for timber production and limited grazing. (Capability unit VIIe-0, dryland; woodland suitability group 3)

**Alpon silt loam, hilly** (20 to 30 percent slopes) (AlF).—This soil occurs on the lower mountain slopes in areas 100 to 200 acres in size. Surface runoff is medium, and the erosion hazard is moderate.

Included are small areas where the slope is more than 30 percent, as well as areas of Dranyon silt loam and Pavohroo loam.

This soil has the same kind of vegetation and is used and managed in the same way as Alpon silt loam, steep, except that it can be seeded by mechanical methods after timber harvest or fire. (Capability unit VIe-1, dryland; woodland suitability group 3)

## Ammon Series

The Ammon series consists of well-drained, nearly level to gently sloping soils that are more than 60 inches deep. These soils formed under bunchgrass and big sagebrush on alluvial fans that consist of outwash from loessal uplands. They are associated with Newdale and Paesl soils.

Elevations range from 4,400 to 4,800 feet. The annual precipitation is about 11 to 13 inches. The mean annual air temperature is 43° to 45° F., and the frost-free period is 110 to 126 days.

In a representative profile the surface layer is grayish-brown silt loam 10 inches thick. The underlying layers are light brownish-gray silt loam that extends to a depth of more than 60 inches. The soils are limy throughout.

Ammon soils are used mainly for irrigated crops.

**Ammon silt loam, 0 to 2 percent slopes** (AmA).—This soil occurs along the edge of mountain foot slopes. Areas



of this soil extend from the benches occupied by Presto soils northward to the survey area boundary. It occurs as large fans, and the total area is about 2,500 acres.

Representative profile: 525 feet west of the southeast corner of the NE $\frac{1}{4}$  sec. 13, T. 1 S., R. 37 E., in an uncultivated grassy area along a field boundary:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure parting to weak, very fine, granular; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many, very fine, irregular pores; moderately calcareous; mildly alkaline; clear, smooth boundary.
- A12—2 to 10 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine and medium, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many, very fine and fine, tubular pores; moderately calcareous; mildly alkaline; gradual, smooth boundary.
- C1—10 to 19 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; many, very fine, tubular pores; moderately calcareous; moderately alkaline; gradual, smooth boundary.
- C2—19 to 34 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common, very fine and fine, tubular pores; many hard cicada krotovinas with weak lime coatings on outside; moderately calcareous; moderately alkaline; gradual, smooth boundary.
- C3—34 to 54 inches, light-gray (10YR 7/2) light silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common, very fine and fine, tubular pores; common hard cicada krotovinas with weak lime coatings on outside; moderately calcareous; moderately alkaline; gradual, smooth boundary.
- C4—54 to 60 inches, light-gray (10YR 7/2) light silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; few, very fine and fine, tubular pores; few hard cicada krotovinas with weak lime coatings on outside; moderately calcareous; moderately alkaline.

The A horizon ranges from 6 to 12 inches in thickness. The C horizon is silt loam or loam. Lime is fairly well distributed throughout the profile, but the A1 horizon is noncalcareous in places.

Permeability is moderate, and the available water capacity is about 12 inches. Surface runoff is slow, and the hazard of water erosion is slight. Roots can penetrate to a depth of more than 60 inches.

This soil is used for irrigated hay, pasture, small grain, potatoes, and sugar beets. (Capability unit IIc-2, irrigated; windbreak suitability group 1)

**Ammon silt loam, 2 to 4 percent slopes (AmB).**—This soil is similar to Ammon silt loam, 0 to 2 percent slopes, except for the slope. It occurs as small tracts within much larger areas of more nearly level soils of the same series. It consists of the narrow breaks along old stream channels that cut through the alluvial fans and terraces. Surface runoff is slow to medium, but slopes are short in most places, and the erosion hazard is slight to moderate.

Included are small areas where the slope is more than 4 percent.

This soil is used for irrigated hay, pasture, small grain, potatoes, and sugar beets. (Capability unit IIe-1, irrigated; windbreak suitability group 1)

## Araveton Series

The Araveton series consists of well-drained, nearly level to steep, loamy soils more than 60 inches thick. These soils formed under three-tip sagebrush and bunchgrass in loess and residuum weathered from rhyolite. They are on mountains, ridges, and alluvial fans. Araveton soils are associated with soils of the Swanner, Wahtigup, and Tetonia series.

Elevations range from 5,500 to 6,500 feet. The annual precipitation is 13 to 16 inches. The mean annual air temperature is 42° to 45° F., and the frost-free period is 80 to 110 days.

In a representative profile the surface layer is dark grayish-brown extremely stony loam 7 inches thick. The subsoil is brown and pale-brown extremely stony loam that extends to a depth of 24 inches. The substratum is pale-brown, light-gray, and very pale brown extremely stony loam. It extends to a depth of more than 60 inches. These soils are limy in the lower part of the subsoil and in the substratum.

Araveton soils are used for range. They are too stony and, in many places, too steep for cultivation.

**Araveton extremely stony loam, hilly** (0 to 30 percent slopes) (AVF).—This soil is on mountains and ridges in areas that range from a few acres to about 100 acres in size.

Representative profile: 1,000 feet north and 900 feet east of the center of sec. 18, T. 4 S., R. 39 E., in an area of range:

- A11—0 to 4 inches, dark grayish-brown (10YR 4/2) extremely stony loam, very dark brown (10YR 2/2) when moist; moderate, fine and very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; about 10 percent of horizon is stones; neutral; gradual, smooth boundary.
- A12—4 to 7 inches, dark grayish-brown (10YR 4/2) extremely stony loam, grayish brown (10YR 5/2) when crushed, very dark grayish brown (10YR 3/2) when moist; moderate, fine and very fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; about 10 percent of horizon is stones; neutral; gradual, smooth boundary.
- B2—7 to 16 inches, brown (10YR 5/3) extremely stony loam, dark grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; about 15 percent of horizon is stones; neutral; clear, wavy boundary.
- B3ca—16 to 24 inches, pale-brown (10YR 6/3) extremely stony loam, dark brown (10YR 4/3) when moist, dark grayish brown (10YR 4/2) when crushed; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; about 20 percent of horizon is angular stones; moderately calcareous; common veins and coatings of lime; mildly alkaline; clear, wavy boundary.
- C1ca—24 to 38 inches, pale-brown (10YR 6/3) extremely stony loam, brown (10YR 5/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; about 25 percent of horizon is angular stones; strongly calcareous; mildly alkaline; gradual, wavy boundary.
- C2ca—38 to 52 inches, light-gray (2.5Y 7/2) extremely stony loam, grayish brown (2.5Y 5/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many, very fine and fine, tubular pores; about 10 percent of horizon is angular stones;

moderately calcareous; common veins and coatings of lime; mildly alkaline; clear, wavy boundary.

C3ca—52 to 66 inches, very pale brown (10YR 7/3) extremely stony loam, brown (7.5YR 5/4) when moist; massive; hard, firm, slightly sticky and slightly plastic; few very fine roots; many, very fine and fine, tubular pores; about 40 percent of horizon is angular stones; moderately calcareous; common veins of lime; mildly alkaline.

The solum ranges from 15 to 26 inches in thickness. Stones make up 2 to 15 percent of the surface layer. The A horizon ranges from 6 to 10 inches in thickness and from 2 to 3 in chroma. The B horizon is 10 to 20 percent stones. The structure of the B2 horizon is weak or moderate, fine or medium, subangular blocky. The upper part of the B horizon ranges from noncalcareous material to material that contains about 5 percent lime. The lower part contains as much as 12 percent lime.

Included are small areas where the slope is more than 30 percent, as well as areas of Swanner extremely stony loam, Tetonia silt loam, and Wahtigup stony loam.

Permeability is moderate, and the available water capacity is 8 to 10 inches. Surface runoff is slow to medium, and the hazard of water erosion is slight to moderate. Roots can penetrate to a depth of more than 60 inches.

This soil is used for range. (Capability unit VIIIs-2, dryland; Stony range site, 12 to 16 inches precipitation)

**Araveton extremely stony loam, steep** (30 to 60 percent slopes) (AVG).—This soil is similar to Araveton extremely stony loam, hilly, except for the slope. It occurs on mountains. Areas of this soil are mostly less than 100 acres in size. Surface runoff is rapid, and the hazard of water erosion is severe.

Included are small areas where the slope is less than 30 percent or more than 60 percent. Also included are areas of Swanner extremely stony loam, Tetonia silt loam, and Wahtigup stony loam.

This soil is used for range. (Capability unit VIIIs-2, dryland; Steep Stony Slopes range site, 12 to 16 inches precipitation)

**Araveton loam, 4 to 12 percent slopes** (ArD).—This soil differs from Araveton extremely stony loam, hilly, in that the surface layer lacks stones and the slopes are less than 30 percent. This soil occurs as narrow bodies along streams and at the mouths of canyons in areas 20 to 100 acres in size. Surface runoff is medium, and the hazard of erosion is moderate.

This soil is used primarily for range, but in some years it is used for dryland small grain to square out fields. (Capability unit VIe-1, dryland; Loamy range site, 12 to 16 inches precipitation)

## Bannock Series

The Bannock series consists of well-drained, nearly level to moderately sloping soils that are 20 to 40 inches deep to very gravelly sands. These soils formed under big sagebrush and bunchgrass in alluvium on high river terraces. These soils are associated with Bock, Polatis, Hayeston, and Packham soils.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 42° to 45° F., and the frost-free period is 110 to 126 days.

In a representative profile the surface layer is grayish-brown loam that is slightly gravelly and 6 inches thick. The subsoil is grayish-brown and light brownish-gray

loam that is slightly gravelly and extends to a depth of 16 inches. The substratum, in the upper part, is pale-brown and light brownish-gray, strongly calcareous, stratified loam, gravelly loam, and very gravelly sandy loam. This is underlain by very gravelly coarse sand at a depth of 36 inches. The profile is limy throughout.

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

**Bannock loam, 0 to 2 percent slopes** (BaA).—This soil occurs on high terraces of the Snake River in areas that are 10 to 200 acres in size.

Representative profile: 320 feet south and 210 feet east of the northwest corner of SW $\frac{1}{4}$  sec. 11, T. 2 S., R. 36 E., in an area of cheatgrass and sagebrush:

A1—0 to 6 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, very thin and thin, platy structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many, very fine and fine, tubular pores; 7 percent of horizon is rounded gravel; slightly calcareous; moderately alkaline; abrupt, wavy boundary.

B2—6 to 11 inches, grayish-brown (10YR 5/2) loam, light brownish gray (10YR 6/2), crushed; when moist, very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), crushed; weak, fine and very fine, subangular blocky structure parting to weak, fine and very fine, granular; hard, friable, slightly sticky and slightly plastic; common very fine and fine and few medium roots; many very fine, and common fine and medium tubular pores; 10 percent of horizon is rounded gravel; slightly calcareous; some pebbles are slightly coated with lime on the lower side; moderately alkaline; clear, wavy boundary.

B3—11 to 16 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine, and few medium roots; many very fine, and few fine tubular pores; 10 percent of horizon is rounded gravel; few worm channels and worm casts; slightly calcareous; most pebbles are moderately coated with lime on the lower side; mildly alkaline; clear, wavy boundary.

C1ca—16 to 24 inches, pale-brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine, and few medium roots; many very fine, and few fine tubular pores; 12 percent of horizon is rounded gravel; very few worm channels and worm casts; strongly calcareous; few splotches and veins of lime; pebbles are thickly coated with lime on lower side; moderately alkaline; gradual, wavy boundary.

C2ca—24 to 32 inches, pale-brown (10YR 6/3) gravelly loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine and fine, and few medium roots; many, very fine, tubular pores; 25 percent of horizon is rounded gravel; strongly calcareous; few splotches and common fine veins of lime; pebbles are thickly coated with lime on loyer side; moderately alkaline; clear, wavy boundary.

C3ca—32 to 36 inches, light brownish-gray (10YR 6/2) very gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable, slightly sticky and nonplastic; common very fine and fine, and few medium roots; many irregular pores; about 70 percent of horizon is rounded gravel; strongly calcareous; pebbles and nonplastic; common very fine and fine, and few alkaline; clear, wavy boundary.

IIC4ca—36 to 45 inches, light brownish-gray (10YR 6/2) very gravelly coarse sand; single grain, loose when dry or moist; nonsticky and nonplastic; common very fine and fine, and few medium roots; many, very fine, irregular pores; 70 percent of horizon is rounded gravel; slightly calcareous; pebbles are thickly coated with lime on lower side; moderately alkaline.



The solum ranges from 13 to 20 inches in thickness. The A1 or Ap horizon ranges from 6 to 11 inches in thickness and from 2 to 3 in chroma. In places the upper 2 or 3 inches is vesicular. The B horizon is dominantly loam, but in places it is gravelly loam or silt loam. The primary structure is weak or moderate, very fine to medium, subangular blocky or weak prismatic. The B horizon has a chroma of 2 or 3. In most places the hue of the A1, B1, and C1 horizons is 10YR, but in some places it is 2.5Y. The A and B horizons are slightly calcareous or noncalcareous and mildly alkaline or moderately alkaline. The Cca horizon, which contains 15 to 25 percent lime, has its upper boundary at depths between 13 and 20 inches.

Included are small areas where the slope is more than 2 percent, small gravelly areas, and areas of Bock loam, Polatis silt loam, and Packham gravelly loam.

Permeability is moderate, and the available water capacity is about 5 to 8 inches. Surface runoff is slow, and the hazard of water erosion is slight. Roots can penetrate into the underlying sand and gravel.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. Only a few small areas are not irrigated. (Capability unit IIs-1, irrigated; windbreak suitability group 1)

**Bannock loam, 2 to 4 percent slopes (BcB).**—This soil is similar to Bannock loam, 0 to 2 percent slopes, except for the slope. It occurs on high terraces of the Snake River in areas generally less than 100 acres in size. Surface runoff is slow to medium, and the hazard of water erosion is slight to moderate.

Included in mapping were small areas where the slope is less than 2 percent or more than 4 percent, as well as areas of Bock loam, Polatis silt loam, and Packham gravelly loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. (Capability unit IIe-3, irrigated; windbreak suitability group 1)

**Bannock loam, 4 to 8 percent slopes (BcC).**—This soil is similar to Bannock loam, 0 to 2 percent slopes, except for the slope. It occurs along the breaks of terraces and old stream channels that meander across the high terraces of the Snake River. Most areas of this soil are less than 50 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate.

Included are small areas where the slope is less than 4 percent or more than 8 percent, as well as areas of Bock loam, Polatis silt loam, and Packham gravelly loam.

This soil is used for irrigated potatoes, sugar beets, hay, pasture, and small grain. (Capability unit IIIe-12, irrigated; windbreak suitability group 2)

## Blackfoot Series

The Blackfoot series consists of somewhat poorly drained, nearly level, stratified, mainly medium-textured soils that are more than 40 inches deep. These soils formed under big sagebrush and bunchgrass in calcareous alluvium. They are on river terraces. Blackfoot soils are associated with Bannock, Bock, and Fulmer soils.

Elevation ranges from 4,200 to 5,500 feet. The annual precipitation is 11 to 13 inches. The mean annual temperature is 40° to 45° F., and the frost-free period is 110 to 126 days.

In a representative profile the surface layer is gray loam 8 inches thick. The underlying materials are stratified and are gray, light gray, and light brownish gray in

color. Their texture is loam, silty clay loam, fine sandy loam, or very fine sandy loam. The soils are limy throughout.

Blackfoot soils are used for irrigated hay, pasture, small grain, potatoes, and sugar beets. In a few places the soils are used for meadow pasture.

**Blackfoot loam (0 to 2 percent slopes) (Bc).**—This soil occurs on long, smooth terraces of the Snake and Blackfoot Rivers in areas that are generally less than 100 acres in size.

Representative profile: 800 feet east and 600 feet south of the northwest corner of NE¼ sec. 20, T. 3 S., R. 34 E., in an irrigated pasture:

Ap—0 to 8 inches, gray (2.5Y 5/1) loam, very dark grayish brown (2.5Y 3/2) when moist; weak, thin and medium, platy structure parting to moderate, medium, granular; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common, very fine, irregular pores; few worm channels and worm casts; moderately calcareous; mildly alkaline; clear, smooth boundary.

C1—8 to 18 inches, gray (2.5Y 5/1 and 6/1) loam, light brownish gray (10YR 6/2) when crushed, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, granular structure and weak, fine and medium, subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine, and few medium tubular pores; few worm channels and worm casts; moderately calcareous; mildly alkaline; clear, smooth boundary.

A1b—18 to 21 inches, gray (2.5Y 5/1) silty clay loam, light brownish gray (10YR 6/2) when crushed; very dark grayish brown (2.5Y 3/2) or very dark gray (2.5Y 3/1) when moist and crushed; common, fine, faint, brown (10YR 5/3) mottles; weak, thin, platy structure parting to weak, fine and medium, granular; hard, very friable, sticky and plastic; common very fine and fine roots; many, very fine and fine, tubular pores; common worm channels and worm casts; moderately calcareous; few, fine, white spots; mildly alkaline; clear, smooth boundary.

C2—21 to 25 inches, gray (2.5Y 6/1) silty clay loam, dark grayish brown (10YR 4/2) when moist; common, fine, faint, brown (10YR 5/3) mottles; weak, coarse and medium, granular structure; hard, friable, sticky and plastic; common very fine and fine roots; many, very fine and fine, tubular pores; few worm channels and worm casts; moderately calcareous; mildly alkaline; clear, smooth boundary.

C3—25 to 29 inches, light-gray (2.5Y 6/1) loam, dark grayish brown (2.5Y 4/2) when moist; common, medium, distinct, brown (10YR 5/3) mottles, and few, medium, distinct, dark grayish-brown (10YR 4/2) mottles; weak, thin and medium, platy structure parting to weak, fine and medium, granular; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine, and few fine and medium tubular pores; few worm channels and worm casts; moderately calcareous, few fine veins and spots of lime; moderately alkaline; clear, wavy boundary.

C4—29 to 40 inches, light-gray (2.5Y 6/1) fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; few, fine, distinct, dark grayish-brown (10YR 4/2) mottles, very dark gray when moist; massive; hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine, and few fine and medium tubular pores; slightly calcareous; moderately alkaline; clear, wavy boundary.

C5—40 to 51 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; common, medium, distinct, dark grayish-brown (10YR 4/2) mottles; massive; slightly hard, very friable, non-sticky and nonplastic; few very fine and fine roots; many very fine, and few fine and medium tubular pores; slightly calcareous; moderately alkaline; clear, wavy boundary.

C6—51 to 70 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; few, medium, distinct, very dark grayish-brown (10YR



3/2) mottles; massive; very hard, firm, sticky and plastic; few very fine and fine roots; common very fine, and few fine and medium tubular pores; moderately calcareous; very few fine spots of lime; mildly alkaline.

The A1 or Ap horizon ranges from 6 to 12 inches in thickness. In places the C horizon is stratified with thin lenses of sandy or clayey material. The profile is slightly or moderately calcareous. Mottling associated with wetness occurs at depths between 18 and 40 inches.

Included are small areas where the slope is more than 2 percent and areas of Bannock loam, Bock loam, and Fulmer loam.

Permeability is moderate, and the available water capacity is about 10 inches. The water table fluctuates between depths of 2 and 4 feet in spring. Surface runoff is slow, and the hazard of water erosion is slight. Roots can penetrate to a depth of more than 60 inches.

This soil is used for irrigated hay, pasture, small grain, and sugar beets. (Capability unit IIw-2, irrigated; windbreak suitability group 3)

**Blackfoot loam, drained** (0 to 2 percent slopes) (Bd).—This soil is similar to Blackfoot loam, except that the water table is more than 4 feet from the surface.

Included are small areas of Bannock loam, Bock loam, and undrained areas of Blackfoot loam.

This soil is used for irrigated hay, pasture, small grain, and sugar beets. Potatoes can be grown also. (Capability unit IIc-2, irrigated; windbreak suitability group 3)

**Blackfoot loam, saline** (0 to 2 percent slopes) (Bf).—This soil is similar to Blackfoot loam, except that it is affected by salt in the surface layer. Conductivity is 4 to 8 millimhos per centimeter at 25° C. The soil is on terraces of the Blackfoot and Snake Rivers. Surface runoff is slow, and the hazard of water erosion is slight.

Included are small areas of nonsaline Blackfoot loam, Bannock loam, Bock loam, and Fulmer loam.

This soil is used for irrigated hay, pasture, small grain, and sugar beets. The salt content of the surface layer, however, limits crop suitability. (Capability unit IIw-2, irrigated; windbreak suitability group 4)

**Blackfoot silty clay loam** (0 to 2 percent slopes) (Bk).—This soil is similar to Blackfoot loam, except for the texture of the surface layer. Permeability is moderately slow. Included in mapping were small areas of Blackfoot loam, Bannock loam, and Bock loam.

This soil is used for irrigated hay, pasture, small grains, and sugar beets. (Capability unit IIw-2, irrigated; windbreak suitability group 3)

## Bock Series

The Bock series consists of deep, well-drained, loamy soils more than 60 inches deep that formed on nearly level to very gently sloping high terraces. The vegetation is mainly big sagebrush and bunchgrass. These soils are associated with Bannock, Packham, Hayston, and Stan soils.

Elevations range from 4,200 to 4,500 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 42° to 45° F., and the frost-free period is 110 to 126 days.

In a representative profile the surface layer is grayish-brown loam about 10 inches thick. The subsoil is brown loam that extends to a depth of 15 inches. The substratum is light brownish-gray and light-gray, stratified alluvium

that is mainly loam and fine sandy loam to a depth of 47 inches. Below 47 inches is very gravelly coarse sand. These soils have a limy substratum.

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

**Bock loam, 0 to 2 percent slopes** (BoA).—This soil is on long, higher terraces of the Snake River in areas about 10 to 400 acres in size.

Representative profile: 1,450 feet east and 600 feet south of the northwest corner of sec. 21, T. 2 S., R. 35 E., in an irrigated pasture:

Ap—0 to 5 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, platy structure parting to moderate, very fine and fine, granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many, very fine, irregular pores; slightly calcareous; mildly alkaline; gradual, smooth boundary.

A11—5 to 10 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, platy structure parting to moderate, fine and medium, subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common, very fine and fine, tubular pores; mildly alkaline; gradual, wavy boundary.

B2—10 to 15 inches, brown (10YR 5/3) loam, pale brown (10YR 6/3), when crushed, dark brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common, very fine and fine, tubular pores; mildly alkaline; clear, wavy boundary.

C1ca—15 to 26 inches, light-gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine pores; strongly calcareous; common veins and spots of fine lime; moderately alkaline; gradual, wavy boundary.

C2ca—26 to 35 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, non-sticky and slightly plastic; common very fine and fine roots; common, very fine and fine, tubular pores; few cicada krotovinas; strongly calcareous; common veins and spots of lime; moderately alkaline; gradual, wavy boundary.

C3—35 to 47 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky and non-plastic; common very fine and fine roots; common, very fine and fine, tubular pores; moderately calcareous; few veins of lime; mildly alkaline; abrupt, wavy boundary.

IIIC4—47 to 60 inches, light brownish-gray (10YR 6/2) very gravelly coarse sand; single grain; loose when dry and moist; few very fine and fine roots; many irregular pores; about 60 percent of horizon is rounded gravel; moderately calcareous; gravel is coated with lime on lower side; mildly alkaline.

The solum ranges from 13 to 20 inches in thickness. The texture is loam and silt loam, and in places gravel makes up 5 to 10 percent of the upper part of the profile. The thickness of the combined A1 and Ap horizons ranges from 8 to 12 inches. The chroma is 2 or 3. The B horizon has a color value of 5 or 6 when dry and a chroma of 2 or 3. The IIC horizon is nonconformable and occurs at depths of 40 to 60 inches or more. The Cca horizon, which contains 15 to 25 percent lime, has its upper boundary at a depth of 13 to 20 inches.

Included are small areas where the slope is more than 2 percent. Also included are areas of Bannock loam and of Hayston loam, 0 to 2 percent slopes, as well as a few areas of Polatis silt loam.

Permeability is moderate, and the available water capacity is about 7 to 11 inches. Surface runoff is slow,

and the hazard of water erosion is slight. Roots can penetrate to a depth of more than 60 inches.

This soil is used for irrigated hay, pasture, small grain, potatoes, and sugar beets. (Capability unit IIc-2, irrigated; windbreak suitability group 1)

**Bock loam, 2 to 4 percent slopes** (BoB).—This soil is similar to Bock loam, 0 to 2 percent slopes, except for the slope. It occurs on high terraces of the Snake River in areas generally less than 100 acres in size. Surface runoff is slow to medium, and the hazard of water erosion is moderate.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Bannock loam and of Hayston loam, 0 to 2 percent slopes, and a few areas of a Polatis silt loam.

This soil is used for irrigated hay, pasture, small grain, potatoes, and sugar beets. (Capability unit IIe-1, irrigated; windbreak suitability group 1)

## Bondranch Series

The Bondranch series consists of well-drained, nearly level to very gently sloping sandy loams that are less than 20 inches deep over basalt. These soils formed under big sagebrush and bunchgrass in eolian material deposited over basalt. They are associated with Matheson, Pancheri, and Tenno soils.

Elevations range from 4,300 to 5,000 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 40° to 45° F., and the frost-free period is 110 to 130 days.

In a representative profile the surface layer is grayish-brown sandy loam about 3 inches thick. The subsoil and substratum are light brownish-gray sandy loam that is underlain by basalt bedrock at a depth of 16 inches.

Bondranch soils are used for range.

**Bondranch sandy loam, undulating** (0 to 4 percent slopes) (BRB).—This soil occurs over old basalt flows west of the Snake River in areas that range from 10 to 150 acres in size.

Representative profile: 1,540 feet north and 50 feet east of the southwest corner of sec. 35, T. 1 S., R. 35 E., in an area of native range:

A1—0 to 3 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure parting to weak, very fine, granular; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many, very fine and fine, tubular pores; mildly alkaline; abrupt, smooth boundary.

B2—3 to 6 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, thick, platy structure parting to weak, medium, subangular blocky; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many, very fine and fine, tubular pores; slightly calcareous; mildly alkaline; clear, wavy boundary.

B3—6 to 11 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

C1ca—11 to 16 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine, and few medium tubular pores; 3 percent of horizon

is angular gravel; moderately calcareous; moderately alkaline; abrupt, wavy boundary.

IIRca—16 to 20 inches, vesicular basalt bedrock; lime coating on basalt surface and in cracks and pores.

The solum ranges from 6 to 12 inches in thickness. The A horizon ranges from 0 to 4 inches in thickness. The Cca horizon begins at a depth of 6 to 12 inches and extends to the bedrock. The chroma is 2 or 3. The depth to basalt ranges from 10 to 20 inches.

Included are small areas where the slope is more than 4 percent. Also included are areas of Lava rock land, Malm fine sandy loam, and Matheson fine sandy loam.

Permeability is moderately rapid, and the available water capacity is about 2 inches. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe. Roots can penetrate to a depth of less than 20 inches.

This soil is used for range. (Capability unit VIIe-1, dryland; Shallow Loamy range site, 8 to 12 inches precipitation)

## Declo Series

The Declo series consists of well-drained, nearly level to strongly sloping, stratified loams and silt loams that are more than 60 inches deep. These soils formed under big sagebrush and bunchgrass. They are on terraces or escarpments. Declo soils are associated with Portneuf, Thornock, and Fingal soils.

Elevations range from 4,200 to 4,500 feet. The annual precipitation is 8 to 11 inches. The mean annual air temperature is 45° to 47° F., and the frost-free period is 110 to 130 days.

In a representative profile the surface layer is light brownish-gray loam 7 inches thick. The subsoil is pale-brown loam that extends to a depth of about 10 inches. The substratum is light-gray, stratified loam and silt loam that extends to a depth of 64 inches. These soils are limy throughout, but they contain more lime in the upper part of the substratum than in other parts of the profile.

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

**Declo loam, 0 to 2 percent slopes** (DeA).—This soil occurs on river terraces in areas that range from a few acres to more than 100 acres in size.

Representative profile: 100 feet north and 1,620 feet east of the southwest corner of the SE¼ sec. 33, T. 5 S., R. 31 E., in an uncultivated field:

Ap—0 to 7 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, very fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; abrupt, smooth boundary.

B—7 to 10 inches, pale-brown (10YR 6/3) loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; moderately calcareous; mildly alkaline; clear, wavy boundary.

IIC1ca—10 to 14 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; moderate, medium, platy structure parting to weak, fine, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; strongly calcareous; common fine



veins and spots of lime; moderately alkaline; gradual, wavy boundary.

C2ca—14 to 25 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many, very fine and fine, tubular pores; common hard nodules of soil material or cicada krotovinas; strongly calcareous; common fine veins and spots of lime; moderately alkaline; clear, wavy boundary.

C3ca—25 to 44 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many, very fine and fine tubular pores; few pockets and lenses of sand; strongly calcareous; common fine veins and spots of lime; moderately alkaline; gradual, smooth boundary.

C4ca—44 to 64 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; lenses are  $\frac{1}{2}$  to 1 inch thick; brownish yellow (10YR 6/6) staining and mottles, dark yellowish brown (10YR 4/4) when moist; mottles increase with depth; weak, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many, very fine and fine, tubular pores; moderately calcareous, common veins and spots of lime; moderately alkaline.

The solum is 9 to 15 inches thick. The A horizon ranges from 6 to 9 inches in thickness. The A horizon ranges from 2 to 3 in chroma. The B horizon has a texture of silt loam or loam, the latter being dominant. Sand or gravel occurs at a depth of more than 40 inches in places.

Included are small areas of Polatis silt loam, Portneuf silt loam, Thornock stony loam, and Fingal loam.

Permeability is moderate, and the available water capacity is about 10 inches. Surface runoff is slow, and the hazard of water erosion is slight. Roots can penetrate to a depth of more than 60 inches.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. (Capability unit IIc-2, irrigated; windbreak suitability group 1)

**Declo loam, 2 to 4 percent slopes (DeB).**—This soil is similar to Declo loam, 0 to 2 percent slopes, except for the slope. It occurs on high terraces adjacent to the Snake River in areas a few acres to more than a hundred acres in size. Surface runoff is medium, and the erosion hazard is slight to moderate.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Polatis silt loam, Portneuf silt loam, Thornock stony loam, and Fingal loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. (Capability unit IIe-1, irrigated; windbreak suitability group 1)

**Declo loam, 4 to 8 percent slopes (DeC).**—This soil is similar to Declo loam, 0 to 2 percent slopes, except for the slope. It occurs on high terraces adjacent to the Snake River in areas generally less than 100 acres in size. Surface runoff is medium, and the erosion hazard is moderate.

Included are small areas where the slope is less than 4 percent or more than 8 percent. Also included are areas of Portino silt loam, Portneuf silt loam, and Thornock stony loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. Row crops are grown less frequently in the rotation than on Declo loam, 0 to 2 percent slopes. (Capability unit IIIe-1, irrigated; windbreak suitability group 2)

**Declo loam, 8 to 12 percent slopes (DeD).**—This soil is similar to Declo loam, 0 to 2 percent slopes, except for the slope. It occurs on high terraces along the Snake

River and occupies breaks along drainageways or along terrace escarpments. Most areas are less than 50 acres in size. Surface runoff is medium to rapid, and the hazard of water erosion is moderate to severe.

Included are small areas where the slope is less than 8 percent or more than 12 percent. Also included are areas of Portino silt loam, Portneuf silt loam, and Thornock stony loam.

This soil is used for irrigated hay, pasture, and small grain. (Capability unit IVe-1, irrigated; windbreak suitability group 2)

**Declo loam, 12 to 20 percent slopes, eroded (DeE2).**—This soil is similar to Declo loam, 0 to 2 percent slopes, except that the surface layer is only about 4 to 7 inches thick. It occurs on high terraces along the Snake River and occupies breaks along drainageways and terrace escarpments. Most areas are less than 10 acres in size. Surface runoff is rapid, and the hazard of erosion is severe.

Included are small areas where the slope is less than 12 percent or more than 20 percent, and areas of Portino silt loam, Portneuf silt loam, and Thornock stony loam.

This soil is used for permanent hay and pasture. (Capability unit IVe-1, irrigated)

**Declo fine sandy loam, 0 to 2 percent slopes (DcA).**—This soil is similar to Declo loam, 0 to 2 percent slopes, except for the texture of the surface layer. It occurs on high terraces along the Snake River. Most areas are less than 50 acres in size. Surface runoff is slow. The hazard of water erosion is slight, but the hazard of soil blowing is moderate.

Included are small areas of Declo loam, Portino silt loam, Portneuf silt loam, Thornock stony loam, and Fingal loam. Also included are areas where the slope is more than 2 percent.

This soil is used for irrigated hay, pasture, small grain, and potatoes. (Capability unit IIe-4, irrigated; windbreak suitability group 1)

**Declo fine sandy loam, 2 to 4 percent slopes (DcB).**—This soil is similar to Declo loam, 0 to 2 percent slopes, except for the texture of the surface layer. It occurs on high terraces adjacent to the Snake River in areas less than 10 acres in size. Surface runoff is slow to medium. The hazard of water erosion is slight to moderate, and the hazard of soil blowing is moderate.

Included are small areas of Declo loam, Portino silt loam, and Fingal loam. Also included are small areas where the slope is less than 2 percent or more than 4 percent.

This soil is used for irrigated hay, pasture, small grain, and potatoes. Potatoes are grown less frequently in the rotation than on Declo loam, 0 to 2 percent slopes. (Capability unit IIe-3, irrigated; windbreak suitability group 1)

**Declo fine sandy loam, 4 to 8 percent slopes (DcC).**—This soil is similar to Declo loam, 0 to 2 percent slopes, except for slope and texture of the surface layer. It occurs in areas less than 10 acres in size. It is on high terraces adjacent to the Snake River. Surface runoff is medium, and the hazard of water erosion or soil blowing is moderate.

Included are small areas of Declo loam, Portino silt loam, and Fingal loam. Also included are areas where the slope is less than 4 percent or more than 8 percent.



This soil is used for irrigated hay, pasture, small grain, and potatoes. Potatoes are grown less frequently in the rotation than on Declo loam, 0 to 2 percent slopes. (Capability unit IIIe-13, irrigated; windbreak suitability group 2)

## Dranyon Series

The Dranyon series consists of well-drained, nearly level to steep soils that are more than 40 inches deep. These soils formed under aspen and bunchgrass in residuum weathered from sandstone and a thin mantle of loess. They are on mountains and ridges. Dranyon soils are associated with soils of the Pavohroo, Nielsen, and Robin series.

Elevations range from 6,200 to 7,000 feet. The annual precipitation is 16 to 19 inches. The mean annual air temperature is 35° to 40° F. The frost-free period is 50 to 70 days, but in some areas frost may occur at any time during the year.

In a representative profile the surface layer is very dark grayish-brown and dark grayish-brown silt loam 20 inches thick. The subsoil is brown to light olive-gray clay loam that extends to a depth of about 52 inches. The substratum is light brownish-gray to pale-brown light clay loam and loam that extends to a depth of 67 inches.

Dranyon soils are used for woodland.

**Dranyon silt loam, hilly** (0 to 30 percent slopes) (DRF).—This soil is on uplands in areas that range from a few acres to about 400 acres in size.

Representative profile: 400 feet west and 200 feet north of the southwest corner of sec. 8, T. 2 S., R. 42 E., in an area of aspen trees and grasses:

A11—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; plentiful, very fine and fine, irregular pores; neutral; gradual, smooth boundary.

A12—7 to 13 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, irregular pores; neutral; clear, wavy boundary.

A3—13 to 20 inches, dark grayish-brown (10YR 4/2) heavy silt loam, dark brown (10YR 3/3) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, irregular pores; neutral; clear, wavy boundary.

IIB21t—20 to 31 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; many, very fine and fine, tubular pores; 10 percent of horizon is gravel; neutral; gradual, wavy boundary.

IIB22t—31 to 44 inches, pale-yellow (2.5Y 7/3) clay loam, light olive brown (2.5Y 5/3) when moist; moderate, fine, subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common, very fine and fine, tubular pores; thin, patchy clay films on all surfaces; few bleached silt grains on ped surfaces; neutral; gradual, smooth boundary.

IIB3t—44 to 52 inches, light olive-gray (5Y 6/2) clay loam, olive (5Y 5/4) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common, very fine and fine, tubular pores; thin, patchy clay films on ped surfaces; neutral; gradual, smooth boundary.

IIC1—52 to 59 inches, light brownish-gray (2.5Y 6/2) light clay loam, grayish brown (2.5Y 5/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common, very fine and fine, tubular pores; neutral; clear, wavy boundary.

IIC2—59 to 67 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few, very fine and fine, tubular pores; neutral.

The B horizon is dominantly clay loam, but in places it is heavy silt loam or gravelly clay loam. It ranges from 5 to 7 in color value when dry. Hues are typically 10YR or 2.5Y but are 7.5Y or 5Y in places. In places sandstone is at a depth of 40 inches, but typically it is at a depth of more than 60 inches.

Included are small areas where the slope is more than 30 percent, as well as areas of Nielsen extremely stony loam, Pavohroo loam, and Robin silt loam.

Permeability is moderately slow, and the available water capacity is 8 to 12 inches or more. Surface runoff is medium to rapid, and the hazard of water erosion is slight to severe. Roots can penetrate to a depth of more than 60 inches.

This soil produces aspen timber and an understory of grass. It is used for woodland grazing. (Capability unit VIe-1, dryland; woodland suitability group 2)

**Dranyon silt loam, steep** (30 to 60 percent slopes) (DRG).—This soil is similar to Dranyon silt loam, hilly, except for the slope. Surface runoff is rapid, and the hazard of water erosion is severe.

Included are small areas where the slope is less than 30 percent or more than 60 percent, as well as areas of Nielsen extremely stony loam, Pavohroo loam, and Robin silt loam.

This soil produces aspen timber and an understory of grass. It is used for woodland and for woodland grazing. (Capability unit VIIe-0, dryland; woodland suitability group 2)

**Dranyon-Gilispie complex, hilly** (0 to 30 percent slopes) (DSF).—This complex consists of about 65 percent Dranyon silt loam, hilly, and 30 percent Gilispie extremely stony loam, hilly. It is on narrow ridges and on mountain slopes that are incised by intermittent drainage-ways. Dranyon soils commonly occupy the southern and western exposures, and Gilispie soils are on ledges and escarpments on the ridges and adjacent to the drainage-ways. Sandstone bedrock crops out in places, and some areas are stony.

This complex is used mainly for woodland grazing and wildlife habitat. (The Dranyon part is in capability unit VIIIs-2, dryland; woodland suitability group 2. The Gilispie part is in capability unit VIIIs-2, dryland; Shallow Stony range site, 16 to 22 inches precipitation)

## Enochville Series

The Enochville series consists of somewhat poorly drained, nearly level soils that are more than 60 inches thick. These soils formed under bunchgrass, silver sagebrush, and big sagebrush in alluvium on bottom lands. They are associated with Robin, Gilispie, Lanark, and Outlet soils.

Elevations range from 5,800 to 6,800 feet. The annual precipitation is 16 to 22 inches. The mean annual air temperature is 38° to 42° F., and the frost-free period is 50 to 80 days.



In a representative profile the surface layer is mottled, dark-gray and dark grayish-brown silt loam and silty clay loam 25 inches thick. The subsoil is mottled, dark grayish-brown, grayish-brown, and yellowish-brown silty clay loam and gravelly sandy clay loam that extends to a depth of 60 inches.

Enochville soils are used for range.

**Enochville silt loam** (0 to 4 percent slopes) (En).—This soil occurs along intermittent drainageways in narrow areas that range from a few acres to about 200 acres in size.

Representative profile: 1,900 feet east and 220 feet south of the northwest corner of sec. 9, T. 3 S., R. 40 E., in a grassy area:

A11—0 to 7 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; few, medium, distinct, brown (10YR 5/3) mottles; strong, medium and fine, granular structure; slightly hard, friable, slightly plastic and slightly sticky; common fine and medium roots; many, very fine, irregular pores; neutral; gradual, smooth boundary.

A12—7 to 13 inches, dark-gray (10YR 4/1) light silty clay loam, black (10YR 2/1) when moist; few, fine, faint, brown (10YR 5/3) mottles; moderate, medium and coarse, granular structure; very hard, friable, plastic and sticky; common fine and medium roots; many very fine, and few fine and medium tubular pores; neutral; gradual, smooth boundary.

A13—13 to 25 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, subangular blocky structure; very hard, firm, plastic and sticky; common fine and medium roots; many very fine and fine, and few medium and coarse tubular pores; neutral; gradual, smooth boundary.

B21g—25 to 41 inches, dark grayish-brown (10YR 4/2) silty clay loam, grayish brown (10YR 5/2) when crushed, very dark grayish brown (10YR 3/2) when moist; common, medium, faint, brown (10YR 5/3) mottles and few, fine, distinct, very dark gray (10YR 3/1) mottles; weak, medium, subangular blocky structure; very hard, firm, plastic and sticky; few fine and medium roots; many very fine, and few fine and medium tubular pores; neutral; gradual, smooth boundary.

B22g—41 to 53 inches, grayish-brown (2.5Y 5/2) light silty clay loam, light brownish gray (10YR 6/2) when crushed, dark grayish brown (2.5Y 4/2) when moist; many, medium, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium and fine, subangular blocky structure; very hard, firm, plastic and sticky; few fine and medium roots; many very fine and fine, and few medium and coarse tubular pores; neutral; gradual, smooth boundary.

B23—53 to 60 inches, yellowish-brown (10YR 5/4) gravelly sandy clay loam, dark brown (10YR 4/3) when moist; many, medium, distinct, strong-brown (7.5YR 5/6) mottles and few, fine, grayish-brown (10YR 5/2) and light-gray (2.5Y 7/2) mottles; massive; hard, friable, slightly plastic and slightly sticky; few fine and medium roots; many, very fine and fine, tubular pores; neutral.

The A horizon ranges from 16 to 30 inches in thickness. The B horizon ranges from 20 to 40 inches in thickness and from 4 to 6 in color value when dry.

Included are small areas where the slope is more than 4 percent, as well as areas of Robin silt loam; Lanark silt loam, rolling; Gilispie extremely stony loam; and Outlet silty clay loam.

Permeability is moderately slow, and the available water capacity is 10 to 12 inches. Surface runoff is slow, and the hazard of water erosion is slight. Roots can penetrate to a depth of more than 40 inches.

This soil is used for range. (Capability unit IVw-9, dryland; Semivet Meadow range site)

## Fingal Series

The Fingal series consists of moderately well drained, nearly level to gently sloping soils that are more than 60 inches thick. These soils formed in alluvium under big sagebrush, greasewood, and saltgrass. They are on old lake terraces. Fingal soils are associated with Declo, Fulmer, and LaJara soils.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 8 to 11 inches. The mean annual air temperature is 45° to 49° F., and the frost-free period is 100 to 110 days.

In a representative profile the surface layer is gray loam 8 inches thick. The subsoil is grayish-brown loam and clay loam, underlain at a depth of 22 inches by light-gray silty clay. The substratum is limy.

Fingal soils are used mainly for hay, pasture (fig. 11), potatoes, sugar beets, and small grain.

**Fingal loam, 0 to 2 percent slopes** (FgA).—This soil occurs on lake terraces in areas that range from a few acres to about 200 acres in size.

Representative profile: 450 feet north and 20 feet west of the southeast corner of sec. 22, T. 4 S., R. 32 E., in a cultivated area.

Ap—0 to 8 inches, gray (N 5/0) loam, very dark grayish brown (2.5Y 3/2) when moist; moderate, fine and medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; slightly calcareous; moderately alkaline; gradual, smooth boundary.

B1—8 to 14 inches, grayish-brown (2.5Y 5/2) loam, light brownish gray (2.5Y 6/2), crushed; when moist, very dark grayish brown (2.5Y 3/2), dark grayish brown (10YR 4/2), crushed; moderate, medium and fine, granular structure; hard, friable, sticky and plastic; common very fine and fine roots; many very fine and fine, and few medium tubular pores; mildly alkaline; gradual, smooth boundary.

B2—14 to 22 inches, grayish-brown (2.5Y 5/2) light clay loam, light brownish gray (2.5Y 6/2), crushed; dark grayish brown (2.5Y 4/2) when moist; weak, medium and coarse, subangular blocky structure parting to weak, fine and medium, granular; hard, friable, sticky and plastic; common very fine and fine roots; common, very fine and fine, tubular pores; mildly alkaline; clear, wavy boundary.

IIC1gca—22 to 33 inches, light-gray (5Y 7/1) silty clay, olive gray (5Y 5/2) when moist; few, fine, distinct, very pale brown (10YR 7/3) and pale-yellow (2.5Y 7/3) mottles; weak, very fine, angular blocky structure; very hard, friable, very sticky and very plastic; common very fine roots; common, very fine, tubular pores; strongly calcareous; common medium splotches of lime; moderately alkaline; gradual, smooth boundary.

IIC2gca—33 to 45 inches, light-gray (5Y 7/1) silty clay, olive gray (5Y 5/2) when moist; common, fine and medium, distinct, very pale brown (10YR 7/3) and pale-yellow (2.5Y 7/3) mottles; weak, thick, platy structure; very hard, friable, very sticky and very plastic; few very fine roots; few, very fine, tubular pores; common, soft, brown and very dark gray iron-manganese concretions; strongly calcareous; common fine spots and splotches of lime; moderately alkaline; clear, wavy boundary.

IIIC3g—45 to 49 inches, light-gray (5Y 7/2) heavy silty clay loam, olive gray (5Y 5/2) when moist; many, medium and coarse, prominent, yellowish-brown (10YR 5/6), light yellowish-brown (10YR 6/4), and strong-brown (7.5Y 5/6) mottles; moderate, medium, platy (laminated) structure; hard, very friable, sticky and plastic; few very fine roots; common, very fine, tubular pores; few, soft, very dark gray (10YR 3/1) iron-manganese concretions between plates; strongly calcareous; few veins and splotches of lime; moderately alkaline; clear, wavy boundary.





Figure 11.—Wet native pasture in an area of Fingal soils. The vegetation is greasewood, foxtail, and saltgrass. Russian-olive trees are in the background.

IIIC4g—49 to 60 inches, light-gray (5Y 7/1) heavy silty clay loam, gray (5Y 6/1) when moist; few, medium, distinct, pale-yellow (2.5Y 7/4) stains between plates and in fractures; moderate, medium, platy structure; hard, friable, sticky and plastic; few very fine roots; few, very fine, tubular pores; few, fine, soft, iron-manganese concretions between plates; strongly calcareous; moderately alkaline.

The A horizon ranges from 6 to 8 inches in thickness. The Cca horizon begins at a depth of 20 to 33 inches. Faint to prominent mottling is between 20 and 40 inches. The B horizon is loam, silt loam, clay loam, or silty clay loam. At a depth of 18 to 30 inches, the soil is stratified lake-laid sediments.

Included are small areas where the slope is more than 2 percent. Also included are areas of Declo loam and Fulmer loam.

Permeability is slow, and the available water capacity is about 9 to 11 inches. Surface runoff is slow, and the hazard of water erosion is slight.

This soil is used for irrigated hay, pasture, potatoes, sugar beets, and small grain. (Capability unit IIs-9, irrigated; windbreak suitability group 4)

**Fingal loam, 2 to 4 percent slopes (FgB).**—This soil is similar to Fingal loam, 0 to 2 percent slopes, except for the slope. The areas are about 10 to 50 acres in size. Surface runoff is slow to medium. The hazard of water erosion is slight to moderate.

Included are small areas where the slope is less than 2 percent or more than 4 percent, as well as areas of Declo loam and Fulmer loam.

This soil is used for irrigated potatoes, sugar beets, alfalfa, and pasture. (Capability unit IIE-1, irrigated; windbreak suitability group 4)

**Fingal loam, saline, 0 to 2 percent slopes (FIA).**—This soil is similar to Fingal loam, 0 to 2 percent slopes, except that the surface layer is moderately affected by salt. The areas are 10 to 100 acres in size. Surface runoff is slow. The hazard of water erosion is slight.

Included are small areas where the slope is more than 2 percent and areas of nonsaline Fingal loam, Declo loam, and Fulmer loam.

This soil is used for irrigated hay, pasture, sugar beets, and small grain. (Capability unit IIIs-8, irrigated; windbreak suitability group 4)

**Fingal loam, saline, 2 to 4 percent slopes (FIB).**—This soil is similar to Fingal loam, 0 to 2 percent slopes, except that the surface layer is moderately affected by salt. The areas are 10 to 100 acres in size. Surface runoff is slow. The hazard of water erosion is slight.

Included are some areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of nonsaline Fingal loam, Declo loam, and Fulmer loam.

This soil is used for irrigated hay, pasture, sugar beets, and small grain. Crops are affected by salinity. (Capability unit IIIs-8, irrigated; windbreak suitability group 4)

**Fingal loam, strongly saline, 0 to 2 percent slopes (FmA).**—This soil is similar to Fingal loam, 0 to 2 percent slopes, except that the surface soil is strongly affected by salts. The areas are about 10 to 100 acres in size. Surface runoff is slow, and the hazard of water erosion is slight.

Included are small areas where the slope is more than



2 percent. Also included are areas of Declo loam, Fulmer loam, and nonsaline or saline Fingal loam.

This soil is used mainly for irrigated salt-tolerant grasses and legumes for pasture, and for barley. (Capability unit IVs-8, irrigated; Saline-alkali Meadow range site, 8 to 12 inches precipitation)

**Fingal clay loam, 0 to 2 percent slopes (FnA).**—This soil is similar to Fingal loam, 0 to 2 percent slopes, except that the surface texture is clay loam. It occurs on old lake terraces in areas 20 to 60 acres in size. Surface runoff is slow, and the hazard of water erosion is none to slight.

Included are small areas where the slope is more than 2 percent and areas of Fingal loam, Declo loam, and Fulmer loam.

This soil is used for irrigated sugar beets, small grain, alfalfa, and pasture. (Capability unit IIs-9, irrigated; windbreak suitability group 4)

## Firth Series

The Firth series consists of somewhat poorly drained, level to very gently sloping soils that are more than 60 inches deep. These soils formed under big sagebrush, rabbitbrush, and bunchgrass. They are on alluvial terraces. Firth soils are associated with Wapello, Wolverine, and Fulmer soils.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 39° to 45° F., and the frost-free period is 110 to 126 days.

In a representative profile the surface layer is grayish-brown sandy loam 12 inches thick. Next is light brownish-gray sandy loam that extends to a depth of about 40 inches. Below this are lake-laid deposits of silt loam. The soils are limy throughout.

Firth soils are used mainly for irrigated hay, pasture, small grain, and potatoes.

**Firth sandy loam (0 to 2 percent slopes) (Fr).**—This soil is on river terraces in areas that range from 10 to 150 acres in size.

Representative profile: 150 feet west and 1,325 feet south of the center of sec. 31, T. 2 S., R. 36 E., in a cultivated area:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure, soft, very friable, nonsticky and nonplastic; many fine and medium roots; many, very fine, irregular pores; slightly calcareous; mildly alkaline; gradual, smooth boundary.

A1—6 to 12 inches, grayish-brown (10YR 5/2) sandy loam; very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; many, very fine and fine, irregular pores; slightly calcareous; mildly alkaline; gradual, smooth boundary.

C1—12 to 24 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many, fine and very fine, irregular pores; moderately calcareous; mildly alkaline; gradual, wavy boundary.

C2—24 to 40 inches, light brownish-gray (10YR 6/2) sandy loam, grayish brown (10YR 5/2) when moist; common, medium, distinct mottles; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many, very fine and fine, irregular pores; strongly calcareous; mildly alkaline; gradual, wavy boundary.

IIC3—40 to 60 inches, light-gray (10YR 7/1) silt loam, grayish brown (10YR 5/2) when moist; many, medium, prominent mottles that are dark yellowish brown (10YR 3/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; strongly calcareous; moderately alkaline.

The A horizon ranges from 8 to 16 inches in thickness. The C horizon is moderately or strongly calcareous. It ranges from 5.5 to 6.5 in color value when dry and from 1 to 2 in chroma. Mottling occurs only in the lower horizons, commonly between 20 and 40 inches. The mottles range from a few to many and from faint to prominent. A IIC horizon of lake-laid silt loam is as shallow as 36 inches in some areas and is lacking in others.

Included are small areas where the slope is more than 2 percent and areas of Wapello fine sandy loam, Fulmer loam, and Wolverine sand, rolling.

Permeability is moderate, and the available water capacity is about 7 to 10 inches. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. This soil is somewhat poorly drained and is more than 40 inches deep.

This soil is used for hay, pasture, small grain, and potatoes. (Capability unit IIw-2, irrigated; windbreak suitability group 3)

**Firth sandy loam, drained (0 to 2 percent slopes) (Fs).**—This soil is similar to Firth sandy loam (0 to 2 percent slopes), except that the water table is generally at a depth below 4 feet. It occurs on river terraces in areas 10 to 150 acres in size. Surface runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included are small areas where the slope is more than 2 percent and areas of Wapello fine sandy loam, Fulmer loam, and Wolverine sand, rolling.

This soil is used for potatoes, small grain, legumes, and pasture. (Capability unit IIc-4, irrigated; windbreak suitability group 1)

## Fulmer Series

The Fulmer series consists of poorly drained, nearly level soils that are more than 60 inches thick. These soils formed under rushes, sedges, alkali bluegrass, wiregrass, saltgrass, and annual forbs in calcareous loamy alluvium. They are on river terraces. Fulmer soils are associated with soils of the LaJara, Wapello, Presto, Firth, and Weeding series.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 39° to 45° F., and the frost-free period is 110 to 126 days.

In a representative profile the surface layer is mottled gray loam 11 inches thick. The subsoil is mottled light-gray loam and silt loam that extends to a depth of 41 inches. The substratum is light-gray loam that extends to a depth of 62 inches. The soils are limy throughout.

Drained areas of Fulmer soils are used for irrigated hay, pasture, small grain, sugar beets, and potatoes. Undrained areas are used for wet meadow.

**Fulmer loam (0 to 2 percent slopes) (Fu).**—This soil is on river terraces in areas that range from 10 acres to 300 acres in size.

Representative profile: 700 feet south and 200 feet east



of the northwest corner of sec. 3, T. 3 S., R. 36 E., in a pasture:

A11—0 to 2 inches, gray (10YR 5/1) and grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when crushed, very dark brown (10YR 2/2) when moist; weak, thin and very thin, platy structure parting to weak, very fine, granular; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine, and few medium and coarse roots; many, very fine, irregular pores; moderately calcareous; moderately alkaline; clear, smooth boundary.

A12g—2 to 11 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; very few, fine, faint, yellowish-brown (10YR 5/4) mottles; moderate, fine, very fine, and medium, granular structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine, and few medium roots; many, very fine and fine, tubular pores; strongly calcareous; few fine spots of lime; mildly alkaline; gradual, smooth boundary.

B21g—11 to 25 inches, light-gray (N 6/0) loam, dark gray (N 4/0) when moist; few, fine, distinct, light yellowish-brown (10YR 6/4) mottles; weak, fine and very fine, granular structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many, very fine and fine, tubular pores; few, fine, soft, very dark gray (10YR 3/1) iron-manganese concretions; strongly calcareous; mildly alkaline; gradual, smooth boundary.

B22g—25 to 41 inches, light-gray (N 6/0) heavy silt loam, dark gray (N 4/0) when moist; many, medium, faint, light brownish-gray (2.5Y 6/2) mottles and few, fine, distinct, light yellowish-brown (10YR 6/4) mottles; weak, medium, fine and very fine, granular structure; hard, firm, sticky and plastic; common very fine and fine roots; many, very fine and fine, tubular pores; very few, fine, soft, very dark gray, iron-manganese concretions; strongly calcareous; mildly alkaline; gradual, smooth boundary.

Cg—41 to 62 inches, light-gray (N 7/0) loam, gray (N 5/0) when moist; few, very fine, distinct, light yellowish-brown mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common, very fine and fine, tubular pores; strongly calcareous; mildly alkaline.

The A horizon ranges from 6 to 12 inches in thickness. The hue is mainly 10YR, but it is 2.5Y in places. An organic surface horizon, 1 to 3 inches thick, occurs in some uncultivated areas. Faint to prominent mottling occurs in or immediately below the A1 horizon. In undrained areas the water table is generally below the A1 horizon and fluctuates considerably during the year. The soil is slightly calcareous to strongly calcareous.

Included are small areas of LaJara sandy loam; Wolverine sand, rolling; Wapello fine sandy loam, and Firth sandy loam.

Permeability is moderate. This soil is poorly drained and is wet much of the time, but the available water capacity is about 10 inches. Surface runoff is slow, and the hazard of water erosion is slight or none. Roots can penetrate to a depth of more than 60 inches, but penetration is limited by the water table.

This soil is used as wet pasture. (Capability unit Vw-2, irrigated; Wet Meadow range site)

**Fulmer loam, drained** (0 to 2 percent slopes) (Fv).—This soil is similar to Fulmer loam, except that the water table is at depths generally between 20 and 40 inches. It occurs on river terraces in areas about 10 to 50 acres in size.

Included are small areas of LaJara sandy loam; Wolverine sand, rolling; Wapello fine sandy loam, and Firth loam.

This soil is used for irrigated hay, pasture, small grain, and sugar beets. (Capability unit IIw-2, irrigated; wind-break suitability group 3)

## Gilispie Series

The Gilispie series consists of well-drained, nearly level to moderately steep, extremely stony soils that formed in loess and residuum weathered from basalt. The soils are on upland slopes. They are 10 to 20 inches deep to basalt bedrock. The vegetation is mainly bunchgrass and big sagebrush. Gilispie soils are associated with soils of the Robin, Lanark, and Dranyon series.

Elevations range from 5,500 to 6,500 feet. The annual precipitation is 18 to 22 inches. The mean air temperature is 40° to 43° F., and the frost-free period is 50 to 80 days.

In a representative profile the surface layer is dark grayish-brown and dark-brown extremely stony loam 6 inches thick. The subsoil is brown extremely stony clay loam that extends to a depth of about 16 inches, where it rests on basalt.

Gilispie soils are used as range.

**Gilispie extremely stony loam, hilly** (0 to 30 percent slopes) (G1F).—This soil (fig. 12) occurs on uplands in areas 20 to 200 acres in size.

Representative profile: 1,300 feet north and 100 feet east of the center of sec. 9, T. 3 S., R. 40 E., in an area of range:

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) extremely stony loam, very dark grayish brown (10YR 3/2) when moist; weak, very thin, platy structure parting to moderate, very fine, granular; soft, friable, slightly sticky and slightly plastic; common medium roots; many, very fine, irregular pores; 10 percent of horizon is stones; slightly acid; abrupt, smooth boundary.

A12—2 to 6 inches, dark-brown (10YR 4/3) extremely stony loam, dark brown (10YR 3/3) when moist; weak, fine and very fine, subangular blocky structure parting to moderate, very fine, granular; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; many, very fine, irregular pores; 5 percent of horizon is stones; neutral; clear, smooth boundary.

B2t—6 to 16 inches, brown (10YR 5/3) extremely stony clay loam, dark brown (7.5YR 3/3) when moist; weak, medium, prismatic structure parting to moderate, fine,



Figure 12.—An area of Gilispie extremely stony loam, hilly. The vegetation is sparse on this soil. The taller, dense vegetation in the background is on an area of a deep Robin soil.



subangular blocky; hard, firm, sticky and plastic; common fine and medium roots and few coarse roots; common, very fine and fine, tubular pores; thin, continuous clay coatings on all ped surfaces; 12 percent of horizon is stones; neutral; abrupt, wavy boundary.

R—16 inches, dark-gray (10YR 4/1), slightly weathered basalt.

The A horizon ranges from 4 to 8 inches in thickness. From 3 to 15 percent of the surface is covered by stones. The hue of the A horizon is 10YR or 2.5Y and the value ranges from 4 to 5 when dry. The B horizon is dominantly clay loam, but in places it is silty clay loam. The color value is 5 or 6 when dry, the chroma is 2 or 3, and the hue is 10YR or 7.5YR. The structure ranges from weak or moderate, medium, prismatic to weak or moderate, medium or fine, subangular blocky.

Included are small areas where the slope is more than 30 percent and areas of Robin silt loam; Lanark silt loam, rolling; and Dranyon silt loam.

Permeability is moderately slow, and the available water capacity is about 2 inches. The soil is low in productivity and supports a sparse cover of vegetation. Surface runoff is medium, and the hazard of water erosion is moderate. Bedrock is at a depth of less than 20 inches.

The soil is used for range. (Capability unit VIIIs-2, dryland; Shallow Stony range site, 16 to 22 inches precipitation)

**Gilispie extremely rocky loam, hilly** (0 to 30 percent slopes) (GMF).—This soil is similar to Gilispie extremely stony loam, hilly, except that there are many areas of rock outcrop and basalt ledges. It occurs as narrow areas, 20 to 100 acres in size, along upland drainageways. Surface runoff is medium, and the hazard of water erosion is moderate.

Included are small areas where the slope is more than 30 percent and areas of Robin silt loam; Lanark silt loam, rolling; and Dranyon silt loam.

The soil is used for range. (Capability unit VIIIs-2, dryland; Shallow Stony range site, 16 to 22 inches precipitation)

## Gravel Pit

Gravel pit (Gp) consists of areas where the soil has been removed and the underlying gravel has been excavated. The areas are scattered throughout the county. They are of little value for cultivation or grazing, but some of the pits contain water and are used by wildlife. (Capability unit VIIIs-1, dryland)

## Hayeston Series

The Hayeston series consists of well-drained, nearly level to very gently sloping soils that are less than 40 inches thick over sand and gravel. These soils formed under big sagebrush and bunchgrass in alluvium. They are on river terraces. Hayeston soils are associated with soils of the Heiseton, Bannock, Blackfoot, and Wardboro series.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 42° to 45° F., and the frost-free period is 110 to 126 days.

In a representative profile the surface layer is grayish-brown sandy loam that contains a little gravel and is 9 inches thick. The underlying material is light brownish-gray, calcareous sandy loam that extends to a depth of

30 inches. Below this is light brownish-gray very gravelly coarse sand. These soils are limy throughout.

Hayeston soils are used primarily for irrigated hay, pasture, small grain, and potatoes.

**Hayeston sandy loam, 0 to 2 percent slopes** (HcA).—This soil is on river terraces in areas that range from 10 to 200 acres in size.

Representative profile: 1,380 feet west and 150 feet north of southeast corner of sec. 2, T. 3 S., R. 34 E., in a cultivated area:

Ap—0 to 9 inches, grayish-brown (2.5Y 5/2) sandy loam, light brownish gray (10YR 6/2) when crushed, very dark grayish brown (10YR 3/2) when moist; weak, very fine, fine, and medium, granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many, very fine, irregular pores and many, very fine and fine, tubular pores; 2 percent of horizon is fine gravel; moderately calcareous; moderately alkaline; abrupt, smooth boundary.

C1—9 to 30 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; abrupt, wavy boundary.

IIC2—30 to 60 inches, light brownish-gray (2.5Y 6/2) very gravelly coarse sand; single grain; loose when dry or moist; common very fine and fine roots; many, very fine, irregular pores; about 60 percent of horizon is rounded gravel; moderately calcareous; a few pebbles are coated on lower sides with lime; moderately alkaline.

The A horizon ranges from 5 to 10 inches in thickness and is slightly or moderately calcareous. It ranges from 5 to 6 in color value when dry and from 2 to 3 in chroma. The C1 horizon ranges from 5 to 6 in color value when dry. It is massive or has weak granular structure. The depth to the IIC horizon ranges from 25 to 40 inches.

Included are small areas where the slope is more than 2 percent. Also included are areas of Heiseton sandy loam, Wardboro soils, Bock loam, and Bannock loam.

Permeability is moderately rapid, and the available water capacity is about 4 to 5 inches. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. Roots can penetrate to a depth of 20 to 40 inches.

This soil is used for irrigated hay, pasture, small grain, and potatoes. (Capability unit IIIs-3, irrigated; wind-break suitability group 1)

**Hayeston sandy loam, 2 to 4 percent slopes** (HcB).—This soil is similar to Hayeston sandy loam, 0 to 2 percent slopes, except for the slope. It occurs on river terraces in areas generally 10 to 100 acres in size. Surface runoff is medium, and the hazards of water erosion and soil blowing are moderate.

Included are small areas where the slope is less than 2 percent. Also included are areas of Heiseton sandy loam, Wardboro soils, Bock loam, and Bannock loam.

This soil is used for irrigated hay, pasture, small grain, and potatoes. (Capability unit IIIs-13, irrigated; wind-break suitability group 1)

**Hayeston loam, 0 to 2 percent slopes** (HeA).—This soil is similar to Hayeston sandy loam, 0 to 2 percent slopes, except for the texture of the surface layer and the rate of permeability. It occurs on river terraces in areas that are 10 to 100 acres in size. Surface runoff is slow, and the hazard of water erosion is slight.

Included are small areas where the slope is more than



2 percent. Also included are areas of Heiseton sandy loam, Wardboro soils, Bock loam, and Bannock loam.

This soil is used for irrigated hay, pasture, small grain, potatoes, and sugar beets. (Capability unit IIs-1, irrigated; windbreak suitability group 1)

## Heiseton Series

The Heiseton series consists of moderately well drained, level to very gently sloping soils that are more than 40 inches deep to sand and gravel. These soils formed under big sagebrush and bunchgrass in alluvium. They are on river terraces. The texture is stratified sandy loam and fine sandy loam. Heiseton soils are associated with soils of the Hayeston, Bannock, Blackfoot, and Wardboro series.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 42° to 45° F., and the frost-free period is 110 to 126 days.

In a representative profile the surface layer is grayish-brown sandy loam 8 inches thick. The underlying material is light brownish-gray, dominantly fine sandy loam that extends to a depth of 45 inches. This is underlain by light brownish-gray very gravelly coarse sand. These soils are limy throughout.

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

**Heiseton sandy loam, 0 to 2 percent slopes (HsA).—**This soil is on river terraces in areas that range from 10 to 200 acres in size.

Representative profile: 150 feet south and 50 feet east of the northwest corner of the SW $\frac{1}{4}$  sec. 11, T. 3 S., R. 34 E., in an area of grasses:

A11—0 to 2 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure parting to weak, fine, granular; soft, very friable, nonsticky and nonplastic; many very fine and fine, and few medium roots; many, very fine, irregular pores; slightly calcareous; moderately alkaline; abrupt, smooth boundary.

A12—2 to 8 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, very fine, granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; common, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

C1—8 to 18 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard; friable, nonsticky and nonplastic; many very fine and fine roots; many, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; abrupt, wavy boundary.

C2—18 to 32 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many, very fine and fine, tubular pores; moderately calcareous; mildly alkaline; clear, wavy boundary.

C3—32 to 38 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; few, fine, faint mottles of yellowish brown (10YR 5/4); massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; moderately calcareous; mildly alkaline; clear, wavy boundary.

C4—38 to 45 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; few, fine, faint mottles of yellowish brown (10YR 5/4); massive; slightly hard, firm, slightly sticky and slightly plastic;

common very fine and fine roots; many, very fine and fine, tubular pores; moderately calcareous; mildly alkaline; abrupt, wavy boundary.

IIC5—45 to 65 inches, light brownish-gray (10YR 6/2) very gravelly coarse sand; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; many, very fine, irregular pores; about 60 percent of horizon is rounded gravel; moderately calcareous; mildly alkaline.

The A horizon ranges from 5 to 12 inches in thickness. It ranges from 5 to 6 in color value when dry and from 2 to 3 in chroma. The C horizons have color values ranging from 5.5 to 6.5 when dry. The textures are stratified but are dominantly fine sandy loam or sandy loam. In places the material is silt loam or loam. Faint to distinct mottles are common at a depth below 30 inches. A nonconformable, very gravelly IIC horizon occurs at depths below 40 inches.

Included are small areas where the slope is more than 2 percent. Also included are areas of Hayeston sandy loam, Wardboro soils, Bannock loam, and Bock loam.

Permeability is moderately rapid, and the available water capacity is about 6 to 8 inches. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. Roots can penetrate to a depth of more than 60 inches.

This soil is used for irrigated hay, pasture, small grain, and potatoes. (Capability unit IIE-4, irrigated; windbreak suitability group 3)

**Heiseton sandy loam, 2 to 4 percent slopes (HsB).—**This soil is similar to Heiseton sandy loam, 0 to 2 percent slopes, except for the slope. It occurs on river terraces in areas 10 to 100 acres in size. Surface runoff is slow to medium, and the hazards of water erosion and soil blowing are moderate.

Included are small areas where the slope is less than 2 percent. Also included are areas of Hayeston sandy loam, Wardboro soils, Bannock loam, and Bock loam.

This soil is used for irrigated hay, pasture, small grain, and potatoes. (Capability unit IIE-3, irrigated; windbreak suitability group 3)

**Heiseton loam, 0 to 2 percent slopes (HtA).—**This soil is similar to Heiseton sandy loam, 0 to 2 percent slopes, except for the texture of the A horizon and the rate of permeability. It occurs on low river terraces in areas 10 to 100 acres in size. Surface runoff is slow, and the hazard of water erosion is slight. Permeability is moderate.

Included are small areas where the slope is more than 2 percent. Also included are areas of Hayeston sandy loam, Wardboro soils, Bannock loam, and Bock loam.

This soil is used for irrigated hay, pasture, small grain, potatoes, and sugar beets. (Capability unit IIC-2, irrigated; windbreak suitability group 3)

## Hymas Series

The Hymas series consists of well-drained, hilly to steep, medium-textured soils. These soils formed in loess and limestone residuum and colluvium. They are on upland ridges and side slopes. The vegetation consists mainly of big sagebrush, bunchgrass, and antelope bitterbrush. Hymas soils are associated with soils of the Wahtigup and Ricrest series.

Elevations range from 4,500 to 7,000 feet. The annual precipitation ranges from 11 to 13 inches. The mean annual air temperature is 40° to 43° F., and the frost-free period is 80 to 110 days.



In a representative profile the surface layer is grayish-brown extremely stony loam 7 inches thick. The underlying material is brown loam and is 20 percent limestone gravel and stones. A layer of light-gray loam, 4 inches thick, occurs above the limestone bedrock. It is 40 percent limestone gravel and stones. The depth to bedrock is 18 inches. These soils are limy throughout but are most limy immediately above the bedrock.

Hymas soils are used for range and water supply.

**Hymas extremely stony loam, hilly** (0 to 30 percent slopes) (HYF).—This soil is on upland mountain ridges and south- and west-facing areas. The surface is convex, and most slopes range from 10 to 30 percent.

Representative profile: 1,980 feet west and 165 feet south of the northeast corner of sec. 35, T. 1 S., R. 38 E., on a 22 percent southwest-facing slope, in an area of range:

A11—0 to 4 inches, grayish-brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many very fine and fine pores; about 20 percent of horizon is limestone gravel and stones; moderately calcareous; mildly alkaline; gradual, smooth boundary.

A12—4 to 7 inches, grayish-brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) when moist; moderate, very fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine pores; about 20 percent of horizon is gravel and stones; moderately calcareous; mildly alkaline; gradual, wavy boundary.

C1—7 to 14 inches, brown (10YR 5/3) gravelly loam, brown (10YR 4/3) when moist; moderate, very fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine pores; about 30 percent of horizon is limestone gravel and stones; strongly calcareous; moderately alkaline; clear, wavy boundary.

C2—14 to 18 inches, light-gray (10YR 7/2) gravelly loam, brown (10YR 5/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine pores; about 40 percent of horizon is limestone gravel and stones; very strongly calcareous; moderately alkaline; abrupt, wavy boundary.

R—18 inches, gray (N 5/0) fractured limestone.

The hue of the A and C horizons is typically 10YR, but it is 2.5Y in places. The amount of gravel and stones on the surface ranges from 20 to 40 percent. The C horizon is 40 to 60 percent lime. It begins at a depth of 6 to 14 inches and extends to bedrock, which begins at a depth of 10 to 20 inches.

Included are small areas where the slope is more than 30 percent and areas of Wahtigup stony loam, Ricrest stony loam, and rock outcrop.

Permeability is moderate, and the available water capacity is 1 to 2 inches. Surface runoff is medium to rapid, and the hazard of water erosion is moderate to severe. The depth to bedrock is less than 20 inches.

This soil is used for range and wildlife habitat. It also serves as a watershed. (Capability unit VIIIs-2, dryland; Shallow Stony range site, 12 to 16 inches precipitation)

**Hymas extremely stony loam, steep** (30 to 60 percent slopes) (HYG).—This soil is similar to Hymas extremely stony loam, hilly, except for the slope. It is generally on upland mountain ridges and south- and west-facing slopes. Most areas are 100 to 300 acres in size. Surface runoff is rapid, and the hazard of water erosion is severe.

Included are small areas where the slope is less than 30 percent. Also included are areas of Wahtigup stony loam and Ricrest stony loam.

This soil is used for range and wildlife habitat. It also serves as a watershed. (Capability unit VIIIs-2, dryland; Steep Stony range site, 12 to 16 inches precipitation)

## Kimama Series

The Kimama series consists of well-drained, nearly level soils that are more than 40 inches thick. These soils formed under big sagebrush and bunchgrass in alluvium from loess. They are in basins or areas of trapped drainage.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 8 to 11 inches. The mean annual air temperature is 45° to 50° F., and the frost-free period is 110 to 130 days. Kimama soils are associated with soils of the Portneuf, Polatis, and Pancheri series.

In a representative profile the surface layer is grayish-brown and brown silt loam 11 inches thick. The subsoil is pale-brown heavy silt loam that extends to a depth of 30 inches. The substratum is light-gray silt loam that extends to a depth of more than 60 inches. The soil is limy only in the substratum.

Kimama soils are used for irrigated hay, pasture, small grain, and sugar beets. Nonirrigated areas are used for range.

**Kimama silt loam** (0 to 2 percent slopes) (Km).—This soil is in basins or areas of trapped drainage. The areas range from 5 to 50 acres in size.

Representative profile: 1,560 feet north and 700 feet west of the southeast corner of sec. 15, T. 5 S., R. 31 E., in an area of range:

A11—0 to 4 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium and fine, granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, irregular pores; mildly alkaline; gradual, smooth boundary.

A12—4 to 11 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; weak, medium, platy structure parting to moderate, medium, granular; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common, very fine and fine, tubular pores; mildly alkaline; gradual, smooth boundary.

B1—11 to 20 inches, pale-brown (10YR 6/3) heavy silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common fine and medium roots; common, very fine and fine, tubular pores; thin, patchy clay films; mildly alkaline; gradual, smooth boundary.

B2t—20 to 30 inches, pale-brown (10YR 6/3) heavy silt loam, pale brown (10YR 6/3) when rubbed; when moist, very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2) when rubbed; moderate, medium, subangular structure; slightly hard, friable, sticky and plastic; few fine and medium roots; common, very fine and fine, tubular pores; thin patchy clay films; few firm cicada krotovinas; mildly alkaline; clear, wavy boundary.

C1ca—30 to 45 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; common, very fine and fine, tubular pores; few firm cicada krotovinas; strongly calcareous; many lime veins, few firm nodules; moderately alkaline, gradual, smooth boundary.

C2ca—45 to 60 inches, light-gray (10YR 7/2) coarse silt loam, grayish brown (10YR 5/2) when moist; moderate,



medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; many very fine and fine, and few medium tubular pores; common cicada krotovinas; strongly calcareous; many lime veins; moderately alkaline.

The solum ranges from 25 to 35 inches in thickness. In places basalt bedrock begins at a depth below 40 inches.

Included are small areas where the slope is more than 2 percent, as well as areas of Portneuf silt loam and Panchari silt loam. Also included are small areas of soils in the bottoms of basins. These soils are lighter colored than this Kimama soil and have a more strongly developed subsoil; in places they are slowly permeable, and water accumulates for short periods during spring runoff.

Permeability is moderately slow, and the available water capacity is about 12 inches. Surface runoff is slow, and the hazard of water erosion is no more than slight. Roots can penetrate to a depth of more than 40 inches.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. (Capability unit IIc-2, irrigated; VIc-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

## Knull Series

The Knull series consists of well-drained soils on basalt plains. These soils have a silt loam surface layer and a clay loam subsoil. They formed in wind-laid silt and silty alluvium overlying basalt bedrock. The soils are nearly level to very gently sloping. The vegetation consists mainly of big sagebrush and bunchgrass. These soils are associated with Portino, Portneuf, and Thornock soils. In the Bingham Area they are mapped only in a complex with Portino soils.

Elevations range from 4,000 to 4,500 feet. The annual precipitation ranges from 8 to 11 inches, mean annual air temperature ranges from 45° to 52° F., and the frost-free period is 100 to 125 days.

In a representative profile the surface layer is light brownish-gray silt loam 5 inches thick. The subsoil is pale-brown light clay loam about 10 inches thick. The substratum is light-gray and white silt loam and clay loam. This material overlies basalt at a depth of 49 inches. The soil contains excess alkali, commonly in the subsoil and substratum, and it is limy in the substratum.

Knull soils are used mainly for irrigated small grain, sugar beets, potatoes, alfalfa, and pasture. Nonirrigated areas are used for range.

Representative profile: 150 feet north and 30 feet east of the southwest corner of sec. 6, T. 5 S., R. 31 E., in an uncultivated area:

A21—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, thin, platy structure parting to moderate, medium, granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, fine and medium, irregular pores; moderately alkaline; clear, smooth boundary.

A22—3 to 5 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, thin, platy structure parting to weak, fine, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common, fine and medium, tubular pores; moderately alkaline; clear, smooth boundary.

B21t—5 to 8 inches, pale-brown (10YR 6/3) light clay loam, brown (10YR 4/3) when moist; moderate, fine, prismatic

structure parting to moderate, fine, subangular blocky; hard, firm, sticky and plastic; thin patchy clay films on ped surfaces; common very fine and fine roots; common tubular pores; moderately alkaline; gradual, smooth boundary.

B22tsa—8 to 15 inches, pale-brown (10YR 6/3) light clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure parting to moderate, medium and fine, subangular blocky; hard, firm, sticky and plastic; common fine and medium roots; common, fine and medium, tubular pores; thin patchy clay films on ped surfaces and in pores; few fine veins and spots of salt; moderately alkaline; gradual, wavy boundary.

C1casa—15 to 21 inches, white (10YR 8/2) light clay loam, grayish brown (10YR 5/2) when moist; weak, fine, subangular blocky structure; slightly hard, firm, sticky and plastic; few fine and medium roots; few, fine and medium, tubular pores; strongly calcareous; few white veins and splotches of lime and salt; moderately alkaline; gradual, wavy boundary.

C2casa—21 to 27 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, platy structure parting to weak, medium and fine, subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; few fine and medium roots; few, very fine and fine, tubular pores; strongly calcareous; many white lime veins and splotches of salt; moderately alkaline; gradual, wavy boundary.

C3casa—27 to 32 inches, light-gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) when moist; massive; slightly hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; few fine pores; strongly calcareous; many white veins and splotches of lime and salt; moderately alkaline; gradual, wavy boundary.

C4ca—32 to 49 inches, white (10YR 8/2) silt loam, light brownish gray (10YR 6/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine pores; strongly calcareous; strongly alkaline; abrupt, wavy boundary.

IIR—49 inches, black (N 2/1) basalt; thick coating of lime on surface and in cracks.

The A horizon ranges from 3 to 6 inches in thickness. It has a color value of 5 or 6 when dry and a chroma of 2 or 3. The B horizon ranges from 5 to 7 in color value when dry. The Cca horizon has a color value of 6 to 8 when dry and a chroma of 2 or 3. The upper part of the C horizon contains few to many veins and splotches of lime and salt. The depth to bedrock ranges from 40 to more than 60 inches, but it is commonly less than 60 inches.

Permeability is slow, and the available water capacity is more than 8 inches. Runoff is medium, and the erosion hazard is slight to moderate.

## LaJara Series

The LaJara series consists of poorly drained, nearly level soils. These soils formed in mixed alluvium over lake-laid silty sediments. They occupy low terraces and bottom lands. The vegetation consists of wet meadow grasses. LaJara soils are associated with soils of the Fulmer and Fingal series.

Elevations range from 4,200 to 5,400 feet. The mean annual precipitation ranges from 11 to 13 inches. The annual soil temperature ranges from 41° to 47° F., and the frost-free season is 110 to 130 days.

In a representative profile the surface layer is gray sandy loam about 12 inches thick. The underlying material is mottled light-gray stratified sandy loam that extends to a depth of about 38 inches. The underlying material, to a depth of more than 60 inches, is lake-laid sediments of light-gray silt loam. These soils are limy throughout.



LaJara soils are used mainly for livestock grazing, but in places small areas are drained and used for irrigated sugar beets, small grain, and forage crops. They are also used for wildlife habitat and recreation.

**LaJara sandy loam** (0 to 2 percent slopes) (lc).—This soil occupies low terraces and bottom lands in areas 10 to 100 acres in size.

Representative profile: 1,300 feet north and 380 feet west of the southeast corner of sec. 32, T. 2 S., R. 36 E., in an area of wet meadow:

01—½ inch to 0, gray (10YR 5/1) root mat that consists principally of leaves, roots, and other organic material; very dark gray (10YR 3/1) when moist; abrupt, wavy boundary.

A11g—0 to 4 inches, gray (2.5Y 5/1) sandy loam, very dark gray (2.5Y 3/1) when moist; few, fine, distinct, light yellowish-brown (10YR 6/4) mottles; mottles are dark brown (7.5YR 4/4) when moist; weak, fine and medium, granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

A12g—4 to 12 inches, gray (2.5Y 5/1) sandy loam, very dark gray (2.5Y 3/1) when moist; common, medium, distinct, light yellowish-brown (10YR 6/4) and very pale brown (10YR 7/4) mottles; weak, fine and medium, granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and medium roots; many, very fine and fine, tubular pores; moderately calcareous; mildly alkaline; abrupt, smooth boundary.

C1g—12 to 28 inches, light-gray (2.5Y 7/1) sandy loam, dark gray (2.5Y 4/1) when moist; common, medium, distinct, light yellowish-brown (10YR 6/4) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many, very fine and fine, tubular pores; moderately calcareous; mildly alkaline; gradual, wavy boundary.

C2g—28 to 38 inches, light-gray (2.5Y 7/1) light sandy loam, gray (2.5Y 5/1) when moist; few, medium, faint, light yellowish-brown (2.5Y 6/4) when moist; mottles; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many, very fine and fine, tubular pores; moderately calcareous; mildly alkaline; clear, wavy boundary.

IIC3g—38 to 60 inches, light-gray (2.5Y 7/1) silt loam, dark gray (2.5Y 4/1) when moist; few, medium, distinct, pale-brown (10YR 6/3) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common, very fine and fine, tubular pores; moderately calcareous; common fine spots, veins, and splotches of lime; mildly alkaline.

The A1 horizon ranges from 10 to 14 inches in thickness. Its color value is 4 to 5 when dry, and its chroma is 1 or 2. The Cg horizon has a color value that ranges from 5 to 7 when dry. In places this horizon consists of stratified fine sandy loam, sandy loam, and coarse sandy loam. Nonconformable silt loam or loam lake-laid sediments are at a depth below 35 to 40 inches. The hues are dominantly 2.5Y but are 10YR or 5Y in places.

LaJara soils, as mapped in the Bingham Area, have less than 18 percent clay at depths between 10 and 40 inches. This is slightly less than is typical for the LaJara series.

Included are small, wet areas of LaJara sandy loam and areas of Fulmer loam.

Permeability is moderate, and the available water capacity is more than 8 inches. Surface runoff is very slow, and the hazard of water erosion is none to slight.

This soil is used for livestock grazing. (Capability unit Vw-2, irrigated; Wet Meadow range site)

**LaJara sandy loam, drained** (0 to 2 percent slopes) (ld).—This soil is similar to LaJara sandy loam, except

that it has been drained sufficiently to use for crops. Surface runoff is slow, and the hazard of water erosion is slight.

Included are small areas of Fulmer loam, drained, and areas of LaJara loam.

This LaJara soil has been drained sufficiently to keep the water table at a depth below 30 inches. The available water capacity is more than 8 inches.

This soil is used for irrigated sugar beets, small grain, and forage crops. (Capability unit IIw-2, irrigated; windbreak suitability group 3)

## Lanark Series

The Lanark series consists of well-drained, nearly level to moderately steep soils more than 60 inches deep. These soils formed under big sagebrush and bunchgrass in loess. They are on uplands. Lanark soils are associated with soils of the Robin, Gilispie, and Enochville series.

Elevations range from 6,000 to 7,000 feet. The annual precipitation is 14 to 18 inches. The mean annual air temperature is 40° to 42° F., and the frost-free period is 80 to 100 days. Some areas can have frost any day of the year.

In a representative profile the surface layer is grayish-brown, dark grayish-brown, and brown silt loam 14 inches thick. The subsoil is brown heavy silt loam and light silty clay loam that extends to a depth of 41 inches. The substratum is limy, pale brown and very pale brown silt loam.

Lanark soils are used mainly for range, because of the short growing season. Some areas in favorable locations are used for such dryland crops as small grain and alfalfa.

**Lanark silt loam, 4 to 12 percent slopes** (lkD).—This soil is on rolling uplands in areas that are 40 to 300 acres in size.

Representative profile: 580 feet north and 250 feet west of the center of sec. 22, T. 3 S., R. 40 E., in an area of grassland:

A11—0 to 2 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2, crushed) when moist; moderate, very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; common, very fine and fine, tubular pores; neutral; abrupt, smooth boundary.

A12—2 to 7 inches, dark grayish-brown (10YR 4/2) and dark-brown (10YR 4/3, crushed) silt loam, very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2, crushed) when moist; moderate, fine and medium, granular structure and weak, fine and medium, subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common, very fine and fine, tubular pores; neutral; gradual, smooth boundary.

A3—7 to 14 inches, brown (10YR 5/3) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common, very fine and fine, tubular pores; neutral; gradual, smooth boundary.

B1t—14 to 28 inches, brown (10YR 5/3) heavy silt loam, dark brown (10YR 3/3) when moist; weak, medium and coarse, subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common, very fine and fine, tubular pores; thin patchy clay films in some pores; few uncoated silt particles on peds; neutral; abrupt, wavy boundary.



B2t—28 to 41 inches, brown (10YR 5/3) and pale-brown (10YR 6/3, crushed) light silty clay loam, dark brown (10YR 4/3) when moist; weak, fine, prismatic structure parting to moderate, medium and fine, subangular blocky; hard, friable, sticky and plastic; few very fine roots; many, very fine, tubular pores; thin patchy clay films on peds; thin and medium, nearly continuous clay films on many pores; few uncoated silt particles on peds, mildly alkaline; gradual, smooth boundary.

C1ca—41 to 54 inches, pale-brown (10YR 6/3) heavy silt loam, brown (10YR 4/3) when moist; weak, medium and fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many, very fine and fine, tubular pores; thin patchy clay films in few pores; moderately calcareous; few fine veins and spots of lime; moderately alkaline; clear, wavy boundary.

C2ca—54 to 66 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many, very fine and fine, tubular pores; strongly calcareous; many fine veins and spots of lime; moderately alkaline.

The A1 horizon ranges from 12 to 25 inches in thickness. The B2t horizon is heavy silt loam or light silty clay loam. It ranges in chroma from 2 to 3. The Cca horizon is 15 to 25 percent lime. The solum, or the depth to the Cca horizon, ranges from 40 to 60 inches.

Included are small areas where the slope is less than 4 percent or more than 12 percent. Also included are areas of Robin silt loam; Gilispie extremely stony loam, hilly; and Enochville silt loam.

Permeability is moderately slow, and available water capacity is about 12 inches. Surface runoff is medium, and the hazard of water erosion is slight to moderate. This soil is more than 40 inches thick.

This soil is used for range and dryland small grain, but the frost hazard makes crop production somewhat uncertain. (Capability unit IIIe-4, dryland; Loamy range site, 16 to 22 inches precipitation)

**Lanark silt loam, 0 to 4 percent slopes (LkB).**—This soil is similar to Lanark silt loam, 4 to 12 percent slopes, except for the slope. It is on uplands in mountain valleys; the areas are 40 to 200 acres in size. Surface runoff is slow to medium, and the hazard of water erosion is slight.

Included are small areas where the slope is more than 4 percent. Also included are areas of Robin silt loam; Gilispie extremely stony loam, hilly; and Enochville silt loam.

This soil is used for range and dryland small grain. (Capability unit IIIe-4, dryland; Loamy range site, 16 to 22 inches precipitation)

**Lanark silt loam, 12 to 20 percent slopes (LkE).**—This soil is similar to Lanark silt loam, 4 to 12 percent slopes, except for the slope. It is on rolling uplands in mountain valleys; the areas are about 40 to 200 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate to severe.

Included are small areas where the slope is less than 12 percent or more than 20 percent. Also included are areas of Robin silt loam; Gilispie extremely stony loam, hilly; and Enochville loam.

This soil is used for range and dryland small grain. (Capability unit IIIe-4, dryland; Loamy range site, 16 to 22 inches precipitation)

**Lanark silt loam, rolling (0 to 30 percent slopes) (LNF).**—This soil is similar to Lanark silt loam, 4 to 12 percent slopes, except for the slope. Frost can occur at

any time of the year. This soil is on rolling uplands in mountain valleys; the areas are 40 to 400 acres in size. Surface runoff is slow to medium, and the hazard of water erosion is slight to moderate.

Included are small areas where the slope is more than 30 percent. Also included are areas of Robin silt loam; Gilispie extremely stony loam, hilly; and Enochville silt loam.

This soil is used for range. (Capability unit VIe-1, dryland; Loamy range site, 16 to 22 inches precipitation)

**Lanark-Robin silt loams, rolling (0 to 30 percent slopes) (LRF).**—This complex is made up of about 60 percent Lanark silt loam, rolling, and about 40 percent Robin silt loam, rolling. The soils are on rolling uplands. The Lanark soil generally occupies south- and west-facing slopes and ridgetops, and the Robin soil occupies north- and east-facing slopes.

The Lanark soil is similar to Lanark silt loam, 4 to 12 percent slopes, except that it is nearly level to moderately steep and the slopes are complex. The Robin soil is similar to Robin silt loam, 0 to 4 percent slopes, except that it is level to moderately steep and the slopes are complex.

This complex is used mainly for range and woodland. Frost can occur any month of the year; farming is risky and rarely attempted. (Capability unit VIe-1, dryland; Loamy range site, 16 to 22 inches precipitation)

## Lava Flows

Lava flows (0 to 30 percent slopes) (LS) is a miscellaneous land type made up of essentially bare basalt (fig. 13). The slope ranges from nearly level to steep, because of the irregular character of the lava. Cracks, crevices, and pressure ridges are common. Lava flows support very little, if any, vegetation, and the areas are inaccessible to livestock.

This miscellaneous land type is used for wildlife habitat and esthetic purposes. It also serves as a watershed. (Capability unit VIIIs-1, dryland)



Figure 13.—An area of Lava flows. The lava is essentially bare, the topography is uneven, and there are pressure ridges. The vegetation consists of sparse stands of sagebrush and a few stunted junipers.



## Lava Rock Land

Lava rock land (0 to 30 percent slopes) (LT) is a miscellaneous land type made up of 40 to 90 percent lava flows and 10 to 60 percent Thornock soils and a soil that resembles those of the Tenno series. The lava flows support little, if any, vegetation. In areas associated with Thornock and other soils, the soil material is less than 10 inches deep to basalt. The vegetation is big sagebrush and such grasses as bluebunch wheatgrass.

This miscellaneous land type is used mainly for limited livestock grazing. (Capability unit VIIIs-2, dryland; Very Shallow range site, 8 to 12 inches precipitation)

## Limestone Rock Land

Limestone rock land (50 to 90 percent slopes) (LV) is a miscellaneous land type made up mostly of limestone rock outcrops and smaller areas of very shallow soils. It is on very steep mountain slopes and canyon walls. The slope ranges from about 50 to 90 percent. The vegetation on the very shallow soils is limited to a few stunted juniper trees and small shrubby plants.

This land type is used for wildlife habitat and for esthetic purposes. It also serves as a watershed. (Capability unit VIIIs-1, dryland)

## Malm Series

The Malm series consists of well-drained, nearly level to very gently sloping soils 20 to 40 inches thick. These soils formed under big sagebrush and bunchgrass in wind-laid deposits. They are on basaltic plains. Malm soils are associated with soils of the Matheson, Bondbranch, and Pancheri series.

Elevations range from 4,300 to 5,000 feet. The annual precipitation is 8 to 11 inches. The mean annual air temperature is 42° to 45° F., and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is grayish-brown fine sandy loam 3 inches thick. The subsoil is brown and pale-brown fine sandy loam. The substratum is light-gray fine sandy loam. It extends to a depth of 34 inches and overlies basalt. These soils are limy in the subsoil and substratum.

Malm soils are used for irrigated pasture, potatoes, and small grain. Some areas are used for range.

**Malm fine sandy loam, 0 to 2 percent slopes (MaA).—**This soil is on uplands in areas that range from 5 to 100 acres in size.

Representative profile: 2,390 feet south and 390 feet west of the center of sec. 35, T. 1 S., R. 35 E., in an area of grassland:

- A1—0 to 3 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine pores; mildly alkaline; abrupt, wavy boundary.
- B1—3 to 6 inches, brown (10YR 5/3) and grayish-brown (10YR 5/2, crushed) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, thick, platy structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common, very fine and fine, tubular pores; 3 percent of horizon is fine gravel; mildly alkaline; clear, wavy boundary.

B2—6 to 18 inches, pale-brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common, very fine and fine, tubular pores; 4 percent of horizon is fine gravel; moderately calcareous; mildly alkaline; gradual, wavy boundary.

C1ca—18 to 23 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 5/3) when moist; weak, medium and fine, subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine and fine roots; common, very fine and fine, tubular pores; few firm cicada krotovinas; 5 percent of horizon is basaltic, angular fine gravel; strongly calcareous; few fine spots, veins, and coatings of lime on gravel; moderately alkaline; clear, wavy boundary.

C2ca—23 to 34 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 5/3) when moist; massive; hard, friable, nonsticky and nonplastic; few very fine and fine roots; common, very fine and fine, tubular pores; few firm cicada krotovinas; 5 percent of horizon is basaltic angular gravel; strongly calcareous; few spots and coatings of lime on gravel; strongly alkaline; abrupt, wavy boundary.

IIR—34 to 39 inches, very dark gray (10YR 3/1) basalt bedrock; lime coating on surface, in pores, and in cracks.

The A1 or Ap horizon ranges from 2 to 10 inches in thickness. It ranges from 5 to 6 in color value when dry. When the color value is as dark as 5 when dry, it is due mainly to the content of very dark basalt sand particles. The chroma is 2 or 3. The C horizon begins at a depth below 12 or 20 inches and is high in lime content. The color value is 6 or 7 when dry. The Cca horizon is sandy loam or fine sandy loam. Basalt fragments are common throughout the profile.

Included are small areas where the slope is more than 2 percent and areas of Matheson fine sandy loam; Bondbranch sandy loam, undulating; and Polatis silt loam.

Permeability is moderately rapid, and the available water capacity is about 3 to 6 inches. Surface runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate. The soil is 20 to 40 inches thick.

This soil is used for irrigated pasture, potatoes, and small grain. (Capability unit IIIs-3, irrigated; VIIs-3, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Malm fine sandy loam, 2 to 4 percent slopes (MaB).—**This soil is similar to Malm fine sandy loam, 0 to 2 percent slopes, except for the slope. It is on undulating or rolling uplands; the areas are 5 to 100 acres in size. Surface runoff is medium, and the hazards of water erosion and soil blowing are moderate.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Matheson fine sandy loam; Bondbranch sandy loam, undulating; and Polatis silt loam.

This soil is used for irrigated pasture, potatoes, and small grain. (Capability unit IIIs-13, irrigated; VIIs-3, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

## Marsh

Marsh (Mh) consists mainly of areas in basins on flood plains. The water table is at or near the surface much of the year. This land type has a broad range in texture, in depth to loose sand and gravel, and in content of organic matter. In places it resembles LaJara sandy loam or Fulmer loam. In most places a thin layer of peat or



muck is on the surface. The principal vegetation is cat-tails, rushes, watercress, and other water-tolerant plants.

Wetness limits use of this land to wildlife habitat and to recreation purposes. It also serves as a watershed. (Capability unit VIIIw-1, irrigated)

## Matheson Series

The Matheson series consists of well-drained, nearly level to gently sloping soils more than 40 inches thick. These soils formed under big sagebrush and bunchgrass in wind-laid sands. They are on upland slopes. Matheson soils are associated with Malm, Bondbranch, and Pancheri soils.

Elevations range from 4,300 to 5,000 feet. The annual precipitation is 8 to 11 inches. The mean annual air temperature is 40° to 45° F., and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is grayish-brown fine sandy loam 3 inches thick. The subsoil is brown and pale-brown fine sandy loam. The substratum is light-gray fine sandy loam that extends to a depth of 46 inches. The underlying material is basalt. Except for the surface layer, these soils are limy.

Matheson soils are used primarily for irrigated pasture, hay, potatoes, and small grain. Small areas are used for range.

**Matheson fine sandy loam, 2 to 4 percent slopes** (MnB).—This soil is on uplands. The areas range from 10 to 200 acres in size.

Representative profile: 250 feet west and 25 feet south of the northeast corner of sec. 10, T. 2 S., R. 35 E., in an area of range:

- A1—0 to 3 inches, grayish-brown (10YR 5/2) and light brownish-gray (10YR 6/2, crushed) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, platy structure parting to weak, very fine, granular; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many, very fine, tubular pores; mildly alkaline; clear, wavy boundary.
- B1—3 to 6 inches, brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2, crushed) when moist; weak, medium, subangular blocky structure parting to weak, very fine, granular; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many, very fine, tubular pores; slightly calcareous; mildly alkaline; clear, wavy boundary.
- B2—6 to 15 inches, pale-brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; gradual, wavy boundary.
- C1ca—15 to 32 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; common, very fine and fine, tubular pores; few hard cicada krotovinas; strongly calcareous; few fine spots and thin coatings of lime; strongly alkaline; gradual, wavy boundary.
- C2ca—32 to 46 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; common, very fine and fine, tubular pores; strongly calcareous; moderately alkaline; abrupt, wavy boundary.
- IIR—46 to 50 inches, very dark gray (10YR 3/1) vesicular basalt; thin coating of lime on surface and in pores and cracks.

The A horizon ranges from 5 to 6 in color value when dry and from 2 to 3 in chroma. The dark colors of the soil are caused mainly by the content of black basalt sand. The soil is slightly calcareous in the surface layer if cultivated or irrigated. The Cca horizon is sandy loam or fine sandy loam. The color value is 6 or 7 when dry. The lime content ranges from 15 to 25 percent. The depth to basalt bedrock is more than 40 inches.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Bondbranch sandy loam, undulating; Malm fine sandy loam; and Pancheri silt loam.

Permeability is moderately rapid, and the available water capacity is about 5 to 9 inches. Surface runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate. This soil is more than 40 inches deep to bedrock.

This soil is used for irrigated hay, pasture, small grain, and potatoes. (Capability unit IIe-3, irrigated; VIIs-3, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Matheson fine sandy loam, 0 to 2 percent slopes** (MnA).—This soil is similar to Matheson fine sandy loam, 2 to 4 percent slopes, except for the slope. It occurs on uplands; the areas are 10 to 200 acres in size. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

Included are small areas where the slope is more than 2 percent. Also included are areas of Bondbranch sandy loam, undulating; Malm fine sandy loam; and Pancheri silt loam.

This soil is used for irrigated hay, pasture, small grain, and potatoes. (Capability unit IIe-4, irrigated; VIIs-3, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Matheson fine sandy loam, 4 to 8 percent slopes** (MnC).—This soil is similar to Matheson fine sandy loam, 2 to 4 percent slopes, except for the slope. It occurs on rolling uplands; the areas are 10 to 100 acres in size. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate.

Included are small areas where the slope is more than 8 percent. Also included are areas of Bondbranch sandy loam, undulating; Malm fine sandy loam; and Pancheri silt loam.

This soil is used for irrigated hay, pasture, small grain, and potatoes. (Capability unit IIIe-13, irrigated; VIIs-3, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 2)

**Matheson-Bondbranch complex, undulating** (0 to 8 percent slopes) (MBC).—This complex is made up of about 35 percent Matheson fine sandy loam, 2 to 4 percent slopes; 30 percent Matheson fine sandy loam, 4 to 8 percent slopes; and 30 percent Bondbranch sandy loam, undulating. The topography and depth of the soil is influenced by underlying basalt. Slopes are generally short, and ridgetops are narrow and elongated. The upper slopes and ridgetops are occupied by Bondbranch soils; the lower slopes and swales are occupied by the deeper Matheson soils. Outcroppings of basalt occur on ridgetops and points.

The Matheson soils are similar to Matheson fine sandy loam, 2 to 4 percent slopes, except for the slope. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. The Bondbranch soil is similar to Bondbranch



sandy loam, undulating, which is described under the Bondranch series. In a few areas slopes are more than 4 percent.

This complex is used mainly for range. The intricate pattern of shallow Bondranch soils and the deeper Mathe-son soils makes cultivation difficult. (Capability unit VIIe-1, dryland; Loamy range site, 8 to 12 inches precipitation)

## Mike Series

The Mike series consists of well-drained, nearly level to moderately steep soils on canyon breaks and slopes. These soils formed under big sagebrush and bunchgrass in loess and residuum weathered from basalt. They are 10 to 20 inches deep. Mike soils are associated with soils of the Newdale, Tetonia, and Rexburg series.

Elevations range from 4,500 to 6,000 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 42° to 45° F., and the frost-free period is 95 to 110 days.

In a representative profile the surface layer is grayish-brown extremely stony silt loam about 5 inches thick. The subsoil is grayish-brown extremely stony silt loam about 5 inches thick. The substratum is white loam that extends to basalt bedrock at a depth of 18 inches. Except for the surface layer, these soils are limy. The most lime is in the substratum.

Mike soils are used for range.

**Mike extremely stony silt loam, 0 to 30 percent slopes (MoF).**—This soil is on breaks and slopes in canyons where streams have cut into a basalt plain. The areas of this soil are 10 to 100 acres in size.

Representative profile: 1,900 feet north and 980 feet west of the southeast corner of sec. 20, T. 2 S., R. 38 E., in an area of sagebrush and grasses:

A1—0 to 5 inches, grayish-brown (10YR 5/2) extremely stony silt loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure parting to weak, very fine and fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; about 10 percent of horizon is angular basalt stones and cobbles; mildly alkaline; clear, smooth boundary.

B2—5 to 10 inches, grayish-brown (10YR 5/2) and light brownish-gray (10YR 6/2, crushed) extremely stony silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine, and few medium tubular pores; few angular pebbles; 10 percent of horizon is angular basalt stones and cobbles; moderately calcareous; moderately alkaline; gradual, wavy boundary.

Cca—10 to 18 inches, white (10YR 8/2) extremely stony loam, pale brown (10YR 6/3) when moist; weak, medium and fine, subangular block structure; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots; few, very fine and fine, tubular pores; few angular pebbles; 10 percent of horizon is angular basalt stones and cobbles; common, very hard, ½-inch to 1-inch cicada krotovinas; strongly calcareous; many fine spots and coatings of lime on stones and cobbles; moderately alkaline; abrupt, wavy boundary.

IIR—18 to 23 inches, very dark gray (10YR 3/1) vesicular basalt; thick lime coating on surface, in cracks, and in pores.

The A1 horizon ranges from 5 to 7 inches in thickness. The chroma is 2 or 3. The A1 horizon is extremely stony silt loam or loam. The Cca horizon is strongly calcareous; it is 15 to

35 percent lime. It begins at a depth below 6 to 14 inches. The color value ranges from 6 to 8 when dry; chroma is 2 or 3. The horizon ranges from loam to silt loam in texture; it is stony or extremely stony.

Included are small areas where the slope is more than 30 percent and areas where a noncalcareous A horizon is 10 inches thick. Also included are areas of Newdale silt loam, Tetonia silt loam, and Lava rock land.

Permeability is moderate, and the available water capacity is about 2 inches. Surface runoff is medium to rapid, and the hazard of water erosion is slight to severe.

This soil is used for range. (Capability unit VIIe-2, dryland; Shallow Stony range site, 8 to 12 inches precipitation)

## Newdale Series

The Newdale series consists of well-drained, nearly level to steep soils more than 60 inches deep. These soils formed under big sagebrush and bunchgrass in calcareous loess. They are on uplands. Newdale soils are associated with soils of the Tetonia, Mike, and Swanner series.

Elevations range from 4,700 to 6,000 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 40° to 45° F., and the frost-free period is 95 to 110 days.

In a representative profile the surface layer is grayish-brown silt loam about 13 inches thick. It is underlain by light-gray silt loam that extends to a depth of 60 inches. The underlying material is limy.

Newdale soils are used for such dryland crops as small grain and hay. Some areas are used for range.

**Newdale silt loam, 4 to 12 percent slopes (NdD).**—This soil is on foot slopes in areas that range from a few acres to several hundred acres in size.

Representative profile: 920 feet north and 350 feet west of the center of sec. 19, T. 3 S., R. 39 E., in an area of native grass:

A11—0 to 2 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure parting to weak, very fine, granular; soft, very friable, nonsticky and slightly plastic; many very fine and fine roots; many, very fine, tubular pores; mildly alkaline; gradual, smooth boundary.

A12—2 to 13 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine, granular structure; slightly hard; very friable, nonsticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; mildly alkaline; gradual, smooth boundary.

C1ca—13 to 23 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; common hard cicada krotovinas; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—23 to 42 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, very 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; common hard cicada krotovinas; strongly calcareous; few fine veins, spots, and coatings of lime on nodules; moderately alkaline; gradual, smooth boundary.

C3—42 to 65 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; gradual, smooth boundary.

The A horizon ranges from 8 to 18 inches in thickness. The depth to the Ca horizon ranges from 8 to 18 inches. The Ca horizon is 20 to 30 percent lime.

Included are small areas where the slope is less than 4 percent or more than 12 percent. Also included are areas of Tetonia silt loam and Mike extremely stony silt loam, 0 to 30 percent slopes.

Permeability is moderate, and the available water capacity is about 11 inches. Surface runoff is medium, and hazard of water erosion is moderate. Roots can penetrate to a depth of more than 60 inches.

This soil is used primarily for such dryland crops as small grain and alfalfa. Some areas are used for range. (Capability unit IIIe-45, dryland; Loamy range site, 8 to 12 inches precipitation)

**Newdale silt loam, 0 to 4 percent slopes (NdB).**—This soil is similar to Newdale silt loam, 4 to 12 percent slopes, except for the slope. It occurs on the foot slopes and benches along the Blackfoot Mountains; the areas are 10 to 400 acres in size. Surface runoff is slow, and the erosion hazard is slight.

Included are small areas where the slope is more than 4 percent. Also included are areas of Tetonia silt loam and Mike extremely stony silt loam, 0 to 30 percent slopes.

This soil is used primarily for such dryland crops as small grain and alfalfa. (Capability unit IIIe-45, dryland; Loamy range site, 8 to 12 inches precipitation)

**Newdale silt loam, 12 to 20 percent slopes (Nde).**—This soil is similar to Newdale silt loam, 4 to 12 percent slopes, except for the slope. It occurs on the foot slopes along the Blackfoot Mountains in areas up to 300 acres in size. Surface runoff is rapid, and the hazard of water erosion is severe.

Included are small areas where the slope is less than 12 percent or more than 20 percent. Also included are areas of Tetonia silt loam and Mike extremely stony silt loam, 0 to 30 percent slopes.

This soil is used for such dryland crops as small grain and is also used for range. (Capability unit IIIe-45, dryland; Loamy range site, 8 to 12 inches precipitation)

**Newdale silt loam, hilly (20 to 30 percent slopes) (NEF).**—This soil is similar to Newdale silt loam, 4 to 12 percent slopes, except for the slope. The slope gradient and the location of the areas make the soil suitable only for range. The soil is on narrow or sloping ridges of the foot slopes along the Blackfoot Mountains; the areas are generally less than 100 acres in size. Runoff is rapid, and the hazard of water erosion is severe.

Included are small areas of Tetonia silt loam; Mike extremely stony silt loam, 0 to 30 percent slopes; and Swanner extremely stony loam. Also included are small areas where the slope is more than 30 percent.

This soil is used for range. (Capability unit VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation)

**Newdale silt loam, steep (30 to 60 percent slopes) (NEG).**—This soil is similar to Newdale silt loam, 4 to 12 percent slopes, except for the slope. It is on steep sides of old gullies incised into the rolling foot slopes by geologic erosion; the areas are generally less than 100 acres in size. Surface runoff is rapid, and the hazard of water erosion is severe.

Included are small areas where the slope is less than 30 percent or more than 60 percent. Also included are

areas of Tetonia silt loam; Mike extremely stony silt loam, 0 to 30 percent slopes; and Swanner extremely stony loam.

This soil is used for range. (Capability unit VIIe-0, dryland; Steep Slopes range site, 8 to 12 inches precipitation)

## Nielsen Series

The Nielsen series consists of well-drained, nearly level to steep soils less than 20 inches deep. These soils formed under big sagebrush and bunchgrass. They are on mountains and foot slopes. Nielsen soils are associated with Sessions and Robin soils.

Elevations range from 6,000 to 7,000 feet. The annual precipitation is 16 to 19 inches. The mean annual air temperature is 35° to 40° F., and the frost-free period is 50 to 80 days.

In a representative profile the surface layer is dark grayish-brown extremely stony loam 9 inches thick. The subsoil is brown and yellowish-brown channery and very channery loam. Bedrock begins at a depth of less than 20 inches.

Nielsen soils are not cultivated, because they are too shallow and stony and because the growing season is too short. They are used for range and wildlife habitat.

**Nielsen extremely stony loam, hilly (0 to 30 percent slopes) (NLF).**—This soil is on mountains and foot slopes. The areas (fig. 14) range from about 40 to 300 acres in size.

Representative profile: 1,200 feet west and 1,200 feet north of the southeast corner of sec. 8, T. 2 S., R. 42 E., in an area of range:

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) extremely stony loam, very dark brown (10YR 2/2) when moist; weak, very thin, platy structure parting to moderate, very fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; 5 percent of horizon is angular gravel and flagstones; neutral; abrupt, smooth boundary.



Figure 14.—An area of Nielsen extremely stony loam, hilly. The surface is extremely stony, and the topography is uneven. The vegetation is sparse.



A12—2 to 6 inches, dark grayish-brown (10YR 4/2) extremely stony loam, very dark brown (10YR 2/2) when moist; weak, thin and medium, platy structure parting to moderate, very fine and fine, granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine, and common fine tubular pores; 8 percent of horizon is angular gravel and flagstones; neutral; clear, wavy boundary.

A3—6 to 9 inches, dark grayish-brown (10YR 4/2) and brown (10YR 5/3, crushed) extremely stony loam, very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2, crushed) when moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine, and few fine tubular pores; 20 percent of horizon is angular fragments of sandstone; thin patchy clay films in some pores; neutral; clear, wavy boundary.

B21t—9 to 13 inches, brown (10YR 5/3) extremely stony loam, dark brown (10YR 3/3) when moist; moderate, very fine and fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine, and few fine tubular pores; 40 percent of horizon is angular fragments of sandstone; very thin patchy clay films on ped surfaces and in pores; neutral; clear, broken boundary.

B22t—13 to 19 inches, yellowish-brown (10YR 5/4) and light yellowish-brown (10YR 6/4, crushed) extremely stony loam, dark yellowish-brown (10YR 4/4) and yellowish brown (10YR 5/4, crushed) when moist; moderate, fine and very fine, subangular blocky structure; hard, friable, sticky and plastic; few very fine, fine, and medium roots; many very fine, and few fine and medium tubular pores; thin patchy clay films on ped surfaces and in pores; about 75 percent of horizon is angular fragments of sandstone; neutral; soil is in cracks in fractured bedrock; abrupt, irregular boundary.

R—19 inches +, very pale brown (10YR 7/4), partly weathered and fractured, sandstone bedrock, yellowish brown (10YR 5/4) when moist; coatings, 1 millimeter thick, of yellowish-brown loam between the platy fragments; mildly alkaline.

The A horizon ranges from 6 to 15 inches in thickness. The color value is 4 or 5 when dry, and the chroma is 2 or 3. The B horizon contains about 18 to 27 percent clay. The color value ranges from 4 to 6 when dry, and the chroma from 2 to 4. The underlying sandstone bedrock is calcareous in some places but noncalcareous in others. The entire profile is extremely stony.

Included are small areas where the slope is more than 30 percent and areas of Sessions silt loam and Robin silt loam.

Permeability is moderately slow, and the available water capacity is about 2 inches. Surface runoff is medium to rapid, and the erosion hazard is moderate to severe. Roots can penetrate to a depth of less than 20 inches.

The soil is used for range. (Capability unit VII-2, dryland: Shallow Stony range site, 16 to 22 inches precipitation)

**Nielsen extremely stony loam, steep** (30 to 60 percent slopes) (NIG).—This soil is similar to Nielsen extremely stony loam, hilly, except for the slope. It occurs on mountains in the Long Valley-Grays Lake area. The tracts are irregular in shape and are 20 to 200 acres in size. Surface runoff is medium to rapid, and the hazard of water erosion is moderate to severe.

Included are small areas where the slope is less than 30 percent or more than 60 percent. Also included are areas of Sessions silt loam and Robin silt loam.

This soil is used for range. It is too steep, stony, and shallow to be cultivated. (Capability unit VII-2, dryland; Steep Stony Slopes range site, 16 to 22 inches precipitation)

## Outlet Series

The Outlet series consists of somewhat poorly drained, nearly level and very gently sloping soils. These soils formed under grasses, sedges, and silver sagebrush in alluvium and lacustrine sediments. Outlet soils are associated with soils of the Robin, Lanark, Sessions, and Enochville series.

Elevations range from 5,500 to 7,000 feet. The annual precipitation is 16 to 19 inches. The mean annual air temperature is 35° to 40° F., and the frost-free period is 50 to 80 days.

In a representative profile the surface layer is very dark gray silty clay loam 16 inches thick. The underlying material is pinkish-gray, light reddish-brown, and light-brown stratified clay loam or loam. It extends to a depth of 60 inches or more. The depth to the seasonal high water table and to mottles ranges from 20 to 40 inches. The soil is limy below the surface layer.

Outlet soils are used mainly for range and wildlife habitat. Small areas are cut for meadow hay.

**Outlet silty clay loam** (0 to 4 percent slopes) (Ot).—This soil is on alluvial fans and flood plains and in lake basins. The areas are 10 to 300 acres in size.

Representative profile: 2,600 feet west and 2,250 feet north of the southeast corner of sec. 20, T. 3 S., R. 43 E. in an area of pasture:

A11—0 to 8 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; strong, medium, granular structure; hard, firm, sticky and plastic; many fine and fine roots; many, very fine, tubular pores; few uncoated silt particles; mildly alkaline; gradual, smooth boundary.

A12—8 to 16 inches, very dark gray (10YR 3/1) and dark gray (10YR 4/1, crushed) silty clay loam, black (10YR 2/1) when moist; weak, coarse, prismatic structure parting to strong, medium, granular; hard, firm, sticky and plastic; common very fine and fine roots; many, very fine, tubular pores; few uncoated silt particles; mildly alkaline; clear, wavy boundary.

C1ca—16 to 24 inches, pinkish-gray (7.5YR 7/2) clay loam, brown (7.5YR 5/2) when moist; weak, coarse, subangular blocky structure and weak, very fine and fine, granular; hard, friable, sticky and plastic; common very fine and fine roots; many, very fine and fine, tubular pores; strongly calcareous; many, fine, soft spots of lime; moderately alkaline; clear, wavy boundary.

C2ca—24 to 36 inches, light reddish-brown (5YR 6/3) light clay loam, pink (5YR 7/3) when crushed, reddish brown (5YR 4/4) when moist; few, medium, faint, reddish-brown (5YR 5/4) mottles; weak, medium, subangular blocky structure parting to weak, medium, granular; hard, friable, sticky and plastic; common very fine and fine roots; many, very fine and fine, tubular pores; strongly calcareous; many, fine, soft spots and coatings of lime; moderately alkaline; gradual, smooth boundary.

IIC3ca—36 to 46 inches, light reddish-brown (5YR 6/3) heavy loam, reddish brown (5YR 4/4) when moist; few, medium, faint, reddish-brown (5YR 5/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many, very fine and fine, tubular pores; few, very fine, dark-gray, soft concretions and stains of iron-manganese; strongly calcareous; common fine veins and spots of lime; mildly alkaline; gradual, smooth boundary.

IIC4—46 to 72 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 4/4) when moist; common, medium, faint, strong-brown (7.5YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; common, very fine, tubular pores; common, very fine, dark-gray, soft masses of iron-manganese; moderately calcareous; mildly alkaline.



The A horizon ranges from 12 to 16 inches in thickness. The color value is 3 or 4 when dry, and the hues are 10YR or 2.5Y. The Cca horizon begins at a depth below 12 to 18 inches. It contains 15 to 35 percent lime and is strongly calcareous. Faint or distinct mottles begin with the upper 24 inches of the soil and extend to a depth of 4 to 6 feet. At depths between 10 and 40 inches, the soil is dominantly clay loam, but it is stratified with other textures.

Included are small areas where the surface layer is silt loam or loam and the slope is more than 4 percent. Also included are areas of Robin silt loam, Lanark silt loam, Sessions silt loam, and Enochville silt loam.

Permeability is moderately slow, and the available water capacity is about 9 to 11 inches. Surface runoff is slow. Roots can penetrate to a depth of 60 inches or more.

This soil is used for range, meadow, hay, and wildlife habitat. (Capability unit IVw-9, dryland; Semiwet Meadow range site)

## Outlet Series, Noncalcareous Variant

This series consists of somewhat poorly drained, nearly level and very gently sloping loamy soils that are underlain by gravel and sand at depths of 20 to 40 inches. These soils formed in alluvium and lacustrine sediments. They are on alluvial fans and bottom lands. The vegetation is water-tolerant grasses, sedges, and rushes. These soils are associated with soils of the Robin, Lanark, Sessions, Enochville, and Outlet series.

Elevations range from 5,500 to 7,000 feet. The annual precipitation is 16 to 19 inches. Mean annual precipitation is 16 to 19 inches. The mean annual air temperature is 35° to 40° F., and the frost-free period is 50 to 80 days.

In a representative profile the surface layer is dark grayish-brown loam 10 inches thick. The subsoil is dark grayish-brown loam and clay loam that extends to a depth of 32 inches. The underlying sand and gravel begins at depths of less than 40 inches and extends to 60 inches or more.

The noncalcareous variant of the Outlet series is used mainly for range. Small areas are used for hay and small grain.

**Outlet loam, noncalcareous variant** (0 to 4 percent slopes) (Ou).—This soil is on alluvial fans and bottom lands. The areas are 10 to 50 acres in size.

Representative profile: 100 feet east and 30 feet south of the northwest corner of sec. 24, T. 4 S., R. 43 E., at the edge of a gravel pit on a nearly level alluvial fan in a field of alfalfa:

Ap—0 to 4 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many very fine and fine pores; 5 to 10 percent of horizon is gravel; neutral; clear, wavy boundary.

A1—4 to 10 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate, medium and coarse, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and medium roots; common, fine and medium, tubular pores; 5 percent of horizon is gravel; slightly acid; gradual, wavy boundary.

B21—10 to 15 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, medium, prismatic structure parting to moderate, medium and coarse, subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; common fine and medium roots; common, fine and medium, tubular pores; 5 to 10 percent of horizon is gravel; gradual, smooth boundary.

B22—15 to 22 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; few, fine, medium and coarse roots; few, coarse, tubular pores; 5 to 10 percent of horizon is gravel; neutral; gradual, smooth boundary.

B23—22 to 32 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; common, medium, distinct, dark reddish-brown (5YR 3/4) and dark-brown (7.5YR 4/4) mottles; moderate, medium, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few fine and medium roots; common, fine and medium, tubular pores; about 10 percent of horizon is gravel; neutral; abrupt, wavy boundary.

IIC1—32 to 38 inches, brown (10YR 5/3) very gravelly loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, firm, slightly sticky and slightly plastic; few medium and coarse roots; common, fine and medium, interstitial pores; about 40 percent of horizon is gravel; neutral; abrupt, wavy boundary.

IIIC2—38 to 60 inches, grayish-brown (10YR 5/2) very gravelly coarse sand; single grain; loose when dry or moist; few medium and coarse roots; common, very fine and fine, interstitial pores; about 60 percent of horizon is rounded gravel; gravel is sandstone, slate, and quartzite; neutral.

The B21 horizon is loam or clay loam. The underlying sand and gravel begins at a depth ranging from 20 to 40 inches.

Included are small areas of Robin, Lanark, Sessions, Enochville, and Outlet soils.

Permeability is moderately slow, and the available water capacity is about 6 to 8 inches. The water table is high in spring and early in summer but drops below a depth of 45 to 50 inches by late summer. Depth to sand and gravel is 20 to 40 inches. Runoff is slow, and the erosion hazard is slight to none.

This soil is used principally for pasture, but small areas are used for meadow, hay, alfalfa, and small grain. (Capability unit IVw-9, dryland; Semiwet Meadow range site)

## Packham Series

The Packham series consists of well-drained, nearly level and very gently sloping soils that are 20 to 35 inches thick over gravel and sand. These soils formed in mixed alluvium under a cover of three-tip sagebrush and grasses. They are on terraces of the Snake River. These soils are associated with soils of the Bannock, Bock, Stan, and Hayeston series.

Elevations range from 4,200 to 4,800 feet. The annual precipitation is 11 to 12 inches. The mean annual air temperature is 39° to 45° F., and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is grayish-brown gravelly loam 6 inches thick. The subsoil is brown gravelly loam 11 inches thick. The substratum is pale-brown and light brownish-gray very gravelly loam or sandy loam. It extends to a depth of 32 inches. Below this is very gravelly coarse sand that extends to a depth of 60 inches or more. The soils are limy at a depth below 24 inches.

Packham soils are used mainly for irrigated pasture, hay, and small grain.

**Packham gravelly loam, 0 to 2 percent slopes** (PaA).—This soil is on high terraces of the Snake River. The areas are 50 to 600 acres in size.



Representative profile: 2,100 feet east and 1,000 feet north of the southwest corner of sec. 24, T. 2 S., R. 34 E., in an irrigated pasture:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) and brown (10YR 5/3, crushed) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; 30 percent of horizon is gravel; mildly alkaline; clear, smooth boundary.

B1—6 to 12 inches, brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2, crushed) when moist; weak, medium, fine, and very fine, granular structure; hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; 35 percent of horizon is gravel; mildly alkaline; gradual, wavy boundary.

B2—12 to 17 inches, brown (10YR 5/3) gravelly loam, dark grayish brown (10YR 4/2) when moist; weak, fine, subangular blocky structure and weak, fine and medium, granular; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine, tubular pores; 45 percent of horizon is gravel; mildly alkaline; gradual, wavy boundary.

C1—17 to 24 inches, pale-brown (10YR 6/3) very gravelly loam, dark grayish brown (10YR 4/2) when moist; massive; hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; 60 percent of horizon is gravel; mildly alkaline; clear, wavy boundary.

C2ca—24 to 32 inches, light brownish-gray (10YR 6/2) very gravelly light sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; no roots; many, very fine, interstitial pores; 80 percent of horizon is gravel; slightly calcareous; lower side of gravel is slightly coated with lime; mildly alkaline; clear, wavy boundary.

IIC3—32 to 60 inches, light brownish-gray (10YR 6/2) very gravelly coarse sand; single grain; loose when dry or moist; many, very fine, interstitial pores; slightly calcareous; mildly alkaline.

The A1 or Ap horizon ranges from 5 to 8 inches in thickness. The chroma is 2 or 3. The B horizon has color value of 5 or 6 when dry. It extends to a depth of 12 to 20 inches. The gravel content ranges from 20 to 60 percent. The depth to the IIC horizon ranges from 20 to 40 inches. The gravel content of the C horizon ranges from 35 to 70 percent.

Included are small areas where the slope is more than 2 percent, as well as areas of Bannock loam.

Permeability is moderate, and the available water capacity is about 4 to 5 inches. Surface runoff is slow, and the hazard of water erosion is slight. Roots can penetrate to a depth of more than 60 inches.

This soil is used mainly for irrigated pasture. It also is used for some hay and small grain. Gravel somewhat hinders cultivation. (Capability unit IVs-1, irrigated; windbreak suitability group 5)

**Packham gravelly loam, 2 to 4 percent slopes (PaB).**—This soil is similar to Packham gravelly loam, 0 to 2 percent slopes, except for the slope. It is on long, narrow breaks along old stream channels that meander across the terraces. The areas range from a few acres to about 50 acres in size. Surface runoff is slow, and the hazard of water erosion is slight.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Bannock loam.

This soil is used mainly for irrigated pasture. It also is used for some hay and small grain. (Capability unit IVs-1, irrigated; windbreak suitability group 5)

## Paesl Series

The Paesl series consists of well-drained, nearly level soils overlying sand and gravel at depths ranging from 20 to 40 inches. These soils formed in mixed alluvium. They are on flood plains and terraces. Nearly all the areas are cultivated. In uncultivated areas the vegetation is big sagebrush, three-tip sagebrush, and bunchgrass. These soils are associated with Ammon, Stan, and Wapello soils.

Elevations range from 4,600 to 4,800 feet. The mean annual precipitation ranges from 11 to 13 inches. The mean annual air temperature ranges from 42° to 45° F., and the frost-free season is 110 to 130 days.

In a representative profile the surface layer is grayish-brown silt loam 9 inches thick. The subsoil is brown and light-brown silt loam. The substratum is pinkish-gray loam to a depth of 27 inches. It is underlain by light brownish-gray very gravelly loamy coarse sand that extends to a depth of more than 50 inches. The soil is limy throughout, but it is more limy in the lower part of the subsoil and substratum than in the surface layer.

Paesl soils are used for irrigated potatoes, sugar beets, small grain, alfalfa, and pasture.

**Paesl silt loam (0 to 2 percent slopes) (Pe).**—This soil is on flood plains and terraces. The areas are 50 to 200 acres in size. The surface is smooth, and slopes are generally less than 1 percent.

Representative profile: 500 feet west and 50 feet south of the northeast corner of sec. 27, T. 1 S., R. 37 E., in an irrigated grainfield:

Ap1—0 to 3 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure parting to weak, very fine and 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; moderately alkaline; clear, smooth boundary.

Ap2—3 to 9 inches, grayish-brown (10YR 5/2) heavy silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, granular structure; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many, very fine and fine, interstitial pores; few worm channels and worm casts; slightly calcareous; mildly alkaline; clear, smooth boundary.

B2—9 to 17 inches, brown (7.5YR 5/4) and light-brown (7.5YR 6/4, crushed) heavy silt loam, dark brown (7.5YR 3/2) and brown (7.5YR 4/4, crushed) when moist; few, medium, faint, grayish-brown (10YR 5/2) mottles; weak, coarse, prismatic structure parting to weak, medium and coarse, subangular blocky; hard, friable, sticky and plastic; common very fine, fine, and medium roots; many, very fine and fine, tubular pores; very few worm channels and worm casts; organic staining on some ped surfaces; slightly calcareous; mildly alkaline; gradual, smooth boundary.

B3ca—17 to 22 inches, light-brown (7.5YR 6/4) silt loam, slightly dark brown (7.5YR 4/2) ped surfaces when moist; weak, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; 10 percent of horizon is gravel; thin patchy clay films in few channels; moderately calcareous; gravel coated with lime on lower side; moderately alkaline; gradual, wavy boundary.

C1ca—22 to 27 inches, pinkish-gray (7.5YR 6/2) loam, brown (7.5YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, fine and very fine, tubular pores; 5 percent of horizon is



gravel; moderately calcareous; few fine veins and spots of lime; moderately alkaline; abrupt, smooth boundary.

IICca—27 to 34 inches, light brownish-gray (10YR 6/2) very gravelly loamy coarse sand, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many, very fine, interstitial pores; about 50 percent of horizon is gravel; moderately calcareous; gravel is coated with lime on lower half; moderately alkaline; gradual, wavy boundary.

IIC3ca—34 to 50 inches, light brownish-gray (10YR 6/2) very gravelly loamy coarse sand; single grain; loose when dry or moist; about 80 percent of horizon is rounded gravel, mostly quartzite; gravel is coated with lime on lower side; moderately calcareous.

The solum ranges from 15 to 25 inches in thickness. The A horizon is 2 or 3 in chroma. The B horizon is silt loam or loam and is 7.5YR or 5YR in hue. The Cca horizon is at a depth below 16 to 20 inches.

Included are small areas where the slope is more than 2 percent. Also included are areas of Paesl fine sandy loam and Ammon silt loam.

Permeability is moderate, and the available water capacity is 6 to 7 inches. Runoff is slow, and the erosion hazard is slight.

This soil is used for irrigated alfalfa, small grain, sugar beets, potatoes, and pasture. (Capability unit IIs-1, irrigated; windbreak suitability group 1)

**Paesl fine sandy loam** (0 to 2 percent slopes) (Pd).—This soil is similar to Paesl silt loam, except for the surface texture. It is on flood plains and terraces. The areas are 50 to 200 acres in size. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

Included are small areas of Paesl silt loam and Ammon silt loam.

This soil is used for irrigated potatoes, small grain, alfalfa, and pasture. (Capability unit IIIs-3, irrigated; windbreak suitability group 1)

## Pancheri Series

The Pancheri series consists of well-drained, nearly level to moderately sloping soils. These soils (fig. 15) formed under big sagebrush and bunchgrass in loess. They are on rolling upland plains. Pancheri soils are associated with soils of the Polatis, Tenno, and Kimama series.

Elevations range from 4,200 to 6,000 feet. The annual precipitation is 8 to 11 inches. The mean annual air temperature is 40° to 45° F., and the frost-free period is 110 to 120 days.

In a representative profile the surface layer is light brownish-gray and pale-brown silt loam 5 inches thick. The subsoil is pale-brown silt loam 8 inches thick. The substratum is light-gray and pale-brown, moderately and strongly calcareous silt loam. It extends to a depth of more than 50 inches. These soils are limy, especially in the substratum.

Pancheri soils are used mainly for irrigated hay, small grain, pasture, potatoes, and sugar beets. They are used for range where not irrigated. In years of favorable moisture, some dryland areas are used for grain.

**Pancheri silt loam, 2 to 4 percent slopes** (PhB).—This soil is on loess plains in areas that range from a few to about 400 acres in size.

Representative profile: 300 feet east and 100 feet south of the northwest corner of sec. 11, T. 2 S., R. 33 E., in an area of range:

A11—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, platy structure parting to weak, very fine and fine, granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine, vesicular pores; moderately alkaline; abrupt, smooth boundary.

A12—3 to 5 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10 YR 4/2) when moist; weak, medium, subangular block structure parting to weak, very fine,



Figure 15.—An area of Pancheri silt loam. The slope is 0 to 2 percent in the foreground and 2 to 4 percent in the background. Sprinkler systems are well suited to the uneven topography. This soil is used for potatoes, which are shipped to world markets as Idaho baking potatoes.



granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; common very fine and fine, and few medium interstitial pores; slightly calcareous; moderately alkaline; clear, wavy boundary.

**B2**—5 to 13 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, medium and coarse, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many fine and medium roots; many, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

**C1ca**—13 to 26 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; moderate, medium and fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common, very fine and fine, tubular pores; about 20 percent of horizon is very hard, very firm cicada krotovinas  $\frac{1}{2}$  to  $\frac{3}{4}$  inch in diameter; strongly calcareous; strongly alkaline; gradual, wavy boundary.

**C2ca**—26 to 40 inches, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; many, very fine and fine, tubular pores; about 5 percent of horizon is very hard, very firm cicada krotovinas; strongly calcareous; moderately alkaline; gradual, wavy boundary.

**C3ca**—40 to 58 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

**IIC4ca**—58 to 71 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; massive; hard, firm, slightly sticky and slightly plastic; no roots; many, very fine and fine, tubular pores; many basalt fragments; strongly calcareous; few spots of gypsum 2 or 3 millimeters in size; moderately alkaline.

The A horizon ranges from 4 to 10 inches in thickness. It has a color value of 5 or 6 when dry and a chroma of 2 or 3. It is generally noncalcareous in the upper 6 inches, except where land leveling or cultivation has mixed the horizons. The C horizon has a color value of 6 or 7 when dry and a chroma of 2 or 3.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Polatis silt loam and Tenno stony loam.

Permeability is moderate, and the available water capacity is about 10 inches. Surface runoff is slow or medium, and the hazard of water erosion is slight or moderate. Roots can penetrate to a depth of 60 inches or more.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. It is used for range and some grain where not irrigated. (Capability unit IIE-1, irrigated; VIE-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Pancheri silt loam, 0 to 2 percent slopes (PhA).**—This soil (fig. 16) is similar to Pancheri silt loam, 2 to 4 percent slopes, except for the slope. It is on loess plains in areas 10 to 300 acres in size. Surface runoff is slow. The hazard of water erosion is slight.

Included are small areas where the slope is more than 2 percent. Also included are areas of Polatis silt loam and Tenno stony loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. It is used for range and some grain where not irrigated. (Capability unit IIC-2, irrigated; VIC-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

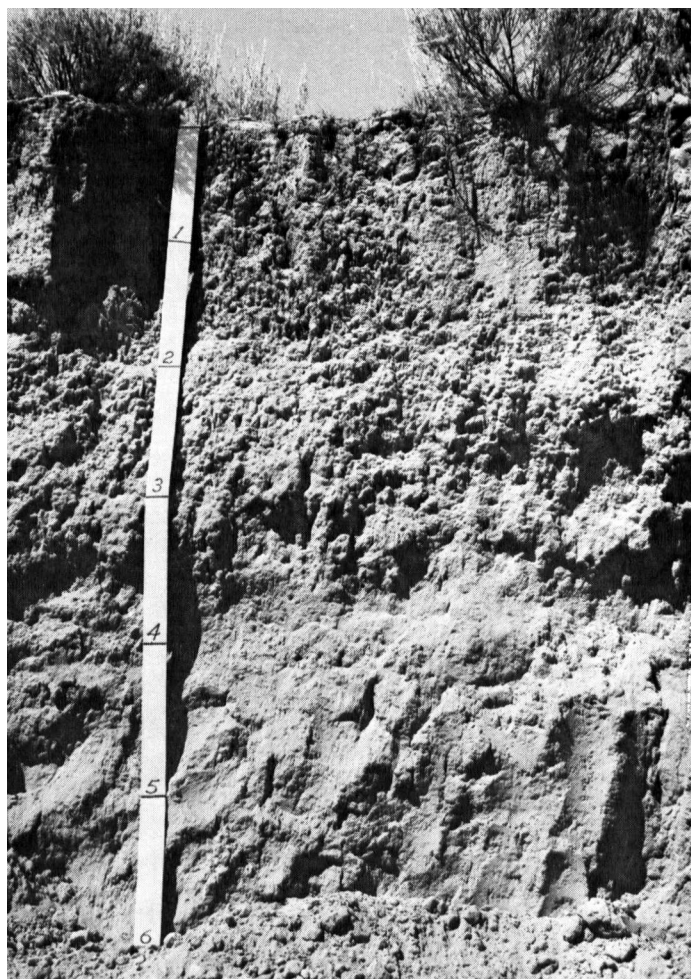


Figure 16.—Profile of Pancheri silt loam, 0 to 2 percent slopes.

**Pancheri silt loam, 4 to 8 percent slopes (PhC).**—This soil is similar to Pancheri silt loam, 2 to 4 percent slopes, except for the slope. It is on rolling loess plains in areas 10 to 100 acres in size. Surface runoff is medium. The hazard of water erosion is moderate.

Included are small areas where the slope is less than 4 percent or more than 8 percent. Also included are areas of Polatis silt loam and Tenno stony loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. It is used for range and some grain where not irrigated. (Capability unit IIIe-1, irrigated; VIE-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 2)

**Pancheri silt loam, 8 to 12 percent slopes (PhD).**—This soil is similar to Pancheri silt loam, 2 to 4 percent slopes, except for the slope. It is generally on rolling loess plains along intermittent drainageways. Areas range from about 10 acres to 100 acres in size. Surface runoff is medium to rapid, and the hazard of water erosion is moderate to severe.

Included are small areas where the slope is less than 8 percent or more than 12 percent and areas of Polatis silt loam and Tenno stony loam.



This soil is used for irrigated hay, pasture, and small grain. (Capability unit IVE-1, irrigated; VIE-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 2)

## Paniogue Series

The Paniogue series consists of well-drained, nearly level, loamy soils 20 to 40 inches deep to gravel and sand. These soils formed under big sagebrush and bunchgrass in calcareous alluvium. Paniogue soils are associated with soils of the Declo and Portneuf series.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 8 to 11 inches. The mean annual air temperature is 45° to 50° F., and the frost-free period is 110 to 130 days.

In a representative profile the surface layer is light brownish-gray loam 9 inches thick. The subsoil is light brownish-gray loam. A light-gray loam substratum overlies gravelly sand at a depth of 31 inches. The profile is limy throughout.

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

**Paniogue loam, 0 to 2 percent slopes (PnA).**—This soil is on alluvial terraces in areas 10 to 100 acres in size. It is nearly level.

Representative profile: 990 feet south and 75 feet east of the center of sec. 15, T. 6 S., R. 31 E., in an area of irrigated pasture:

Ap—0 to 4 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, interstitial pores; slightly calcareous; moderately alkaline; gradual, smooth boundary.

A1—4 to 9 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; moderate, medium and coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, interstitial pores; slightly calcareous; moderately alkaline; abrupt, wavy boundary.

B2—9 to 19 inches, light brownish-gray (10YR 6/2) loam, grayish brown (10YR 5/2) when moist; weak, medium, platy structure parting to weak, medium and fine, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; gradual, smooth boundary.

C1ca—19 to 31 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common, very fine and fine, tubular pores; many firm cicada krotovinas  $\frac{1}{2}$  to  $\frac{3}{4}$  inch in diameter; strongly calcareous; moderately alkaline; abrupt, wavy boundary.

IIC2ca—31 to 50 inches, pale-brown (10YR 6/3) gravelly sand, brown (10YR 4/3) when moist; single grain, loose when dry or moist; few medium and coarse roots; many, very fine and fine, interstitial pores; about 20 percent of horizon is gravel; strongly calcareous; moderately alkaline.

The A horizon ranges from 5 to 9 inches in thickness. The color value is 5 or 6 when dry and the chroma is 2 or 3. It generally is slightly calcareous. Sand and gravel are at a depth of 20 to 40 inches, and lime makes up more than 20 to 25 percent of the soil material at this depth.

Included are small areas where the slope is more than 2 percent. Also included are areas of Declo loam, Portneuf silt loam, and Paniogue loam.

Permeability is moderate, and the available water capacity is about 4 to 6 inches. Surface runoff is slow, and the hazard of water erosion is slight to none. Roots can penetrate to a depth of 20 to 40 inches.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. (Capability unit IIs-1, irrigated; windbreak suitability group 1)

## Pavohroo Series

The Pavohroo series consists of well-drained, nearly level to steep soils that have a surface layer of loam and silt loam and a clay loam subsoil. These soils formed in loess, colluvium, and residuum weathered from limestone. They are on ridges and sides of mountains. The vegetation consists mostly of Douglas-fir, aspen, and pinegrass. Pavohroo soils are associated with soils of the Sheegee and Ricrest series.

Elevations range from 6,000 to 8,000 feet. The annual precipitation ranges from 20 to 25 inches. The mean annual air temperature ranges from 37° to 42° F., and frost can occur at any time during the year.

In a representative profile the surface layer is very dark gray and dark grayish-brown loam and silt loam 17 inches thick. The subsoil is dark grayish-brown, grayish-brown, and brown clay loam and gravelly clay loam to a depth of 44 inches. The substratum is limy, brown gravelly loam. It extends to a depth of 56 inches and overlies fractured limestone bedrock.

Pavohroo soils are used for woodland and range.

**Pavohroo loam, steep (30 to 60 percent slopes) (PBG).**—This soil is on ridges and sides of mountains in areas 50 to 300 acres in size. The surface is convex, and slope ranges from 30 to 60 percent.

Representative profile: 1,300 feet south of the northeast corner of sec. 28, T. 2 S., R. 39 E., on a north-facing 35 percent slope in an area of timber:

O1—1 inch to 0, black (10YR 2/1) decomposed needles and leaves; abrupt, wavy boundary.

A11—0 to 3 inches, very dark gray (10YR 3/1) loam, black (10YR 2/1) when moist; moderate, fine, granular structure; soft, friable, slightly sticky and slightly plastic; abundant fine and medium roots; many, very fine and fine, interstitial pores; slightly acid; clear, smooth boundary.

A12—3 to 9 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure parting to moderate, medium, granular; slightly hard, friable, slightly sticky and slightly plastic; plentiful fine and medium roots; many, very fine and fine, interstitial pores; slightly acid; gradual, smooth boundary.

A13—9 to 17 inches, dark grayish-brown (10YR 4/2) loam that contains few angular fragments of limestone, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure parting to moderate, coarse, granular; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, interstitial pores; slightly acid; gradual, smooth boundary.

B1—17 to 26 inches, dark grayish-brown (10YR 4/2) light clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium and fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, tubular pores; common angular fragments of limestone; slightly acid; clear, wavy boundary.

B2—26 to 36 inches, grayish-brown (10YR 5/2) gravelly clay loam, dark grayish brown (10YR 4/2) when moist; mod-



erate, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, tubular pores; 20 percent of horizon is limestone gravel; slightly acid; gradual, wavy boundary.

**B3**—36 to 44 inches, brown (10YR 5/3) light gravelly clay loam, dark grayish brown (10YR 4/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many, very fine and fine, tubular pores; 30 percent of horizon is limestone gravel; slightly acid; gradual, wavy boundary.

**C**—44 to 56 inches, brown (10YR 5/3) gravelly loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many, very fine and fine, tubular pores; 35 percent of horizon is limestone gravel; slightly calcareous; mildly alkaline; abrupt, wavy boundary.

**R**—56 to 65 inches, gray (N 5/0) limestone, dark gray (N 4/0) when moist.

The A horizon has a color value of 3 or 4 when dry and a chroma of 1 or 2. The B horizon ranges from 4 to 6 in color value when the soil is dry and from 2 to 3 in chroma. Where present, the C horizon is slightly or moderately calcareous. The depth to the C horizon ranges from 36 to 48 inches. Limestone bedrock begins at a depth below 40 inches, commonly below 55 or 60 inches.

Included are small areas where the slope is less than 30 percent, as well as areas of Sheege extremely stony loam and Ricrest loam.

Permeability is moderately slow, and the available water capacity is about 7 to 9 inches. Surface runoff is medium to rapid, and the erosion hazard is severe. Roots can penetrate to a depth of more than 40 inches, or to bedrock.

This soil is suited to the production of timber and to limited woodland grazing. (Capability unit VIIe-0, dryland; woodland suitability group 4)

**Pavohroo loam, hilly** (0 to 30 percent slopes) (PBF).—This soil is similar to Pavohroo loam, steep, except for the slope. It is generally on ridges and sides of mountains; the areas are 100 to 300 acres in size. Runoff is medium or rapid, and the erosion hazard is moderate to severe.

Included are small areas where the slope is more than 30 percent. Also included are areas of Sheege extremely stony loam and Ricrest loam.

This soil is used for woodland and for woodland grazing. (Capability unit VIe-1, dryland; woodland suitability group 4)

## Polatis Series

The Polatis series consists of well-drained, nearly level to moderately sloping soils that are 20 to 40 inches deep to bedrock. These soils (fig. 17) formed under big sagebrush and bunchgrass in limy loess. They are on undulating uplands. Polatis soils are associated with Pancheri, Tenno, and Kimama soils.

Elevations range from 4,200 to 5,000 feet. The mean annual precipitation is 8 to 11 inches. The mean annual air temperature is 42° to 45° F., and the frost-free period is 110 to 120 days.

In a representative profile the surface layer is light brownish-gray silt loam 3 inches thick. The subsoil is pale-brown silt loam 4 inches thick. The substratum is light-gray silt loam. Basalt bedrock is at a depth of 28 inches. The profile is limy throughout.

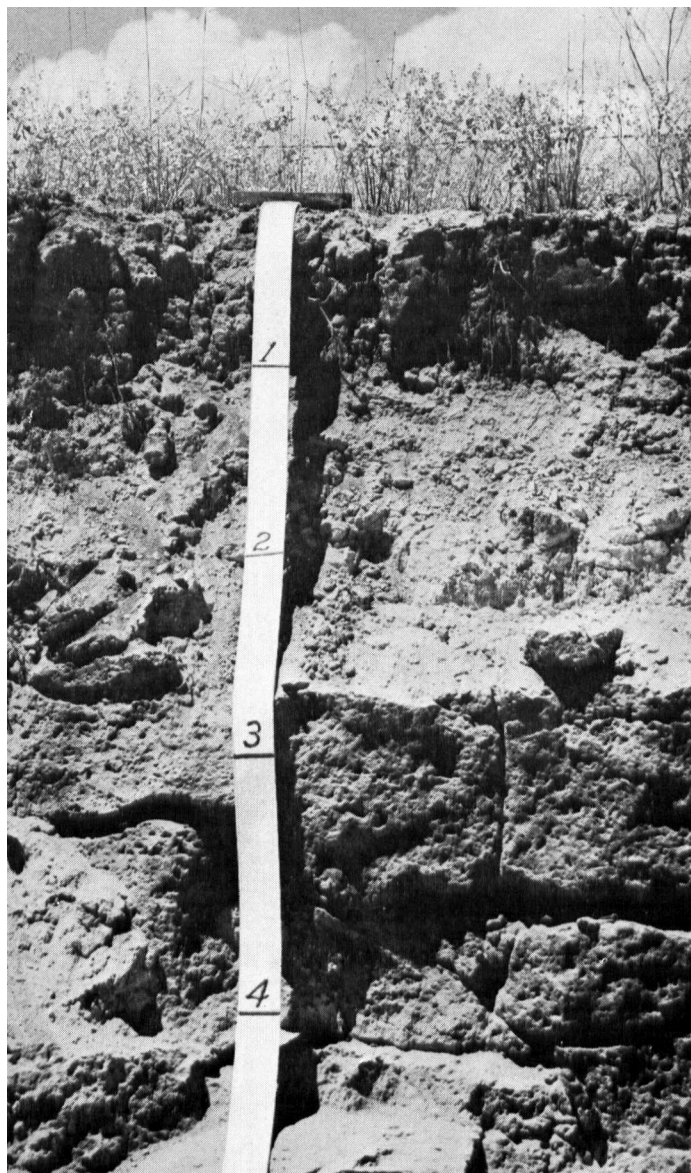


Figure 17.—Profile of Polatis silt loam.

Polatis soils are used mainly for irrigated hay, pasture, grain, sugar beets, and potatoes. Nonirrigated areas are used for range.

**Polatis silt loam, 2 to 4 percent slopes (PoB).**—This soil is on uplands. The areas are 10 to 300 acres in size.

Representative profile: 800 feet east and 125 feet south of the northwest corner of sec. 11, T. 2 S., R. 33 E., in an area of range:

**A1**—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure parting to weak, very fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many, very fine and fine, vesicular pores; slightly calcareous; moderately alkaline; abrupt, smooth boundary.

**B2**—3 to 7 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure parting to weak, very fine, granular; soft, very friable, slightly sticky and slightly



plastic; many very fine and fine roots; common, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

C1ca—7 to 16 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; strong, fine and medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common, very fine and fine, tubular pores; many firm cicada krotovinas; strongly calcareous; strongly alkaline; gradual, wavy boundary.

C2ca—16 to 26 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; massive; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; common, very fine and fine, tubular pores; many firm cicada krotovinas; strongly calcareous; moderately alkaline; abrupt, wavy boundary.

C3ca—26 to 28 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; massive; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; common, very fine and fine, tubular pores; common fragments of basalt; strongly calcareous; moderately alkaline; abrupt, wavy boundary.

IIR—28 to 33 inches, black (N 2/0) basalt; lime coatings on surfaces and in cracks.

The A horizon ranges from 4 to 8 inches in thickness. It has a color value of 5 or 6 when dry and a chroma of 2 or 3. The B2 horizon has been destroyed where the soil has been cultivated. A strongly calcareous Cca horizon begins at a depth of 6 to 15 inches. It has a color value of 6 or 7 when dry and a chroma of 2 or 3. Basalt bedrock begins at depths between 20 and 40 inches, commonly at depths below 25 inches.

Included are small areas where the surface layer is loam or fine sandy loam. Also included are areas where the slope is less than 2 percent or more than 4 percent. Other inclusions are areas of a Pancheri silt loam; Tenno extremely stony loam, undulating; and Kimama silt loam.

Permeability is moderate, and the available water capacity is about 4 to 7 inches. Surface runoff is medium, and the hazard of water erosion is slight to moderate. The soil is 20 to 40 inches deep to bedrock.

Where irrigated, this soil is used for hay, pasture, small grain, sugar beets, and potatoes. Where not irrigated, it is used for range. (Capability unit IIe-11, irrigated; VIe-1 dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Polatis silt loam, 0 to 2 percent slopes (PoA).**—This soil is similar to Polatis silt loam, 2 to 4 percent slopes, except for the slope. It is on loess plains in areas 10 to 300 acres in size. Surface runoff is slow, and the hazard of water erosion is slight.

Included are small areas where the slope is more than 2 percent. Also included are areas of Pancheri silt loam; Tenno extremely stony loam, undulating; and Kimama silt loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. It is used for range where not irrigated. (Capability unit IIs-1, irrigated; VIs-3, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Polatis silt loam, 4 to 8 percent slopes (PoC).**—This soil is similar to Polatis silt loam, 2 to 4 percent slopes, except for the slope. It is on rolling uplands in areas 10 to 200 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate.

Included are small areas of Pancheri silt loam and Tenno extremely stony loam, undulating.

This soil is used for irrigated small grain, sugar beets, potatoes, alfalfa, and pasture. Nonirrigated areas are used

for range. (Capability unit IIIe-12, irrigated; VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 2)

**Polatis stony silt loam, 0 to 2 percent slopes (PrA).**—This soil is similar to Polatis silt loam, 2 to 4 percent slopes, except for the slope and the stony surface layer. It is on loess plains in areas 10 to 200 acres in size. Surface runoff is slow, and the hazard of water erosion is slight.

Included are small areas where the slope is more than 2 percent. Also included are areas of Pancheri silt loam; Tenno extremely stony loam, undulating; and Polatis silt loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. It is used for range where not irrigated. (Capability unit IIs-1, irrigated; VIs-3, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Polatis stony silt loam, 2 to 4 percent slopes (PrB).**—This soil is similar to Polatis silt loam, 2 to 4 percent slopes, except for the stony surface layer. It is on uplands in areas 10 to 200 acres in size. Surface runoff is medium, and the hazard of water erosion is slight to moderate.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Pancheri silt loam; Tenno extremely stony loam, undulating; and Polatis silt loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. It is used for range where not irrigated. (Capability unit IIe-11, irrigated; VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Polatis stony silt loam, 4 to 8 percent slopes (PrC).**—This soil is similar to Polatis silt loam, 2 to 4 percent slopes, except for the slope and stony surface layer. It is on rolling uplands in areas 10 to 100 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate.

Included are small areas where the slope is less than 4 percent or more than 8 percent. Also included are areas of Pancheri silt loam; Tenno extremely stony loam, undulating; and Polatis silt loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. It is used for range where not irrigated. (Capability unit IIIe-12, irrigated; VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 2)

**Polatis-Tenno complex, undulating (0 to 12 percent slopes) (PCD).**—This complex consists of about 20 percent Polatis stony silt loam, 0 to 2 percent slopes; 20 percent Polatis stony silt loam, 2 to 4 percent slopes; 15 percent Polatis stony silt loam, 4 to 8 percent slopes; and 35 percent Tenno extremely stony loam, undulating (0 to 12 percent slopes). Some small areas of rock outcrop and Pancheri silt loam are included.

The Polatis soils of this complex are similar to Polatis silt loam, 2 to 4 percent slopes, except for the wider range of slope. The Tenno soils are similar to Tenno extremely stony loam, undulating, which is described under the Tenno series.

The topography is loess-covered basalt plains cut by shallow, entrenched, intermittent drainageways. The slopes are short and generally parallel the drainageways. The slope gradient is nearly level to moderate.



These soils are used principally for range, because irrigation water is generally not available for crops. In places some areas are irrigated by sprinkler systems for pasture, but generally in conjunction with areas of deeper nonstony soils. Some of the larger areas of Polatis soils can be tilled sufficiently for seedbed preparation to improve the stands. (The Polatis part is in capability unit VIIIs-2, dryland; Loamy range site, 8 to 12 inches precipitation. The Tenno part is in capability unit VIIIs-2, dryland; Shallow Stony range site, 8 to 12 inches precipitation)

## Portino Series

The Portino series consists of well-drained, nearly level to moderately sloping soils 20 to 40 inches deep. These soils formed in calcareous loess. They are on uplands. The natural vegetation is big sagebrush and bunchgrass. Portino soils are associated with Portneuf and Trevino soils.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 8 to 11 inches. The mean annual air temperature is 45° to 50° F., and the frost-free season is 110 to 130 days.

In a representative profile the surface layer is light brownish-gray and pale-brown silt loam 5 inches thick. The subsoil is pale-brown silt loam about 5 inches thick. The substratum is white and light-gray silt loam. Basalt is at a depth of 28 inches.

Portino soils are used mainly for irrigated hay, pasture, small grain, sugar beets, and potatoes. Nonirrigated areas are used for range.

**Portino silt loam, 2 to 4 percent slopes (PsB).**—This soil is on uplands in areas 10 to 300 acres in size. It is very gently sloping.

Representative profile: 2,600 feet east and 150 feet north of the center of sec. 27, T. 4 S., R. 30 E., in an area of range:

A11—0 to 2 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure parting to weak, fine, granular; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, fine and medium, tubular pores; mildly alkaline; gradual, smooth boundary.

A12—2 to 5 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, medium, granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, fine and medium, interstitial pores; mildly alkaline; clear, wavy boundary.

B2—5 to 10 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) when moist; weak, fine, subangular blocky structure parting to weak, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, fine and medium, tubular pores; moderately calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—10 to 19 inches, white (10YR 8/2) silt loam, light brownish gray (10YR 6/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common, fine and medium, tubular pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—19 to 25 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, fine and medium, tubular pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C3ca—25 to 28 inches, light-gray (10YR 7/2) silt loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, fine and medium, tubular pores; strongly calcareous; moderately alkaline; abrupt, wavy boundary.

IIR—28 to 33 inches, black (10YR 2/1) basalt; medium coating of lime on surface and in cracks.

The A1 horizon ranges from 4 to 8 inches in thickness. The color value is 5 or 6 when dry, and the chroma is 2 or 3. The A1 horizon is generally noncalcareous where undisturbed in the upper 3 to 5 inches. It is slightly to moderately calcareous where mixed to a depth of 7 inches. The Cca horizon is strongly calcareous. It ranges from 16 to 30 inches in thickness, and contains more than 15 percent lime in most parts. Where bedrock is more than 30 inches deep, a moderately calcareous layer is between the Cca horizon and bedrock in some places. The depth to basalt bedrock is 20 to 40 inches, but generally is more than 24 inches.

Included are small areas where the surface layer is loam and areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Portneuf silt loam; Thornock extremely stony loam, undulating; and Kimama silt loam.

Permeability is moderate, and the available water capacity is 4 to 7 inches. Surface runoff is medium, and the hazard of water erosion is slight in unirrigated areas but moderate in irrigated areas. Roots can penetrate to a depth of 20 to 40 inches or to bedrock.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. Areas where irrigation water is not available are used for range. (Capability unit IIe-11, irrigated; VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Portino silt loam, 0 to 2 percent slopes (PsA).**—This soil is similar to Portino silt loam, 2 to 4 percent slopes, except for the slope. Surface runoff is slow, and the hazard of water erosion is none to slight.

Included are small areas of Portneuf silt loam; Thornock extremely stony loam, undulating; and Kimama silt loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes and, in nonirrigated areas, for range. (Capability unit IIs-1, irrigated; VIs-3, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Portino silt loam, 4 to 8 percent slopes (PsC).**—This soil is similar to Portino silt loam, 2 to 4 percent slopes, except for the slope. It is in areas 10 to 200 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate in irrigated areas and slight in unirrigated areas.

Included are small areas where the slope is less than 4 percent or more than 8 percent. Also included are areas of Portneuf silt loam and Thornock extremely stony loam, undulating.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes and, in nonirrigated areas, for range. (Capability unit IIIe-12, irrigated; VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 2)

**Portino stony silt loam, 0 to 2 percent slopes (PtA).**—This soil is similar to Portino silt loam, 2 to 4 percent slopes, except that it is nearly level and the surface layer is stony. The soil is on loess-covered basalt plains in areas



10 to 200 acres in size. Surface runoff is slow, and the hazard of water erosion is none to slight.

Included are small areas where the slope is more than 2 percent. Also included are areas of Portneuf silt loam; Thornock extremely stony loam, undulating; and Portino silt loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. In nonirrigated areas it is used for range. (Capability unit IIs-1, irrigated; VIs-3, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Portino stony silt loam, 2 to 4 percent slopes (PtB).**—This soil is similar to Portino silt loam, 2 to 4 percent slopes, except that the surface layer is stony. The soil is on uplands and is very gently sloping in areas 10 to 200 acres in size. Surface runoff is medium, and the hazard of water erosion is slight in unirrigated areas but moderate in irrigated areas.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Portneuf silt loam; Thornock extremely stony loam, undulating; and Portino silt loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes and, in nonirrigated areas, for range. (Capability unit IIe-11, irrigated; VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Portino stony silt loam, 4 to 8 percent slopes (PtC).**—This soil is similar to Portino silt loam, 2 to 4 percent slopes, except it has gentle slopes and the surface layer is stony. The soil is in areas 10 to 100 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate in irrigated areas and slight in unirrigated areas.

Included are small areas where the slope is less than 4 percent or more than 8 percent. Also included are areas of Portneuf silt loam; Thornock extremely stony loam, undulating; and Portino silt loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes and, in nonirrigated areas, for range. (Capability unit IIIe-12, irrigated; VIe-1 dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 2)

**Portino stony silt loam, 8 to 12 percent slopes (PtD).**—This soil is similar to Portino silt loam, 2 to 4 percent slopes, except that it has moderate slopes and the surface layer is stony. The soil is in areas 10 to 100 acres in size. Surface runoff is medium to rapid, and the hazard of water erosion is severe in irrigated areas and moderate in unirrigated areas.

Included are small areas where the slope is less than 8 percent or more than 12 percent. Also included are areas of Portneuf silt loam; Thornock extremely stony loam, undulating; and Portino silt loam.

This soil is used for irrigated hay, pasture, and small grain. In nonirrigated areas it is used for range. (Capability unit IVe-2, irrigated; VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 2)

**Portino-Knull silt loams, 0 to 2 percent slopes (PuA).**—This complex consists of about 60 percent Portino silt loam, 0 to 2 percent slopes, and 30 percent Knull silt loam, 0 to 2 percent slopes. Included are small areas where the slope is more than 2 percent. Also included

are areas of Portneuf silt loam and Thornock extremely stony loam, undulating.

The Portino soil is similar to Portino silt loam, 2 to 4 percent slopes, except for the slope. Also, the erosion hazard on this Portino soil is none to slight. The Knull soil has the profile described as representative of the Knull series.

These soils are on basalt plains and are very gently sloping. The Knull soil generally is in circular spots 10 to 30 feet in diameter and is surrounded by the Portino soils. The spots are close together in some places, but widely separated in others. Surface runoff is slow, and the erosion hazard is none to slight.

These soils are used for irrigated crops and for range. Small grain, potatoes, sugar beets, and forage crops are grown where irrigation water is available. The soils are used for range and are reseeded to suitable grasses where irrigation water is not available. (Capability unit IIs-1, irrigated; VIs-3, dryland; Loamy range site, 8 to 12 inches precipitation)

**Portino-Knull silt loams, 2 to 4 percent slopes (PuB).**—This complex consists of about 60 percent of a Portino silt loam and 30 percent of a Knull silt loam. The remaining 10 percent is minor soils.

The Portino soil is similar to Portino silt loam, 2 to 4 percent slopes. The erosion hazard on the Portino soil is moderate. The Knull soil has a profile similar to the one described as representative of the Knull series.

These soils are on basalt plains. The Knull soil generally is in circular spots and is surrounded by the Portino soil. The spots are close together in some places, but widely separated in others.

These soils are used for irrigated small grain, potatoes, sugar beets, forage crops, and for range in nonirrigated areas. (Capability unit IIe-11, irrigated; VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation)

**Portino-Thornock complex, undulating (2 to 12 percent slopes) (PFD).**—This complex consists of about 20 percent Portino stony silt loam, 2 to 4 percent slopes; 20 percent Portino stony silt loam, 4 to 8 percent slopes; 20 percent Portino stony silt loam, 8 to 12 percent slopes; and 40 percent Thornock extremely stony loam, undulating. Some small areas of rock outcrop and of a Portneuf silt loam are included.

The Portino soils are similar to Portino silt loam, 2 to 4 percent slopes, except for the wider range of slope. The Thornock soil is similar to Thornock extremely stony loam, undulating, which is described under the Thornock series.

The topography is basalt plains cut by shallow, entrenched, intermittent drainageways. Slopes are short, and they parallel the drainageways in most places. The soils are nearly level to moderately sloping.

Soils of this complex are used mainly for range. Some areas can be irrigated by sprinkler systems for pasture, but it is generally in conjunction with areas of deeper nonstony soils. The larger areas of Portino soils can be tilled sufficiently for seedbed preparation to establish more desirable grasses. (The Portino part is in capability unit VIIIs-2, dryland; Loamy range site, 8 to 12 inches precipitation. The Thornock part is in capability unit VIIIs-2, dryland; Shallow Stony range site, 8 to 12 inches precipitation)



## Portneuf Series

The Portneuf series consists of well-drained, nearly level to moderately sloping soils more than 40 inches deep to basalt. These soils formed in calcareous loess. They are on rolling uplands. The natural vegetation is mainly big sagebrush and grass. Portneuf soils are associated with soils of the Portino, Thornock, and Kimama series.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 8 to 11 inches. The mean annual air temperature is 45° to 47° F., and the frost-free period is 110 to 130 days.

In a representative profile the surface layer is pale-brown silt loam 4 inches thick. The subsoil is pale brown and very pale brown silt loam, and it extends to a depth of 14 inches. The substratum is light-gray, very pale brown, and pale brown limy silt loam. It extends to a depth of 58 inches.

Portneuf soils are used mainly for irrigated hay, pasture, small grain (fig. 18), sugar beets, and potatoes. Nonirrigated areas are used for range.

**Portneuf silt loam, 2 to 4 percent slopes (PvB).**—This soil is in rolling areas that range from 10 to 300 acres in size.

Representative profile: 150 feet north and 60 feet west of the southeast corner of sec. 34, T. 5 S., R. 30 E., in a field of crested wheatgrass:

Ap—0 to 4 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure parting to moderate, thin, platy; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, interstitial pores; mildly alkaline; gradual, smooth boundary.

B2—4 to 10 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, tubular pores; mildly alkaline; gradual, wavy boundary.

B3—10 to 14 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) when moist; weak, very fine and fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, tubular pores;

moderately calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—14 to 29 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; common, very fine and fine, tubular pores; many firm cicada krotovinas; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—29 to 42 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few, very fine and fine, tubular pores; strongly calcareous; moderately alkaline; clear, smooth boundary.

A1b—42 to 44 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; massive; hard, firm, slightly sticky and slightly plastic; common, very fine and fine, tubular pores; slightly calcareous; moderately alkaline; abrupt, smooth boundary.

B21b—44 to 49 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many, very fine and fine, tubular pores; slightly calcareous; moderately alkaline; clear, smooth boundary.

B22b—49 to 58 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many, very fine and fine, tubular pores; slightly calcareous; moderately alkaline; abrupt, wavy boundary.

IIR—58 inches, black (10YR 2/1) basalt bedrock.

The A1 or Ap horizon ranges from 1 inch to 6 inches in thickness. It has a color value of 5 or 6 when dry and a chroma of 2 or 3. The B horizon is dominantly silt loam, but it is loam in places. It has a color value of 5 or 6 when dry and a chroma of 2 or 3. The hue of all horizons generally is 10YR. A calcic horizon, which contains 22 to 28 percent lime, begins at a depth of 7 to 15 inches. In some places C horizons or buried A or B horizons are below the Cca horizon. Basalt bedrock begins at a depth below 40 inches and commonly at a depth below 60 inches.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Portino silt loam; Thornock extremely stony loam, undulating; and Kimama silt loam.

Permeability is moderate, and the available water capacity is about 11 inches. Surface runoff is medium, and the hazard of water erosion is slight to moderate. Roots can penetrate to a depth of more than 40 inches or to bedrock.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. Nonirrigated areas are used for range. (Capability unit IIe-1, irrigated; VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Portneuf silt loam, 0 to 2 percent slopes (PvA).**—This soil is similar to Portneuf silt loam, 2 to 4 percent slopes, except for the slope. It is on uplands in areas 10 to 300 acres in size. Surface runoff is slow, and the hazard of water erosion is slight.

Included are small areas where the slope is more than 2 percent. Also included are areas of Portino silt loam; Thornock extremely stony loam, undulating; and Kimama silt loam.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes and, in nonirrigated areas, for range. (Capability unit IIc-2, irrigated; VIc-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 1)

**Portneuf silt loam, 4 to 8 percent slopes (PvC).**—This soil is similar to Portneuf silt loam, 2 to 4 percent slopes,

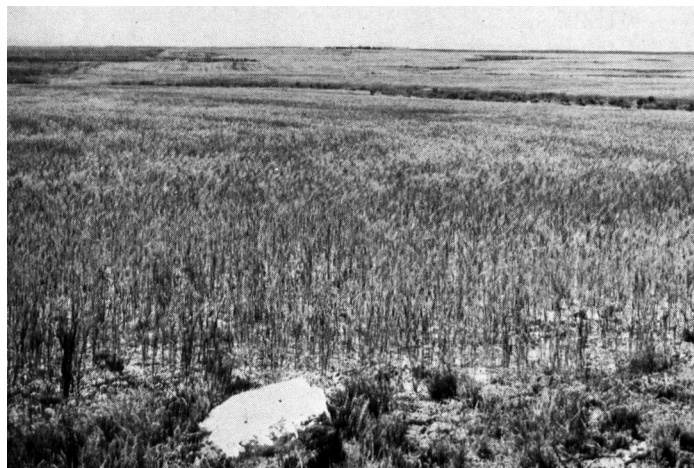


Figure 18.—A stand of wheat on Portneuf soils. The topography is uneven, and there are a few rock outcrops.



except for the slope. It is on uplands in areas 10 to 200 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate.

Included are small areas where the slope is less than 4 percent or more than 8 percent. Also included are areas of Portino silt loam and Thornock extremely stony loam, undulating.

This soil is used for irrigated hay, pasture, small grain, sugar beets, and potatoes. In nonirrigated areas it is used for range. (Capability unit IIIe-1, irrigated; VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 2)

**Portneuf silt loam, 8 to 12 percent slopes (PvD).**—This soil is similar to Portneuf silt loam, 2 to 4 percent slopes, except for the slope. It is on rolling uplands in areas 10 to 100 acres in size. Surface runoff is medium to rapid, and the hazard of water erosion is severe.

Included are small areas where the slope is less than 8 percent or more than 12 percent. Also included are areas of Portino silt loam and Thornock extremely stony loam, undulating.

This soil is used for irrigated hay, pasture, small grain, and, in nonirrigated areas, for range. (Capability unit IVE-1, irrigated; VIe-1, dryland; Loamy range site, 8 to 12 inches precipitation; windbreak suitability group 2)

## Presto Series

The Presto series consists of somewhat excessively drained, nearly level soils that have a loamy sand surface layer and silt loam underlying layers. These soils formed under big sagebrush and grass in mixed sandy and silty deposits. They are on river terraces. Presto soils are associated with soils of the Wolverine, Weeding, and Wapello series.

Elevations range from 4,200 to 5,400 feet. The annual precipitation is 8 to 12 inches. The mean annual air temperature is 40° to 45° F., and the frost-free period is 100 to 126 days.

In a representative profile the surface layer is grayish-brown loamy sand about 8 inches thick. The underlying material is brown and light brownish-gray loamy sand to a depth of 28 inches. This is underlain by nonconformable light brownish-gray and light-gray silt loam that extends to a depth of 60 inches or more.

Presto soils are used for irrigated hay, pasture, and small grain. Nonirrigated areas are used for range.

**Presto loamy sand (0 to 2 percent slopes) (Pw).**—This soil is on smooth river terraces in areas that range from 10 to 100 acres in size.

Representative profile: 600 feet west and 100 feet south of the northeast corner of sec. 14, T. 2 S., R. 36 E., in an area of range.

A11—0 to 3 inches, grayish-brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure parting to weak, very fine, granular; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; slightly calcareous; mildly alkaline; abrupt, smooth boundary.

A12—3 to 8 inches, grayish-brown (10YR 5/2) and brown (10YR 5/3, crushed) loamy sand, very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2, crushed) when moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many, very fine and fine, tubular

pores; slightly calcareous; moderately alkaline; clear, wavy boundary.

C1—8 to 17 inches, brown (10YR 5/3) loamy sand, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; gradual, wavy boundary.

C2—17 to 28 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; abrupt, smooth boundary.

IIC3ca—28 to 34 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, thick, platy structure breaking to weak, medium, subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; strongly calcareous; many fine veins and few fine spots and splotches of lime; moderately alkaline; gradual, wavy boundary.

IIC4ca—34 to 50 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, thick, platy structure breaking to weak, medium and fine, subangular blocky; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many, very fine and fine, tubular pores; strongly calcareous; many veins, spots, and splotches of lime; moderately alkaline; gradual, wavy boundary.

IIC5ca—50 to 60 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; no roots; many, very fine and fine, tubular pores; strongly calcareous; common fine veins and few fine spots and thin coatings of lime; moderately alkaline.

The solum ranges from 6 to 12 inches in thickness. The A1 or Ap horizon ranges in color value from 5 to 5.5 when dry. The dark color is related, in part, to the presence of dark basaltic sand. The chroma is 2 or 3. The Cca horizon contains 15 to 25 percent lime, except in the upper part, which is only moderately calcareous in places. The lower strata are generally nonconforming lake sediments and are moderately calcareous in places.

Included are small areas where the slope is more than 2 percent. Also included are areas of a Wapello fine sandy loam; Wolverine sand, rolling; and Weeding loamy sand.

Permeability is rapid to a depth of 28 inches and moderate below 28 inches. The available water capacity is about 4 to 6 inches. Surface runoff is slow. The hazard of water erosion is only slight, but the hazard of soil blowing is severe. Roots can penetrate to a depth of 60 inches or more.

This soil is used for hay, pasture, and small grain. Nonirrigated areas are used for range. (Capability unit IVE-5, irrigated; VIIe-1, dryland; Sandy range site, 8 to 12 inches precipitation; windbreak suitability group 5)

## Rexburg Series

The Rexburg series consists of well-drained, gently sloping to steep soils. These soils formed in deep loess overlying basalt bedrock. They are on uplands, benches, and ridges. Where the soils are not cultivated, the vegetation is mostly bunchgrass and big sagebrush. Rexburg soils are associated with Lanark, Tetonia, Robin, and Wahtigup soils.

Elevations range from 4,700 to 6,200 feet. The mean annual precipitation ranges from 13 to 16 inches. The mean annual air temperature ranges from 40° to 45° F., and the frost-free season is 80 to 110 days.



In a representative profile the surface layer is dark grayish-brown silt loam 12 inches thick. The subsoil is grayish-brown and brown silt loam 13 inches thick. The substratum is very pale brown silt loam and is 15 to 25 percent lime.

Rexburg soils are used for dryland small grain and range.

**Rexburg silt loam, 4 to 12 percent slopes (ReD).**—This soil (fig. 19) is on upland ridgetops and benches. The surface is convex.

Representative profile: 1,520 feet north and 1,320 feet east of the southwest corner of sec. 5, T. 4 S., R. 39 E., on a 4 percent southeast slope, in an area of native grasses:

A11—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, very thin, platy structure in the upper 2 inches and in

the lower part weak, very fine and fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; neutral; clear, smooth boundary.

A12—7 to 12 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine, tubular pores; neutral; clear, smooth boundary.

B2—12 to 17 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine, tubular pores; thin patchy clay films; thin, continuous, uncoated silt grains on ped surfaces; neutral; gradual, wavy boundary.

B3—17 to 25 inches, brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine, tubular pores; thin, continuous, uncoated silt grains on ped surfaces; neutral; abrupt, wavy boundary.

C1ca—25 to 40 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; moderate, medium and coarse, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common, very fine, tubular pores; common cicada krotovinas; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—40 to 50 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common, very fine, tubular pores; few cicada krotovinas; strongly calcareous; moderately alkaline; diffuse, wavy boundary.

C3ca—50 to 75 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common, very fine, tubular pores; strongly calcareous; moderately alkaline.

The B horizon is silt loam or heavy silt loam. The color value is 5 or 6 when dry. The C horizon is silt loam. It extends to a depth below 40 inches and generally below 60 inches. The color value is 6 or 7 when dry, and the chroma is 3 or 4. The A and B horizons are noncalcareous; the C horizon is strongly calcareous to a depth of 40 inches or more.

Included are small areas where the slope is more than 12 percent. Also included are areas of Lanark silt loam.

Permeability is moderate, and the available water capacity is about 11 inches. Runoff is medium, and the erosion hazard is slight to moderate. Roots can penetrate more than 60 inches deep.

This soil is used mainly for winter wheat and barley and for range. It also serves as a watershed. (Capability unit IIIe-4, dryland; Loamy range site, 12 to 16 inches precipitation)

**Rexburg silt loam, 12 to 20 percent slopes (ReE).**—This soil is similar to Rexburg silt loam, 4 to 12 percent slopes, except for the slope. It is on side slopes and ridges in areas 100 to 300 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate.

Included are small areas where the slope is less than 12 percent. Also included are areas of Lanark silt loam and Tetonia silt loam.

This soil is used for winter wheat and barley and for range. It also serves as a watershed. (Capability unit IIIe-4, dryland; Loamy range site, 12 to 16 inches precipitation)

**Rexburg-Wahtigup association, hilly (4 to 30 percent slopes) (RGF).**—This association is composed of about

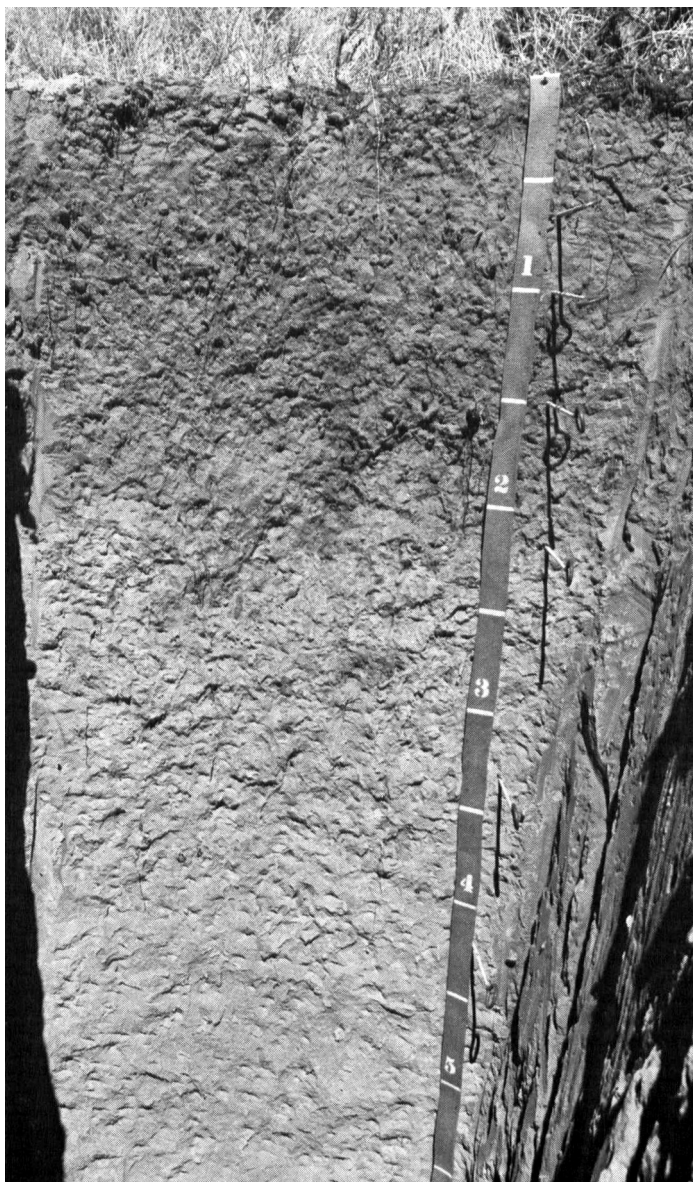


Figure 19.—Profile of Rexburg silt loam, 4 to 12 percent slopes.



20 percent Rexburg silt loam, 4 to 12 percent slopes; 40 percent Rexburg silt loam, 12 to 20 percent slopes; and 40 percent Wahtigup stony loam, hilly. The topography is gently sloping to moderately steep. The association is on upland benches and ridges. The Rexburg soils are on the ridgetops and side slopes, and the Wahtigup soils are on the steeper, south-facing areas and on foot slopes.

These soils are used mainly for range. The Rexburg soils are suitable for dryland crops of wheat and barley. They are rarely farmed, because accessibility is poor, the areas are small, and moving farm machinery from one area to another is difficult. The Wahtigup soils are unsuited to cultivation because of stones, but they can be worked sufficiently to prepare a seedbed for planting improved species. (The Rexburg part is in capability unit IIIe-4, dryland; Loamy range site, 12 to 16 inches precipitation. The Wahtigup part is in capability unit VIe-1, dryland; Loamy range site, 12 to 16 inches precipitation)

**Rexburg-Wahtigup association, steep** (30 to 60 percent slopes) (RGG).—This association is composed of about 60 percent Rexburg silt loam, steep, and 40 percent Wahtigup stony loam, steep. These soils are on ridges, side slopes, benches, and foot slopes. The Rexburg soils are on the north-facing foot slopes, ridgetops, and benches. They are surrounded and intermingled with the Wahtigup soils that are on the south- and west-facing exposures.

Rexburg silt loam, steep, is similar to Rexburg silt loam, 4 to 12 percent slopes, except that the soil is steep, runoff is rapid, and the erosion hazard is severe. Wahtigup stony loam, steep, is similar to Wahtigup stony loam, hilly, except that the soil is steep, runoff is rapid, and the erosion hazard is severe.

This association is used for range. The Rexburg soils occupy small, inaccessible areas that are too steep and erodible to be worked with farm machinery. The Wahtigup soils are not suited to cultivation, because of the slope, stoniness, and erodibility. (The Rexburg part is in capability unit VIIe-0, dryland; Steep Slopes range site, 12 to 16 inches precipitation. The Wahtigup part is in capability unit VIIe-0, dryland; Steep Slopes range site, 8 to 12 inches precipitation)

## Ricrest Series

The Ricrest series consists of well-drained, moderately steep to very steep soils. These soils have a stony loam surface layer and a clay loam subsoil overlying gravelly loam materials. They formed in loess, colluvium, and residuum weathered from limestone. They are on mountain ridges and side slopes. The vegetation consists mainly of big sagebrush, bitterbrush, serviceberry, Nevada bluegrass, Douglas-fir, aspen, and snowberry. Ricrest soils are associated with soils of the Hymas, Wahtigup, and Pavohroo series.

Elevations range from 5,000 to 6,500 feet. The annual precipitation ranges from 16 to 19 inches. The mean annual air temperature ranges from 38° to 44° F., and the frost-free season is 50 to 80 days.

In a representative profile the surface layer is very dark gray stony loam about 9 inches thick. The subsoil is dark-gray light clay loam about 14 inches thick. Light brownish-gray and light-gray gravelly loam or light clay loam is at a depth below 23 inches. This material is limy.

Ricrest soils are used for grazing. They also serve as a watershed.

**Ricrest stony loam, steep** (30 to 60 percent slopes) (RHG).—This soil is on mountain ridges and foot slopes. The surface is convex, and the slope ranges from 30 to 60 percent. The slopes face north and east.

Representative profile: 50 feet west and 20 feet north of the center of sec. 30, T. 2 S., R. 39 E., on north-facing slope of 32 percent in an area of grass and brush:

A11—0 to 4 inches, very dark gray (10YR 3/1) stony loam (very dark grayish-brown, 10YR 3/2, crushed), black (10YR 2/1) when moist; moderate, fine and medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many, very fine, interstitial pores; about 5 percent of horizon is stones and cobblestones; mildly alkaline; clear, smooth boundary.

A12—4 to 9 inches, very dark gray (10YR 3/1) stony loam (dark gray, 10YR 4/1, crushed), black (10YR 2/1) when moist; moderate, medium and coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine, interstitial pores; 5 percent of horizon is stones and cobblestones; mildly alkaline; clear, wavy boundary.

B21—9 to 15 inches, dark-gray (10YR 4/1) light clay loam, very dark gray (10YR 3/1) when moist; moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; many, very fine and fine, tubular pores; about 5 percent of horizon is gravel; mildly alkaline; gradual, wavy boundary.

B22—15 to 23 inches, dark-gray (10YR 4/1) light clay loam (gray, 10YR 5/1, crushed), very dark gray (10YR 3/1) when moist; moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; many, very fine and fine, tubular pores; about 10 percent of horizon is limestone gravel; mildly alkaline; abrupt, wavy boundary.

C1ca—23 to 27 inches, light brownish-gray (10YR 6/2) gravelly light clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; many, very fine and fine, tubular pores; about 15 percent of horizon is limestone gravel; strongly calcareous; few spots of lime; moderately alkaline; gradual, wavy boundary.

C2ca—27 to 40 inches, light brownish-gray (10YR 6/2) gravelly loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few, very fine and fine, tubular pores; about 25 percent of horizon is limestone gravel that is slightly lime-coated on lower side; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C3ca—40 to 60 inches, light-gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many very fine and fine pores; about 40 percent of horizon is limestone gravel that is slightly lime-coated on lower side; strongly calcareous; moderately alkaline.

The A horizon has a color value of 3 or 4 when dry and a chroma of 1. The B horizon has a color value of 4 or 5 when dry and a chroma of 1 or 2. The C horizon has a color value of 6 or 7 when dry and a chroma of 2 or 3. The combined thickness of the A and B horizons is 18 to 24 inches. The B horizon commonly is light clay loam, but it ranges to light silty clay loam in some places. A calcareous horizon is at a depth between 18 and 24 inches. It is 15 to 30 percent lime and 10 to 50 percent limestone fragments of gravel size. In some places extremely gravelly and stony limestone colluvium or limestone is at a depth below 40 inches.

Included are small areas where the slope is less than 30 percent. Also included are areas of Hymas extremely stony loam, Wahtigup stony loam, and Pavohroo loam.



Permeability is moderate, and the available moisture capacity is about 6 to 8 inches. Runoff is rapid, and the erosion hazard is moderate to severe. Roots can penetrate to a depth of 60 inches or more.

This soil is used for grazing. (Capability unit VIIe-0, dryland; Steep Slopes range site, 16 to 22 inches precipitation)

**Ricrest stony loam, hilly** (20 to 30 percent slopes) (RHF).—This soil is similar to Ricrest stony loam, steep, except for the slope. It is on ridges and foot slopes in areas 50 to 200 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate.

This soil is used mainly for grazing. (Capability unit VIe-1, dryland; Steep Slopes range site, 16 to 22 inches precipitation)

**Ricrest extremely stony loam, very steep** (60 to 80 percent slopes) (RIG).—This soil is similar to Ricrest stony loam, steep, except that it is extremely stony and is very steep. It is on side slopes in areas 50 to 100 acres in size. Surface runoff is rapid, and the erosion hazard is severe to very severe. This soil is used principally for water supply. (Capability unit VIIs-2, dryland)

**Ricrest-Wahtigup stony loams, hilly** (20 to 30 percent slopes) (RLF).—This complex consists of about 60 percent Ricrest stony loam, hilly, and 40 percent Wahtigup stony loam, hilly. These soils are on mountain ridges, side slopes, and foot slopes. The ridges are about 100 feet wide and are 300 to 1,000 feet long. The Ricrest soil is on the higher parts of slopes and faces north and east. The Wahtigup soil is on the lower foot slopes and faces south and west.

The Ricrest soil is similar to Ricrest stony loam, steep, except that the slope is more gentle, surface runoff is medium, and the areas can be tilled sufficiently to reseed suited plant species. The Wahtigup soil in this complex is similar to Wahtigup stony loam, hilly, which is described under the Wahtigup series.

This complex is used mainly for range. (The Ricrest part is in capability unit VIe-1, dryland; Steep Slopes range site, 16 to 22 inches precipitation. The Wahtigup part is in capability unit VIe-1, dryland; Loamy range site, 12 to 16 inches precipitation)

**Ricrest-Wahtigup stony loams, steep** (30 to 60 percent slopes) (RLG).—This complex consists of about 60 percent Ricrest stony loam, steep, and 40 percent Wahtigup stony loam, steep. These soils are on the higher and steeper mountain ridges, side slopes, and foot slopes. The Ricrest soil faces north and east, and the Wahtigup soil faces south and west.

This complex is used mainly for range. (The Ricrest part is in capability unit VIIe-0, dryland; Steep Slopes range site, 16 to 22 inches precipitation. The Wahtigup part is in capability unit VIIe-0, dryland; Steep Slopes range site, 8 to 12 inches precipitation)

## Riverwash

Riverwash (Rv) consists of mixed, waterwashed sand and gravel. Most of it is in sand or gravel bars. It occurs along streams or rivers and is often flooded during spring. In places scattered willow trees and a few weeds provide some protection from erosion along the streambanks. Production of usable forage is negligible. These areas are

suitable for wildlife habitat, but not for grazing. The areas also serve as a watershed. (Capability unit VIIIw-1, irrigated)

## Robin Series

The Robin series consists of well-drained soils. These soils are nearly level and gently sloping on valley floors, but they range to steep on mountain foot slopes. They formed in loess. The vegetation is mostly bunchgrass and scattered stands of big sagebrush and aspen. Robin soils are associated with soils of the Lanark, Gilispie, and Dranyon series.

Elevations range from 5,800 to 7,000 feet. The mean annual precipitation is 17 to 19 inches, and the mean annual air temperature is 36° to 40° F. The frost-free period is generally 50 to 80 days, but some areas can have frost any day of the year.

In a representative profile the surface layer is dark grayish-brown silt loam 18 inches thick. The subsoil is grayish-brown, brown, and pale-brown silt loam. It has slightly more clay than the surface layer.

Robin soils are used mainly for range, but sizable areas are used for dryland crops, such as small grain or alfalfa and grass.

**Robin silt loam, 0 to 4 percent slopes** (RoB).—This soil (fig. 20) is on the high mountain valley floors. The areas are irregular in shape and are nearly level. They generally are more than 100 acres in size.

Representative profile: 580 feet east and 1,550 feet north of the center of sec. 9, T. 3 S., R. 40 E., in an area of range:

A11—0 to 11 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; moderate, very fine, fine, and medium, granular structure in the upper part and weak, very fine and fine, granular in the lower part; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many, very fine and fine, interstitial pores; slightly acid; gradual, wavy boundary.

A12—11 to 18 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; few fine streaks of light brownish gray; weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many, very fine and fine, interstitial pores; lower part is grayish brown when dry and dark brown when moist and has few ½-inch splotches of light brownish-gray partly uncoated silt; few partly uncoated silt grains on ped surfaces; slightly acid; clear, wavy boundary.

B1—18 to 30 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak-medium and coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable, slightly sticky and slightly plastic; common very fine and fine, and few medium roots; many, very fine and fine, tubular pores; thin, patchy, clay films on ped and pore surfaces; thin coatings of light-gray (10YR 7/2), nearly clean silt on ped surfaces; many krotovinas 3 to 4 inches across; neutral; clear, wavy boundary.

B21t—30 to 48 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) when moist; moderate, medium and coarse, prismatic structure parting to moderate, medium and coarse, subangular blocky; hard, friable, sticky and plastic; common very fine and fine roots; many, very fine and fine, tubular pores; several brown (7.5YR 4/3) silty clay loam bands ½ to 1 inch thick; thin, patchy clay films on ped surfaces and thick, continuous clay films in bands; common coatings of light-gray (10YR 7/2) silt on ped surfaces, and few 3/10 to ½-inch pockets of light-gray material; neutral; gradual, wavy boundary.



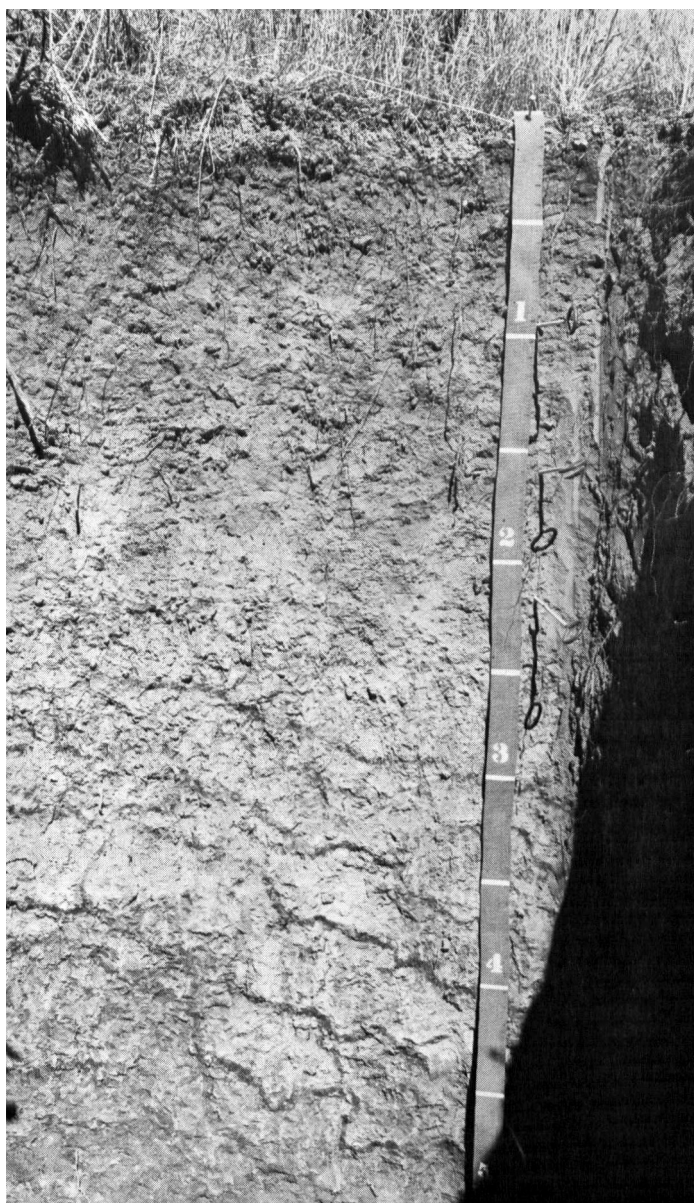


Figure 20.—Profile of Robin silt loam, 0 to 4 percent slopes.

B22t—48 to 72 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; moderate, medium and fine, prismatic structure parting to weak, medium, sub-angular blocky; hard, friable, slightly sticky and slightly plastic; few very fine roots; many, very fine and fine, tubular pores; nearly continuous clay films in some channels, and thin patchy clay films on ped surfaces; thick, continuous, brown (10YR 4/3) clay films in clayey bands  $\frac{1}{2}$  to 1 inch thick; few streaks and common light-gray uncoated silt on ped surfaces; common, soft, iron-manganese oxide concretions less than 1 millimeter across; neutral.

The B horizon ranges from heavy silt loam to light silty clay loam in texture. It is about 18 to 20 percent clay.

Included are small areas where the slope is more than 4 percent. Also included are areas of Lanark silt loam, Outlet silty clay loam, and, in some places, Gilispie extremely stony loam, hilly.

Permeability is moderate, and the available water capacity is about 11 inches. Surface runoff is slow, and the erosion hazard is slight. The short growing season limits use of the soil for crops. Roots can penetrate to a depth of more than 60 inches.

This soil is used for summer range and for dryland crops, such as small grain, alfalfa, and grass. (Capability unit IIIc-9, dryland; Loamy range site, 16 to 22 inches precipitation)

**Robin silt loam, 4 to 12 percent slopes (RoD).**—This soil is similar to Robin silt loam, 0 to 4 percent slopes, except for the slope. It is on uplands in high mountain valleys. The areas are irregular in shape. Many are several hundred acres in size. Surface runoff is medium, and the erosion hazard is moderate. Most of the erosion occurs during violent summer storms or during rapid melting of snow over frozen soil, particularly on fallow land. A short growing season limits use of the soil for crops.

Included are small areas of Lanark silt loam, Outlet silty clay loam, and Gilispie extremely stony loam, hilly.

This soil is used for range and for dryland crops, such as small grain, alfalfa, and grass. (Capability unit IIIc-9, dryland; Loamy range site, 16 to 22 inches precipitation)

**Robin silt loam, 12 to 20 percent slopes (RoE).**—This soil is similar to Robin silt loam, 0 to 4 percent slopes, except for the slope. It is mainly along the breaks of draws and drainageways in high mountain valleys. The areas are generally less than 100 acres in size. Runoff is medium, and the hazard of water erosion is moderate. Water erosion can be serious on fallow land during violent summer storms or during rapid melting of snow when the soil is frozen.

Included are small areas where the slope is less than 12 percent or more than 20 percent. Also included are areas of Lanark silt loam or Gilispie extremely stony loam, hilly.

This soil is used for range and for dryland crops, such as small grain, alfalfa, and grass. (Capability unit IIIc-9, dryland; Loamy range site, 16 to 22 inches precipitation)

**Robin silt loam, rolling (0 to 30 percent slopes) (RNF).**—This soil is similar to Robin silt loam, 0 to 4 percent slopes, except that the slopes are complex and the gradient is as much as 30 percent in places. The soil is in areas where frost can occur at any time. It is on valley floors, rolling uplands, and mountain foot slopes in high mountain valleys. The areas are several hundred acres in size. Surface runoff is slow to medium, and the hazard of water erosion is slight to moderate.

Included are small areas of Lanark silt loam; Outlet silty clay loam; Gilispie extremely stony loam, hilly; and Dranyon silt loam.

This Robin soil is used for range. (Capability unit VIc-1, dryland; Loamy range site, 16 to 22 inches precipitation)

**Robin silt loam, steep (30 to 60 percent slopes) (RNG).**—This soil is similar to Robin silt loam, 0 to 4 percent slopes, except for the slope. It is in breaks leading into draws and drainageways. In many places it faces north, and frost can occur any day of the year. Surface runoff is rapid, and the erosion hazard is severe.

Included are small areas of Dranyon silt loam and Gilispie extremely stony loam, hilly.



This Robin soil is used only for range. (Capability unit VIIe-0, dryland; Steep Slopes range site, 16 to 22 inches precipitation)

**Robin-Gilispie complex, rolling** (0 to 30 percent slopes) (RPF).—This complex consists of about 70 percent Robin silt loam, rolling, and 30 percent Gilispie extremely stony loam, hilly. It is on uplands that are cut by a drainage pattern of intermittent streams. The Robin soils formed in deep loess overlying basalt. They are on ridgetops and slopes. The Gilispie soils are on the breaks and bottoms of drainageways. Geologic erosion has thinned or removed the loess and exposed the basalt to weathering or other soil-forming processes.

The Robin soils are similar to Robin silt loam, 0 to 4 percent slopes, except that the slopes are convex and the gradient is as much as 30 percent in places. They can have frost any day of the year. Runoff is slow to medium, and the erosion hazard is slight to moderate. The Gilispie soil in this complex is similar to Gilispie extremely stony loam, hilly, which is described under the Gilispie series.

This complex is used for range. (The Robin part is in capability unit VIIs-2, dryland; Loamy range site, 16 to 22 inches precipitation. The Gilispie part is in capability unit VIIs-2, dryland; Shallow Stony range site, 16 to 22 inches precipitation)

**Robin-Gilispie complex, steep** (30 to 60 percent slopes) (RPG).—This complex consists of about 70 percent Robin silt loam and 30 percent Gilispie extremely rocky loam, steep. It is on the steeper mountain slopes and breaks along canyons and drainageways. The Robin soils are on ridgetops and side slopes, and the Gilispie soils are on south-facing slopes, canyon walls, and escarpments.

The Robin soils are similar to Robin silt loam, 0 to 4 percent slopes, except for the slope. They are in areas where frost can occur any day of the year. Runoff is rapid, and the hazard of erosion is severe. The Gilispie soils are similar to Gilispie extremely stony loam, hilly, except for the many areas of rock outcrop and basalt ledges. Slopes are steep, runoff is rapid, and the erosion hazard is severe.

This complex is used for grazing and wildlife habitat. It also serves as a watershed. (The Robin part is in capability unit VIIs-2, dryland; Steep Slopes range site, 16 to 22 inches precipitation. The Gilispie part is in capability unit VIIs-2, dryland; Steep Stony Slopes range site, 16 to 22 inches precipitation)

**Robin-Swanner association, hilly** (0 to 30 percent slopes) (RSF).—This association consists of about 70 percent Robin silt loam, rolling, and 30 percent Swanner extremely stony loam, hilly. These soils are on mountain slopes, foot slopes, and ridgetops that are incised by a pattern of intermittent and permanent streams. The Robin soils formed in deep loess and are on ridgetops, north-facing slopes, and mountain foot slopes. The Swanner soils formed in residuum weathered from rhyolite and welded tuff, mixed with some loess near the surface. They are on shallow ridgetops and south- and west-facing slopes.

The Robin soils are similar to Robin silt loam, 0 to 4 percent slopes, except for the slope. Frost can occur at any time during the year. Surface runoff is slow to medium, and the erosion hazard is slight to moderate.

The Swanner soils are similar to Swanner extremely stony loam, hilly, which is described under the Swanner series.

This association is used for range. (The Robin part is in capability unit VIe-1, dryland; Loamy range site, 16 to 22 inches precipitation. The Swanner part is in capability unit VIIs-2, dryland; Shallow Stony range site, 12 to 16 inches precipitation)

**Robin-Swanner association, steep** (30 to 60 percent slopes) (RSG).—This association consists of about 70 percent Robin silt loam, steep, and 30 percent Swanner extremely stony loam, steep. The topography is steep mountain foot slopes. The Robin soils are on north-facing slopes, and the Swanner soils are on steep ridges and south-facing slopes.

The Robin soils are similar to Robin silt loam, 0 to 4 percent slopes, except for the slope. Frost can occur any time during the year. Surface runoff is rapid, and the erosion hazard is severe. The Swanner soils are similar to Swanner extremely stony loam, hilly, except for the slope. Surface runoff is rapid, and the erosion hazard is severe.

This association is used mainly for range. (The Robin part is in capability unit VIIe-0, dryland; Steep Slopes range site, 16 to 22 inches precipitation. The Swanner part is in capability unit VIIs-2, dryland; Steep Stony Slopes range site, 12 to 16 inches precipitation)

## Sasser Series

The Sasser series consists of well-drained, nearly level to gently sloping soils that are about 38 inches deep to sand and gravel. These soils formed under grasses and shrubs in fine sandy alluvium. They are on river terraces. Sasser soils are associated with soils of the Bannock, Bock, and Stan series.

Elevations range from 4,200 to 4,600 feet. The mean annual precipitation is 11 to 13 inches. The mean annual air temperature is 39° to 45° F., and the frost-free period is 110 to 130 days.

In a representative profile the surface layer is grayish-brown sandy loam 6 inches thick. The subsoil is light brownish-gray and pale-brown fine sandy loam 8 inches thick. The substratum is light-gray fine sandy loam that contains as much as 15 percent gravel. It extends to a depth of 38 inches. It is underlain by sand and water-worn gravel. These soils are limy throughout but have lime accumulations in the substratum.

Sasser soils are used mainly for irrigated hay, pasture, and small grain.

**Sasser fine sandy loam, 0 to 2 percent slopes (SaA).**—This soil is on river terraces in areas that range from 20 to 200 acres in size.

Representative profile: 650 feet south and 50 feet east of the northwest corner of sec. 18, T. 3 S., R. 35 E., in an area of irrigated pasture:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and medium roots; many, very fine and fine, interstitial pores; slightly calcareous; mildly alkaline; abrupt, smooth boundary.

AB—6 to 10 inches, light brownish-gray (10YR 6/2) fine sandy loam, very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2, crushed) when moist;



weak, very fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; common, very fine and fine, tubular pores; about 5 percent of horizon is gravel; slightly calcareous; mildly alkaline; clear, smooth boundary.

B2—10 to 14 inches, pale-brown (10YR 6/3) and light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, subangular blocky structure; hard, friable, nonsticky and nonplastic; common fine and medium roots; many, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—14 to 21 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine and medium roots; many, very fine and fine, tubular pores; about 5 percent of horizon is gravel; strongly calcareous; few fine veins and spots of lime; moderately alkaline; gradual, wavy boundary.

C2ca—21 to 32 inches, light-gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; many, very fine and fine, tubular pores; few hard nodules (cicada krotovinas); about 5 percent of horizon is gravel; strongly calcareous; few splotches of lime; gravel is lime-coated on bottom side; moderately alkaline; gradual, wavy boundary.

C3ca—32 to 38 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; many, very fine and fine, tubular pores; about 15 percent of horizon is rounded gravel; strongly calcareous; few small spots of lime; gravel is lime-coated on lower half; moderately alkaline; abrupt, wavy boundary.

IIC4ca—38 to 50 inches, light brownish-gray (10YR 6/2) very gravelly coarse sand; single grain; loose when dry or moist; few fine and medium roots; porous; about 70 percent of horizon is varicolored rounded gravel, mostly quartzite; gravel is lime-coated on lower side; moderately alkaline.

A strong Cca horizon begins at a depth of about 8 to 16 inches. It extends to the underlying sand and gravel. The color value is 6 or 7 when dry and 4 or 5 when moist. A stratum of loose sand and gravel is within 40 inches of the surface; its upper boundary commonly is below a depth of 30 inches.

Included are small areas where the slope is more than 2 percent. Also included are areas of Stan fine sandy loam; Wolverine sand, rolling; and Paesl fine sandy loam.

Permeability is moderately rapid, and the available water capacity is about 5 to 6 inches. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. Roots can penetrate to a depth of more than 60 inches.

This soil is used for hay, pasture, small grain, and potatoes. (Capability unit IIIs-3, irrigated; windbreak suitability group 1)

**Sasser fine sandy loam, 2 to 4 percent slopes (ScB).**—This soil is similar to Sasser fine sandy loam, 0 to 2 percent slopes, except for the slope. It occurs on high river terraces in areas 20 to 200 acres in size. Surface runoff is medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Stan fine sandy loam; Wolverine sand, rolling; and Paesl fine sandy loam.

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

potatoes. (Capability unit IIIe-13, irrigated; windbreak suitability group 1)

**Sasser fine sandy loam, 4 to 8 percent slopes (ScC).**—This soil is similar to Sasser fine sandy loam, 0 to 2 percent slopes, except for the slope. It occurs on high river terraces in areas 10 to 50 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing also is moderate.

Included are small areas where the slope is less than 4 percent or more than 8 percent. Also included are areas of Stan fine sandy loam; Wolverine sand, rolling; and Paesl fine sandy loam.

This soil is used for hay, pasture, and small grain. (Capability unit IIIe-13, irrigated; windbreak suitability group 2)

## Sessions Series

The Sessions series consists of well-drained soils. The surface layer is silt loam or silty clay loam, and the subsoil is silty clay. These soil (fig. 21) formed in loess and residuum weathered from sandstone. They are on uplands. The slope ranges from 0 to 30 percent. The vegetation consists mainly of perennial grasses, three-tip sagebrush and forbs. Sessions soils are associated with soils of the Nielsen, Lanark, and Robin series.

Elevations range from 5,800 to 7,000 feet. The mean annual air temperature is 36° to 42° F., and the annual precipitation is 16 to 19 inches. The frost-free period is 50 to 80 days, but some areas can have frost any day of the year.

In a representative profile the surface layer is dark-brown and reddish-brown silt loam and silty clay loam 15 inches thick. The subsoil is reddish-brown and brown silty clay. It extends to a depth of 71 inches. Sessions soils are used mainly for dryland small grain, hay, and range.

**Sessions silt loam, 4 to 12 percent slopes (SeD).**—This soil is on uplands in areas 20 to 200 acres in size. The topography is rolling.

Representative profile: 50 feet north and 30 feet east of the center of sec. 3, T. 3 S., R. 41 E., in an area of range:

A11—0 to 6 inches, dark-brown (7.5YR 4/2) silt loam, very dark brown (7.5YR 2/2) when moist; moderate, medium, granular and very fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine, interstitial pores; medium acid; gradual, smooth boundary.

A12—6 to 10 inches, dark-brown (7.5YR 4/3) heavy silt loam, brown (7.5YR 5/2, crushed), very dark brown (7.5YR 2/2) and dark brown (7.5YR 3/2, crushed) when moist; moderate, medium and fine, granular structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine, tubular pores; few, partly uncoated silt grains; slightly acid; gradual, smooth boundary.

A3—10 to 15 inches, reddish-brown (5YR 5/3) silty clay loam, dark reddish brown (5YR 3/3) when moist; moderate, very fine and fine, subangular blocky structure; very hard, firm, sticky and plastic; common very fine and fine roots; many, very fine, tubular pores; few, partly uncoated silt grains on ped surfaces; slightly acid; gradual, smooth boundary.

B21t—15 to 35 inches, reddish-brown (5YR 5/4) light silty clay, dark reddish brown (5YR 3/4) and reddish brown (5YR 4/4, crushed) when moist; strong, medium and fine, subangular blocky structure; extremely hard, firm, sticky and plastic; common fine and medium roots; common.





Figure 21.—An area of Sessions soils used for dryfarmed grain and summer fallow. Steep Nielsen soils are in the background.

very fine, tubular pores; thick, continuous clay films on ped faces and in channels; medium acid; clear, wavy boundary.

B22t—35 to 46 inches, brown (7.5YR 5/2) light silty clay, dark brown (7.5YR 4/2) when moist; strong, medium, subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; common, very fine, tubular pores; thick, continuous clay films on ped faces and in channels; medium acid; clear, wavy boundary.

B23t—46 to 60 inches, reddish-brown (2.5YR 5/4) light silty clay, dark reddish brown (2.5YR 3/4) and reddish brown (2.5YR 4/4, crushed) when moist; moderate, medium and fine, subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; many, very fine and fine, tubular pores; slightly darker reddish-brown (2.5YR 4/4), medium, continuous clay films on ped faces; thick clay films in channels; few, uncoated silt grains on some peds; slightly acid; clear, wavy boundary.

B3t—60 to 71 inches, reddish-brown (2.5YR 5/4) light silty clay, dark reddish brown (2.5YR 3/4) when moist; moderate, medium and fine, subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; many, very fine, tubular pores; reddish brown (2.5YR 4/4), thin, patchy clay films on ped faces; medium clay films in channels; few fragments of weathered sandstone; moderately calcareous; moderately alkaline.

The A1 or Ap horizon ranges from 6 to 12 inches in thickness. The color value is 4 or 5 when dry, and the chroma is 2 or 3. The hue is 10YR or 7.5YR. The B horizon is dominantly silty clay, but in some places it is clay. The color value is 4 or 5 when dry, and the chroma ranges from 2 to 4. The hue is 7.5YR, 5YR, or 2.5YR. In most places the profile is slightly to moderately calcareous at a depth below 4 or 5 feet. The depth to sandstone bedrock commonly is more than 60 inches.

Included are small areas where the slope is less than 4 percent or more than 12 percent. Also included are areas of Nielsen extremely stony loam; Lanark silt loam, rolling; and Robin silt loam.

Permeability is slow, and the available water capacity is 9 to 10 inches. Surface runoff is medium, and the hazard of water erosion is moderate. Roots can penetrate to a depth of more than 60 inches.

This soil is used for dryland small grain, hay, and for range. (Capability unit IIIe-9, dryland; Loamy range site, 16 to 22 inches precipitation)

**Sessions silt loam, 12 to 20 percent slopes (SeE).**—This soil is similar to Sessions silt loam, 4 to 12 percent slopes, except for the slope. It is on rolling uplands in areas 10 to 100 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate.

Included are small areas where the slope is less than 12 percent or more than 20 percent. Also included are areas of Nielsen extremely stony loam; Lanark silt loam, rolling; and Robin silt loam.

This Sessions soil is used for dryland small grain, hay, and for range. (Capability unit IIIe-9, dryland; Loamy range site, 16 to 22 inches precipitation)

**Sessions silt loam, rolling (0 to 30 percent slopes) (SMF).**—This soil is similar to Sessions silt loam, 4 to 12 percent slopes, except that the slopes are convex and the gradient is as much as 30 percent in places. Frost can occur at any time during the year. This soil is on rolling uplands in areas 20 to 300 acres in size. Surface runoff is medium to rapid, and the hazard of water erosion is moderate to severe.

Included are small areas where the slope is more than 30 percent. Also included are areas of Nielsen extremely stony loam; Lanark silt loam, rolling; and Robin silt loam.

This soil is used for range. It is too steep and the



climate is too cold for cultivated crops. Some areas can be tilled for seeding to suitable grasses. (Capability unit VIe-1, dryland; Loamy range site, 16 to 22 inches precipitation)

**Sessions-Nielsen complex, hilly** (0 to 30 percent slopes) (SNF).—This complex consists of 65 percent Sessions silt loam, rolling, and 35 percent Nielsen extremely stony loam, hilly. The topography is long, narrow ridges conforming to underlying strata of sandstone, and there are many rock outcrops. The ridges range from a few feet to as much as 100 feet in width. Nielsen soils are generally on ridges; Sessions soils occupy areas between the ridges where less resistant rock has been weathered and soil material has accumulated.

The Sessions soils in this complex are similar to Sessions silt loam, 4 to 12 percent slopes, except for the slope. Surface runoff is medium to rapid, the erosion hazard ranges from moderate to severe. Frost can occur at any time. The Nielsen soils are similar to Nielsen extremely stony loam, hilly, which is described under the Nielsen series. (The Sessions part is in capability unit VIIs-2, dryland; Loamy range site, 16 to 22 inches precipitation. The Nielsen part is in capability unit VIIs-2, dryland; Shallow Stony range site, 16 to 22 inches precipitation)

**Sessions-Nielsen complex, hilly, eroded** (0 to 30 percent slopes) (SNF2).—This complex consists of about 65 percent Sessions silt loam, rolling, and 35 percent Nielsen extremely stony loam, hilly. The complex is on uplands. It has ridges and side slopes. Many areas of sandstone outcrops and areas of shallow, extremely stony soils occur on ridges and adjacent to outcrops. Sessions soils occupy the side slopes, and Nielsen soils are on the ridgetops and outcrop areas.

The Sessions soils are similar to Sessions silt loam, 4 to 12 percent slopes, except for the slope. Surface runoff is medium, and the erosion hazard is moderate to severe. Frost can occur at any time. About 50 percent of the areas have been eroded. The silt loam surface layer that remains after erosion is very thin, or it has been completely removed. The surface layer, if mixed to a depth of 7 inches, is silty clay loam in texture. The Nielsen soils are similar to Nielsen extremely stony loam, hilly, which is described under the Nielsen series.

This complex is used for range. The Sessions soils, where not eroded, have a cover of perennial grasses and some three-tip sagebrush. On the eroded areas, the vegetation is principally wyethia. (The Sessions part is in capability unit VIIs-2, dryland; Loamy range site, 16 to 22 inches precipitation. The Nielsen part is in capability unit VIIs-2, dryland; Shallow Stony range site, 16 to 22 inches precipitation)

## Sheege Series

The Sheege series consists of well-drained soils that formed in loess and residuum weathered from limestone. These soils are on mountain slopes. The slope ranges from 0 to 60 percent. The soils are 10 to 20 inches deep over bedrock. The vegetation is mainly big sagebrush and bunchgrass. Sheege soils are associated with Pavohroo and Robin soils.

Elevations range from 6,500 to 7,000 feet. The annual precipitation is 16 to 19 inches. The mean annual air

temperature is 40° to 43° F., and the frost-free period is 50 to 80 days.

In a representative profile the surface layer is grayish-brown or dark grayish-brown extremely stony loam that extends to a depth of 17 inches, where it rests on limestone bedrock. The soil is limy throughout.

Sheege soils are used for grazing.

**Sheege extremely stony loam, hilly** (0 to 30 percent slopes) (SOF).—This soil is on mountain slopes in areas 20 to 300 acres in size.

Representative profile: 2,020 feet west and 1,600 feet south of the northeast corner of sec. 21, T. 3 S., R. 40 E., in an area of range:

A11—0 to 6 inches, dark grayish-brown (10YR 4/2) extremely stony loam, very dark brown (10YR 2/2) when moist; moderate, very fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine, interstitial pores; 50 percent of horizon is angular fragments of limestone, about 15 percent of which are gravel size; slightly calcareous; hard lime coats some limestone fragments on lower side; mildly alkaline; gradual, wavy boundary.

A12—6 to 17 inches, grayish-brown (10YR 5/2) extremely stony loam, dark brown (10YR 3/3) when moist; weak, very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine pores; 35 percent of horizon is angular fragments of limestone and cobbles; 15 percent of which are gravel size; very strongly calcareous; white, hard lime coating, ½ millimeter to 3 millimeters thick, on lower half of rock fragments; some lime occurs as short stalactites; moderately alkaline; abrupt, broken boundary.

R—17 inches +, dark-gray (N 4/0) limestone bedrock; somewhat fractured; little soil material in cracks; very pale brown and white, hard lime coating, ½ millimeter to 2 millimeters thick, on the bedrock.

The depth to bedrock ranges from 10 to 20 inches. Angular fragments of limestone range from 15 to 80 percent, by volume, of the horizon; the higher content occurs near the bedrock.

Included are small areas where the slope is more than 30 percent. Also included are areas of Pavohroo loam, Alpon silt loam, and Robin silt loam.

Permeability is moderate, and the available water capacity is about 1 to 2 inches. Surface runoff is medium to rapid, and the hazard of water erosion is moderate. The depth to bedrock is less than 20 inches.

This soil is used for range. The production of forage is limited by the shallow root zone and low available water capacity. (Capability unit VIIs-2, dryland; Shallow Stony range site, 16 to 22 inches precipitation)

**Sheege extremely stony loam, steep** (30 to 60 percent slopes) (SOG).—This soil is similar to Sheege extremely stony loam, hilly, except for the slope. It is on steep mountain slopes in areas 20 to 300 acres in size. Surface runoff is rapid, and the hazard of water erosion is moderate to severe.

Included are small areas where the slope is less than 30 percent or more than 60 percent. Also included are areas of Pavohroo loam, Alpon silt loam, and Robin silt loam.

This soil is used for range. (Capability unit VIIs-2, dryland; Steep Stony slopes range site, 16 to 22 inches precipitation)

**Sheege-Pavohroo association, hilly**, (0 to 30 percent slopes) (SPF).—This association consists of about 65 percent Sheege extremely stony loam, hilly, and 35 percent



Pavohroo loam, hilly. These soils are on mountain ridges. The ridgetops are narrow and are level to moderately steep. The side slopes are gentle to moderately steep and face north and south. Sheege soils are on the tops and south-facing slopes; Pavohroo soils are on the north-facing slopes.

The Pavohroo soils are similar to Pavohroo loam, steep, except for the slope. Surface runoff is medium, and the erosion hazard is slight to severe.

Sheege soils are used entirely for grazing. Pavohroo soils are used mainly for timber production but have a grazable understory of grass. They produce low yields of timber products, and where timber has been removed, they can be seeded to suitable plant species. (The Sheege part is in capability unit VIIIs-2, dryland; Shallow Stony range site, 16 to 22 inches precipitation. The Pavohroo part is in capability unit VIe-1, dryland; woodland suitability group 4)

**Sheege-Robin association, hilly** (0 to 30 percent slopes) (SRF).—This association consists of about 75 percent Sheege extremely stony loam, hilly, and 25 percent Robin silt loam, rolling. Sheege soils are on the ridgetops and south-facing slopes, and Robin soils are on the north-facing slopes and foot slopes.

The Sheege soils in this association are similar to Sheege extremely stony loam, hilly. The depth to bedrock is 10 to 20 inches. The Robin soils are similar to Robin silt loam, 0 to 4 percent slopes, except for slope. Surface runoff is medium, and the erosion hazard is slight to moderate. Frost can occur at any time during the year.

This association is used for range and timber production. (The Sheege part is in capability unit VIIIs-2, dryland; Shallow Stony range site, 16 to 22 inches precipitation. The Robin part is in capability unit VIe-1, dryland; Loamy range site, 16 to 22 inches precipitation)

**Sheege-Robin association, steep** (30 to 60 percent slopes) (SRG).—This association consists of about 75 percent Sheege extremely stony loam, steep, and 25 percent Robin silt loam, steep. These soils are in steep mountainous areas. Sheege soils are on ridgetops and south-facing slopes, and Robin soils are on slopes facing north and west.

The Sheege soils are similar to Sheege extremely stony loam, hilly, except for the slope. Surface runoff is rapid, and the erosion hazard is severe. The Robin soils are similar to Robin silt loam, 0 to 4 percent slopes, except for the slope and the severe hazard of erosion.

This association is used mainly for range and for timber production. (The Sheege part is in capability unit VIIIs-2, dryland; Steep Stony Slopes range site, 16 to 22 inches precipitation. The Robin part is in capability unit VIIe-0, dryland; Steep Slopes range site, 16 to 22 inches precipitation)

## Spaa Series

The Spaa series consists of well-drained, shallow soils that formed in travertine material deposited by warm water from mineral springs. These soils are on low terraces. The natural vegetation is big sagebrush and bunchgrass. Spaa soils are associated with soils of the Robin and Outlet series.

Elevations range from 5,500 to 5,800 feet. The annual precipitation is 16 to 19 inches. The mean annual air

temperature is 42° to 44° F., and the frost-free season is 70 to 90 days.

In a representative profile the surface layer is dark grayish-brown and grayish-brown loam about 7 inches thick. The C horizon is light brownish-gray and light-gray loam that contains thin lenses of cemented travertine. It extends to a depth of 18 inches and overlies travertine.

These soils are used for range.

**Spaa extremely rocky loam** (0 to 4 percent slopes) (SS).—This soil is on terraces in areas 50 to 200 acres in size. It is nearly level to gently sloping and consists of soil and rock. The areas are adjacent to the north end of the Blackfoot Reservoir in the southeastern part of the survey area.

Representative profile: 1,800 feet west and 2,400 feet north of the southeast corner of sec. 31, T. 4 S., R. 41 E., in an area of range:

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, coarse, granular structure; slightly hard, friable, slightly sticky and nonplastic; common fine and medium, and few coarse roots; many, very fine and fine, interstitial pores; strongly calcareous; moderately alkaline; gradual, smooth boundary.

A12—3 to 7 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, granular structure; slightly hard, friable, slightly sticky and nonplastic; common fine and medium, and few coarse roots; many, very fine and fine, interstitial pores; strongly calcareous; moderately alkaline; gradual, smooth boundary.

C1—7 to 8 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; slightly hard, friable, slightly sticky and nonplastic; common fine and medium, and few coarse roots; many, very fine and fine, interstitial pores; strongly calcareous; moderately alkaline; abrupt, smooth boundary.

C2—8 to 18 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; many, very fine and fine, interstitial pores; thin lenses of cemented travertine; strongly calcareous; moderately alkaline; abrupt, smooth boundary.

R—18 inches, white (10YR 8/1) indurated travertine mixed with loamy travertine material; strongly calcareous.

The A horizon is 6 to 8 inches thick. It has a color value of 4 or 5 when dry and a chroma of 2 or 3. It is moderately to strongly calcareous. The C horizon is underlain by travertine bedrock at a depth of 10 to 20 inches.

Permeability is moderate above the indurated travertine material, and the available water capacity is about 1 to 2 inches. The indurated material however, is essentially impermeable to roots and water. A few roots, however, penetrate through horizontal cracks in the bedrock. The cracks are generally more than 4 inches apart. Surface runoff is medium, and the hazard of water erosion is slight to moderate. This soil is less than 20 inches deep to bedrock.

This soil is used for range. It is too rocky and too shallow for seeding to suitable plant species. (Capability unit VIIIs-2, dryland; Shallow Stony range site, 16 to 22 inches precipitation)

## Stan Series

The Stan series consists of well-drained soils that formed in sandy alluvium on river terraces. The slope is 0 to 4 percent. These soils are fine sandy loam in texture.



The vegetation is mainly big sagebrush and bunchgrass. Stan soils are associated with soils of the Sasser, Bannock, and Paesl series.

Elevations range from 4,200 to 5,500 feet. The mean annual precipitation is 11 to 13 inches. The mean annual air temperature is 39° to 45° F., and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is grayish-brown and brown fine sandy loam 16 inches thick. The subsoil is pale-brown fine sandy loam 13 inches thick. The substratum is light-gray fine sandy loam to a depth of 50 inches. It is underlain by light-gray, very gravelly light sandy loam. These soils are limy throughout but are most limy in the substratum.

Stan soils are used for irrigated hay, pasture, small grain, and potatoes.

**Stan fine sandy loam, 0 to 2 percent slopes (StA).—**This soil is on river terraces in areas 10 to 200 acres in size.

Representative profile: 500 feet west and 150 feet south of the center of sec. 15, T. 2 S., R. 35 E., in a cultivated area:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; slightly calcareous; mildly alkaline; gradual, smooth boundary.

A1—8 to 16 inches, brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many, very fine and fine, tubular pores; slightly calcareous; mildly alkaline; gradual, smooth boundary.

B2—16 to 29 inches, pale-brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many, very fine and fine, tubular pores; slightly calcareous; mildly alkaline; clear, wavy boundary.

C1ca—29 to 38 inches, light-gray (10YR 7/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, nonsticky and nonplastic; common very fine and fine roots; common, very fine and fine, tubular pores; about 5 percent of horizon is cicada krotovinas; strongly calcareous; common fine veins and spots of lime; mildly alkaline; gradual, wavy boundary.

C2ca—38 to 50 inches, light-gray (10YR 7/2) light fine sandy loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many, very fine and fine, tubular pores; strongly calcareous; common veins and coatings of lime; mildly alkaline; clear, wavy boundary.

IIC3ca—50 to 60 inches, light-gray (10YR 7/2) very gravelly light sandy loam, grayish brown (10YR 5/2) when moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many, very fine, interstitial pores; moderately calcareous; gravel is moderately coated with lime on lower side and partly coated on upper side; mildly alkaline.

The A1 or Ap horizon ranges from 8 to 16 inches in thickness. It has a color value of 4 or 5 when dry, a chroma of 2 or 3, and a hue of 10YR or 2.5Y. The subsoil has a color value of 5 or 6 when dry and a chroma of 2 or 3. Its texture is fine sandy loam or sandy loam, and it is 6 to 14 inches thick. The Cca horizon has a color value of 6 or 7 when dry and a chroma of 2 or 3. At depths between 10 and 40 inches the texture is dominantly fine sandy loam, but it is sandy loam in places. The soil is commonly underlain by sand and gravel at a depth of 40 to 50 inches.

Included are small areas where the slope is more than 2 percent. Also included are areas of Sasser fine sandy loam, Bannock loam, and Paesl fine sandy loam.

Permeability is moderately rapid, and the available water capacity is about 6 inches. Surface runoff is slow, and the hazard of water erosion is slight. The soil is subject to moderate soil blowing if left bare of vegetation. Roots can penetrate to a depth of 60 inches or more.

This soil is used for irrigated hay, pasture, small grain, and potatoes. (Capability unit IIe-4, irrigated; wind-break suitability group 1)

**Stan fine sandy loam, 2 to 4 percent slopes (StB).—**This soil is similar to Stan fine sandy loam, 0 to 2 percent slopes, except for the slope. It is on river terraces in areas 10 to 200 acres in size. The topography is gently sloping. Surface runoff is slow to medium, and the hazards of water erosion and soil blowing are moderate.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Sasser fine sandy loam, Bannock loam, and Paesl fine sandy loam.

This soil is used for irrigated hay, pasture, small grain, and potatoes. (Capability unit IIe-3, irrigated; wind-break suitability group 1)

## Stony Rock Land

Stony rock land (30 to 80 percent slopes) (SU) is a miscellaneous land type made up of essentially bare basalt. Very thin wind-laid silts cover some of the areas. The soil is less than 10 inches deep. In most places basalt covers 80 to 90 percent of the surface. The slope ranges from 30 to 80 percent. There is little, if any, vegetation, and the areas are generally not accessible to livestock.

This land type is used principally for water supply, wildlife habitat, and esthetic purposes. (Capability unit VIIIs-1, dryland)

## Swanner Series

The Swanner series consists of well-drained and somewhat excessively drained, shallow, loamy soils that formed in loess and residuum weathered from rhyolite and welded tuff. These soils are on mountain ridges and slopes. They are nearly level to steep. The vegetation is mainly big sagebrush and bunchgrass. Swanner soils are associated with Araveton, Tetonia, Newdale, and Wahtigup soils.

Elevations range from 4,500 to 6,500 feet. The annual precipitation is 12 to 15 inches. The mean annual air temperature is 38° to 45° F., and the frost-free period is 80 to 110 days.

In a representative profile the surface layer is grayish-brown extremely stony loam about 14 inches thick. The underlying layer is limy, light brownish-gray extremely stony loam 4 inches thick. It rests on fractured rhyolite or welded tuff. Bedrock is at a depth of less than 20 inches.

Swanner soils are used for range.

**Swanner extremely stony loam, hilly (0 to 30 percent slopes) (SWF).—**This soil is on mountain slopes and ridges in areas 20 to 300 acres in size.

Representative profile: 1,160 feet east of the center of sec. 18, T. 4 S., R. 39 E., in an area of range:

A11—0 to 2 inches, grayish-brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium and fine, granular structure;



soft, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, interstitial pores; 20 percent of horizon is stones and channery fragments; neutral; gradual, smooth boundary.

A12—2 to 7 inches, grayish-brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; soft, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, interstitial pores; 20 percent of horizon is stones and channery fragments; neutral; gradual, smooth boundary.

A13—7 to 14 inches, grayish-brown (10YR 5/2) extremely stony loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; soft, friable, slightly sticky and slightly plastic; plentiful fine and medium roots; many, very fine and fine, interstitial pores; 50 percent of horizon is stones; neutral; clear, wavy boundary.

Cca—14 to 18 inches, light brownish-gray (10YR 6/2) extremely stony loam, dark grayish brown (10YR 4/2) when moist; massive; soft, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, interstitial pores; 60 percent of horizon is stones of welded tuff or rhyolite; slightly calcareous; neutral; clear, irregular boundary.

IIR—18 inches, light-gray (5Y 7/1) welded tuff; gray (5Y 5/1) when moist.

The A horizon is 10 to 20 inches thick. It has a color value of 4 or 5 when dry; a chroma of 2 or 3; and a hue of 10YR, 2.5Y, or 5Y.

Included are small areas where the slope is more than 30 percent. Also included are areas of Araveton extremely stony loam, Tetonia silt loam, Newdale silt loam, and Wahtigup stony loam.

Permeability is moderate, and the available water capacity is 1 or 2 inches. Surface runoff is medium, and the hazard of water erosion is moderate. Bedrock begins at a depth of less than 20 inches.

This soil is used for range. (Capability unit VIIIs-2, dryland; Shallow Stony range site, 12 to 16 inches precipitation)

**Swanner extremely stony loam, steep** (30 to 60 percent slopes) (SWG).—This soil is similar to Swanner extremely stony loam, hilly, except for the slope. It is on mountain slopes in areas 20 to 300 acres in size. Surface runoff is rapid, and the hazard of water erosion is severe.

Included are small areas where the slope is less than 30 percent or more than 60 percent. Also included are areas of Araveton extremely stony loam, Tetonia silt loam, Newdale silt loam, and Wahtigup stony loam.

This soil is used for range. It is rarely overgrazed, because of the steep slope and the extremely stony surface layer. (Capability unit VIIIs-2, dryland; Steep Stony range site, 12 to 16 inches precipitation)

## Tenno Series

The Tenno series consists of well-drained, nearly level to moderately sloping soils 10 to 20 inches deep to basalt. These soils formed in loess on basalt plains. They are stony loam to extremely stony loam in texture. The vegetation consists mainly of big sagebrush and bunchgrass. Tenno soils are associated with Pancheri, Polatis, and Kimama soils.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 8 to 11 inches. The mean annual air temperature is 42° to 45° F., and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is brown stony loam generally about 5 inches thick. The subsoil is brown and pale-brown stony loam about 10 inches thick. The substratum is limy, light brownish-gray stony loam. It extends to a depth of 17 inches.

Tenno soils are used mainly for range, but small areas associated with areas of deeper soils are cultivated.

**Tenno stony loam, 0 to 4 percent slopes** (TdB).—This soil is on plains in areas 5 to 200 acres in size.

Representative profile: 1,370 feet north and 370 feet west of the southeast corner of sec. 9, T. 2 S., R. 34 E., in an area of range:

A1—0 to 5 inches, brown (10YR 5/3) and pale-brown (10YR 6/3, crushed) stony loam, dark brown (10YR 3/3) and dark grayish brown (10YR 4/2, crushed) when moist; weak, thin, platy structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, interstitial pores; 2 percent of horizon is angular basalt gravel; mildly alkaline; gradual, smooth boundary.

B1—5 to 12 inches, brown (10YR 5/3) and pale-brown (10YR 6/3, crushed) stony loam, dark brown (10YR 4/3) and dark grayish brown (10YR 4/2, crushed) when moist; weak, coarse, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine tubular pores; 2 percent of horizon is angular basalt gravel; mildly alkaline; gradual, smooth boundary.

B2—12 to 15 inches, pale-brown (10YR 6/3) stony loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; 2 percent of horizon is angular basalt gravel; moderately alkaline; clear, wavy boundary.

C1ca—15 to 17 inches, light brownish-gray (10YR 6/2) stony loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many, very fine and fine, tubular pores; 2 percent of horizon is angular basalt gravel; lime coatings on bottom of gravel; moderately calcareous; few fine veins and spots of lime; strongly alkaline; abrupt, wavy boundary.

IIR—17 to 20 inches, dark-gray (10YR 4/1) basalt bedrock; vesicular; lime coating on surface and in cracks.

The A horizon has a color value of 5 or 6 when dry and a chroma of 2 or 3. The Cca horizon contains about 3 to 15 percent lime and ranges from 2 to 6 inches in thickness. It has a color value of 6 or 7 when dry and a chroma of 2 or 3. The depth to basalt bedrock ranges from 10 to 20 inches, but typically is between 15 and 20 inches.

Included are small areas where the slope is more than 4 percent. Also included are areas of Pancheri silt loam, Polatis silt loam, and Kimama silt loam.

Permeability is moderate, and the available water capacity is about 2.5 inches. Surface runoff is slow, and the hazard of water erosion is slight. Bedrock is at a depth of less than 20 inches.

This soil is used for irrigated pasture, alfalfa, small grain, and in a few places, for potatoes and sugar beets. Areas not irrigated are used for range, and machinery can be used for seeding to more desirable grasses. (Capability unit IVs-1, irrigated; VIIIs-2, dryland; Shallow Loamy range site, 8 to 12 inches precipitation)

**Tenno stony loam, 4 to 8 percent slopes** (TdC).—This soil is similar to Tenno stony loam, 0 to 4 percent slopes, except for the slope. It is on rolling basalt plains in areas 5 to 200 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate.



Included are small areas where the slope is less than 4 percent or more than 8 percent. Also included are areas of Pancheri silt loam, Polatis silt loam, and Kimama silt loam.

This soil is used mainly for alfalfa and irrigated pasture where irrigation water is available and for range where no water is available. (Capability unit IVE-2, irrigated; VIIIs-2, dryland; Shallow Loamy range site, 8 to 12 inches precipitation)

**Tenno extremely stony loam, undulating** (0 to 12 percent slopes) (TED).—This soil is similar to Tenno stony loam, 0 to 4 percent slopes, except that it is nearly level to moderately sloping and rock outcrops cover as much as 50 percent of the area. It is on rolling basalt plains in areas 10 to 200 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate.

Included are small areas where the slope is more than 12 percent. Also included are areas of Polatis silt loam and Polatis stony silt loam.

This soil is used for range. (Capability unit VIIIs-2; dryland Shallow Stony range site, 8 to 12 inches precipitation)

## Terrace Escarpments

Terrace escarpments (20 to 60 percent slopes) (TM) consists of severely eroded, steep and very steep banks or escarpments. It occurs most commonly as terrace breaks on alluvial terraces of the Snake and Blackfoot Rivers. The slope ranges from about 20 percent to more than 60 percent. Runoff is rapid to very rapid, and the hazard of erosion is severe.

Areas of this land type are suited mainly to wildlife habitat. They also serve as a watershed. (Capability unit VIIIE-1, dryland)

## Tetonia Series

The Tetonia series consists of well-drained soils that formed in thick loess on upland slopes. The texture is silt loam; the slope ranges from 0 to 60 percent. The vegetation is mainly big sagebrush and bunchgrass. Tetonia soils are associated with Araveton, Newdale, Swanner, and Gilispie soils.

Elevations range from 5,500 to 6,200 feet. The annual precipitation is 13 to 15 inches. The mean annual air temperature is 37° to 43° F., and frost can occur at any time during the year.

In a representative profile the surface layer is dark grayish-brown silt loam about 18 inches thick. The subsoil is grayish-brown silt loam that extends to a depth of about 26 inches. The substratum is limy, light-gray and light brownish-gray silt loam that extends to a depth of more than 60 inches.

Tetonia soils are used mainly for range.

**Tetonia silt loam, rolling** (0 to 30 percent slopes) (TNF).—This soil is on hilly upland slopes in areas that range from 20 to 200 acres in size.

Representative profile: 1,000 feet east and 330 feet north of the southwest corner of sec. 17, T. 4 S., R. 39 E., in an area of range:

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure parting to weak, medium and fine, granular; soft, friable, slightly sticky and slightly plas-

tic; many very fine and fine roots; many, very fine and fine, interstitial pores; neutral; gradual, smooth boundary.

A12—3 to 11 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, granular structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, interstitial pores; neutral; gradual, smooth boundary.

A13—11 to 18 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, interstitial pores; neutral; gradual, smooth boundary.

B2—18 to 26 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, tubular pores; mildly alkaline; clear, wavy boundary.

C1ca—26 to 44 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium and fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many, very fine and fine, tubular pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—44 to 60 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine and medium roots; many, very fine and fine, tubular pores; strongly calcareous; moderately alkaline.

The A horizon ranges from 14 to 20 inches in thickness. The color value is 4 or 5 when dry and 2 to 3 when moist. The B horizon is silt loam in texture and ranges from 4 to 5 in color value when dry. The structure ranges from weak to moderate, fine to medium, subangular blocky. The Cca horizon is 20 to 40 inches thick.

Included are small areas where the slope is less than 12 percent or more than 20 percent. Also included are areas of Newdale silt loam, Araveton extremely stony loam, and Swanner extremely stony loam.

Permeability is moderate, and the available water capacity is about 11 inches. Surface runoff is medium to rapid, and the hazard of water erosion is moderate to severe. Roots can penetrate to a depth of more than 60 inches.

This soil is used for range. (Capability unit VIe-1, dryland; Loamy range site, 12 to 16 inches precipitation)

**Tetonia silt loam, steep** (30 to 60 percent slopes) (TNG).—This soil is similar to Tetonia silt loam, rolling, except for the slope. It is on north-facing upland slopes in areas 10 to 300 acres in size. Surface runoff is medium to rapid, and the hazard of water erosion is severe.

Included are small areas where the slope is less than 30 percent. Also included are areas of Newdale silt loam, Araveton extremely stony loam, and Swanner extremely stony loam.

This soil is used for range. The slope prevents successful reseeding to more desirable grasses. (Capability unit VIIe-0, dryland; Steep Slopes range site, 12 to 16 inches precipitation)

**Tetonia-Gilispie association, hilly** (0 to 30 percent slopes) (TOF).—This association consists of about 60 percent Tetonia silt loam, rolling, and 40 percent Gilispie extremely stony loam, hilly. Tetonia soils are in areas of thick loess. Gilispie soils are in areas of thin loess. These areas are in irregular patterns that range from a few square feet to 50 acres in size.

This association is used for range. The Tetonia soils



have a high potential for production of forage. They can be improved by reseeding to more desirable plant species, but their use is limited by a short frost-free season. The Gilispie soils have a low potential for production of forage because of stoniness and limited soil depth. They are too stony to reseed. (The Tetonia part is in capability unit VIe-1, dryland; Loamy range, 12 to 16 inches precipitation. The Gilispie part is in capability unit VIIs-2, dryland; Shallow Stony range site, 16 to 22 inches precipitation)

**Tetonia-Gilispie association, steep** (30 to 60 percent slopes) (TOG).—This association consists of about 60 percent Tetonia silt loam, steep, and 40 percent Gilispie extremely stony loam, steep. Tetonia soils are on north-facing slopes, and Gilispie soils are on ridges, on south-facing slopes, and in drainageways.

The Tetonia soils are steeper than Tetonia silt loam, rolling, and they are highly susceptible to erosion. The Gilispie soils are steeper than Gilispie extremely stony loam, hilly, and they also are highly susceptible to erosion.

This association is used mainly for range, water supply, wildlife habitat, and esthetic purposes. Tetonia soils produce high yields of forage, but they are limited by a short growing season and by their slope. Gilispie soils produce low amounts of usable forage and are used for range, wildlife habitat, and esthetic purposes. They also serve as a watershed. Soils in this association are too steep and too stony for reseeding to improved vegetation. (The Tetonia part is in capability unit VIIe-0, dryland; Steep Slopes range site, 12 to 16 inches precipitation. The Gilispie part is in capability unit VIIs-2, dryland; Steep Stony Slopes range site, 16 to 22 inches precipitation)

## Thornock Series

The Thornock series consists of well-drained, stony to extremely stony, loamy soils that formed in wind-laid silts on basalt plains. The soils are 10 to 20 inches deep to basalt bedrock. The slope ranges from 0 to 12 percent. The vegetation is mainly big sagebrush and bunchgrass. Thornock soils are associated with Portneuf, Portino, and Kimama soils.

Elevations range from 4,200 to 4,800 feet. The annual precipitation is 8 to 11 inches. The mean annual air temperature is 45° to 48° F., and the frost-free period is 110 to 130 days.

In a representative profile the surface layer is brown and pale-brown stony loam 6 inches thick. The underlying layer is very pale brown stony loam that rests on basalt bedrock at a depth of 15 inches. These soils are limy throughout, except for the surface layer.

Thornock soils are used mainly for range. Small areas are cultivated, generally as inclusions in fields of deeper soils. Loose stones on the surface are generally picked up so that irrigation and tillage operations can be carried on.

**Thornock stony loam, 0 to 4 percent slopes** (ThB).—This soil is on rolling basalt plains in areas that range from 5 to 200 acres in size.

Representative profile: 200 feet south and 100 feet west of the northeast corner of sec. 27, T. 4 S., R. 30 E., in an area of range:

A11—0 to 3 inches, brown (10YR 5/3) and pale-brown (10YR 6/3, crushed) stony loam, dark grayish brown (10YR 4/2) when moist; weak, very thin, platy structure parting to weak, very fine, granular; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine, interstitial pores and common, very fine, tubular pores; about 20 percent, by volume, of horizon is coarse fragments of angular gravel, cobblestones, and stones; neutral; gradual, smooth boundary.

A12—3 to 6 inches, pale-brown (10YR 6/3) stony loam, dark brown (10YR 4/3) when moist; weak, very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium roots; common, very fine and fine, tubular pores; about 25 percent, by volume, of horizon is coarse fragments of angular gravel, cobblestones, and stones; slightly calcareous; mildly alkaline; clear, wavy boundary.

Cca—6 to 15 inches, very pale brown (10YR 7/3) stony loam, brown (10YR 5/3) when moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium roots; common, very fine and fine, tubular pores; about 30 percent, by volume, of horizon is coarse fragments of angular gravel, cobblestones, and stones; strongly calcareous; moderately alkaline; abrupt, wavy boundary.

IIR—15 inches, black (10YR 2/1) basalt bedrock; thick vesicular coating of lime on surface and in cracks and pores of rock; some vesicles contain light reddish-brown (5YR 6/4) or pale-brown material.

The A1 horizon ranges from 5 to 8 inches in thickness. The Cca horizon is strongly calcareous. It begins at a depth of 6 to 12 inches and extends to bedrock at a depth of 10 to 20 inches.

Included are small areas where the slope is more than 4 percent. Also included are areas of Portneuf silt loam and Portino stony silt loam. Rock outcrops are common.

Permeability is moderate, and the available water capacity is about 2.5 inches. Surface runoff is slow, and the hazard of water erosion is slight. Roots can penetrate to a depth of less than 20 inches.

This soil is used mainly for range. Small areas are irrigated and cultivated where they are included in fields of deeper soils. Stones are generally picked up in these areas so that farming operations can be carried on. (Capability unit IVs-1, irrigated; VIIs-2, dryland; Shallow Loamy range site, 8 to 12 inches precipitation)

**Thornock stony loam, 4 to 8 percent slopes** (ThC).—This soil is similar to Thornock stony loam, 0 to 4 percent slopes, except for the slope. It is on rolling basalt plains in areas 5 to 200 acres in size. Surface runoff is medium, and the hazard of water erosion is moderate.

Included are small areas where the slope is less than 4 percent or more than 8 percent. Also included are areas of Portneuf silt loam and Portino stony silt loam.

This soil is used mainly for irrigated pasture where irrigation water is available and for range where water is not available. (Capability unit IVE-2, irrigated; VIIs-2, dryland; Shallow Loamy range site, 8 to 12 inches precipitation)

**Thornock extremely stony loam, undulating** (0 to 12 percent slopes) (TTD).—This soil is similar to Thornock stony loam, 0 to 4 percent slopes, except for the slope and the rock outcrops that cover up to 50 percent of the area. It is on undulating basalt plains in areas 5 to 200 acres in size. Surface runoff is slow to medium, and the hazard of water erosion is slight to moderate.

Included are small areas where the slope is more than 12 percent. Also included are areas of a Portneuf silt loam and a Portino stony silt loam.



This soil is used for range. It is too stony and has too many rock outcrops to be cultivated or reseeded to improved grasses. (Capability unit VIIc-2, dryland; Shallow Stony range site, 8 to 12 inches precipitation)

## Turnerville Series

The Turnerville series consists of well-drained, nearly level to moderately steep soils that formed in wind-laid silt. These soils are on mountain foot slopes. The texture is silt loam over silty clay loam. The vegetation consists of lodgepole pine, Douglas-fir, pinegrass, and forbs. Turnerville soils are associated with Sessions, Dranyon, and Outlet soils.

Elevations range from 6,500 to 7,500 feet. The annual precipitation is 18 to 22 inches. The mean annual air temperature is 40° to 43° F., and the frost-free period is 50 to 80 days.

In a representative profile the surface layer is gray silt loam about 1 inch thick. The subsurface layer is light brownish-gray silt loam about 20 inches thick. The subsoil is pale-brown and brown silty clay loam that extends to a depth below 60 inches.

Turnerville soils are used for woodland that has a grazable understory.

**Turnerville silt loam, hilly** (0 to 30 percent slopes) (TUF).—This soil is on mountains and foot slopes in areas 40 to 300 acres in size.

Representative profile: 1,320 feet south and 1,480 feet west of the northeast corner of sec. 14, T. 2 S., R. 42 E., in an area of woodland:

- A1—0 to 1 inch, gray (10YR 5/1) silt loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; soft, friable, nonsticky and nonplastic; common fine and medium roots; common, very fine, interstitial pores; medium acid; abrupt, smooth boundary.
- A21—1 to 9 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, medium and fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine and medium roots; common, very fine and fine, tubular pores; medium acid; gradual, smooth boundary.
- A22—9 to 23 inches, light brownish-gray (10YR 6/2) silt loam, dark brown (10YR 4/3) when moist; moderate; medium and fine, granular structure; soft, friable, nonsticky and nonplastic; common fine and medium roots; common, fine and medium, tubular pores; medium acid; gradual, wavy boundary.
- B&A—23 to 27 inches, light brownish-gray (10YR 6/2) material from the A2 horizon, brown (10YR 4/3) when moist, mixed with brown (10YR 5/3) light silty clay loam from the B2 horizon, dark yellowish brown (10YR 4/4) when moist; weak, medium, prismatic structure; moderate, medium, continuous clay films; slightly hard, firm, sticky and plastic; few fine and medium roots; common, very fine and fine, tubular pores; medium acid; gradual, wavy boundary.
- B21t—27 to 48 inches, pale-brown (10YR 6/3) light silty clay loam, dark brown (10YR 4/3) when moist; medium, nearly continuous clay films that are brown (10YR 5/3) when dry and dark brown (10YR 4/3) when moist; moderate, coarse, prismatic structure parting to moderate, medium and coarse, subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; few fine, medium, and coarse roots; common very fine and fine, and few medium pores; bleached silt coatings on some ped surfaces; slightly acid; gradual, diffuse boundary.
- B22t—48 to 72 inches, brown (7.5YR 5/3) light silty clay loam, dark brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine, medium, and coarse roots; common, very fine and fine, tubular pores and few,

medium, tubular pores; thin, patchy clay films; few fragments of decomposed sandstone; slightly acid.

The A1 horizon ranges from 0 to 6 inches in thickness and from 1 to 3 in chroma. The A2 horizon ranges from 10 to 25 inches in thickness and has a color value of 5 or 6 when dry. The B horizon is light silty clay loam or clay loam in texture.

Included are small areas where the slope is more than 30 percent. Also included are areas of Sessions silt loam and Dranyon silt loam.

Permeability is moderately slow, and the available water capacity is about 12 inches. Surface runoff is medium, and the hazard of water erosion is moderate to severe. Roots can penetrate to a depth of more than 60 inches.

This soil is used for woodland that has a grazable understory. (Capability unit VIc-1, dryland; woodland suitability group 1)

## Wahtigup Series

The Wahtigup series consists of somewhat excessively drained, moderately steep and steep, stony soils. These soils formed in loess and stony colluvium weathered from limestone. They are on mountain foot slopes. The vegetation is mainly three-tip sagebrush and grass. Wahtigup soils are associated with Ricrest, Newdale, and Hymas soils.

Elevations range from 4,800 to 5,800 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 40° to 45° F., and the frost-free period is 80 to 110 days.

In a representative profile the surface layer is grayish-brown stony and gravelly loam 9 inches thick. The underlying layer is pinkish-gray gravelly loam to a depth of 45 inches, where it rests on limestone gravel. These soils are limy throughout.

Wahtigup soils are used mainly for range.

**Wahtigup stony loam, hilly** (20 to 30 percent slopes) (WHF).—This soil is on mountain foot slopes in areas that range from 20 to 400 acres in size.

Representative profile: 1,900 feet north of the southeast corner of sec. 24, T. 2 S., R. 38 E., in an area of range:

- A1—0 to 6 inches, grayish-brown (10YR 5/2) stony loam, very dark grayish brown (10YR 3/2) when moist; weak, very thin, platy structure parting to weak, very fine, granular; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, interstitial pores; about 10 percent of horizon is dark-gray and white, fine (angular) gravel that is coated with lime on the lower side; moderately calcareous; mildly alkaline; gradual, wavy boundary.
- A12—6 to 9 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, interstitial pores; about 20 percent of horizon is dark-gray limestone gravel; moderately calcareous; gravel is coated with lime on lower side; mildly alkaline; gradual, wavy boundary.
- C1—9 to 14 inches, pinkish-gray (7.5YR 7/2) gravelly heavy loam, brown (7.5YR 5/4) and brown (7.5YR 5/2, crushed) when moist; massive, slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many, very fine and fine, tubular pores; about 20 percent of horizon is light reddish-brown and light-gray gravel; gravel is coated with lime on bottom and two-thirds of the way up the sides; strongly calcareous; moderately alkaline; gradual, smooth boundary.



C2—14 to 28 inches, pinkish-gray (7.5YR 7/2) gravelly heavy loam, brown (7.5YR 5/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many, very fine and fine, tubular pores; about 30 percent of horizon is dark-gray gravel; gravel is coated with lime on bottom sides and slightly on top; strongly calcareous; moderately alkaline; gradual, smooth boundary.

C3—28 to 45 inches, pinkish-gray (7.5YR 7/2) gravelly loam, brown (7.5YR 5/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many, fine and very fine, tubular pores; about 30 percent of horizon is pinkish-gray, light-brown, and brown limestone; angular and subangular gravel is coated with lime on bottom and on sides; strongly calcareous; moderately alkaline; gradual, wavy boundary.

IIC4—45 to 60 inches, dark-gray (10YR 4/1) and light-gray (10YR 7/2) limestone gravel that is coated with lime except on top.

The A1 horizon is 6 to 10 inches thick. The color value is 4 or 5 when dry and is 2 or 3 when moist. The chroma is 2 or 3. The C horizon ranges from 5 to 8 in color value when dry and from 3 to 6 when moist. The chroma is 2 or 3. The hue is mainly 10YR in both the A and C horizons, but it is 7.5YR in some places.

Included are small areas where the slope is more than 30 percent. Also included are areas of Newdale silt loam, Ricrest stony loam, and Hymas extremely stony loam.

Permeability is moderate, and the available water capacity is about 6 to 8 inches. Surface runoff is medium to rapid, and the hazard of water erosion is severe. Roots can penetrate to a depth of more than 40 inches.

This soil is used mainly for range. The slope is generally too irregular or too hilly for cultivation. Some areas can be worked sufficiently with farm machinery to prepare a seedbed for reseeding to suitable plant species. (Capability unit VIe-1, dryland; Loamy range site, 12 to 16 inches precipitation)

**Wahtigup stony loam, steep** (30 to 60 percent slopes) (WHG).—This soil is similar to Wahtigup stony loam, hilly, except for the slope. It is on steep mountain foot slopes in areas 20 to 400 acres in size. Surface runoff is rapid, and the hazard of water erosion is severe.

Included are small areas where the slope is less than 30 percent or more than 60 percent. Also included are areas of Newdale silt loam, Ricrest stony loam, and Hymas extremely stony loam.

This soil is used only for range, because it is too steep for cultivation. It cannot be worked with farm machinery to prepare a seedbed for suitable plant species. (Capability unit VIIe-0, dryland; Steep Slopes range site, 8 to 12 inches precipitation)

## Wapello Series

The Wapello series consists of well-drained, nearly level and very gently sloping soils that are 20 to 30 inches deep over silt loam or loam. These soils are fine sandy loam in texture. They formed on stream terraces under big sagebrush and bunchgrass. Wapello soils are associated with Wolverine, Presto, and Firth soils.

Elevations range from 4,200 to 4,600 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 42° to 45° F., and the frost-free season is 110 to 125 days.

In a representative profile the surface layer is grayish-brown fine sandy loam 8 inches thick. The underlying material is light brownish-gray and light-gray fine sandy

loam. It is underlain at a depth of 29 inches by stratified layers of light-gray silt loam and loamy alluvium. These soils are limy throughout.

Wapello soils are used mainly for irrigated hay, small grain, and for pasture.

**Wapello fine sandy loam, 0 to 2 percent slopes** (WcA).—This soil is on stream terraces in areas 10 to 200 acres in size.

Representative profile: 800 feet south and 800 feet east of the northwest corner of sec. 24, T. 2 S., R. 36 E., in a cultivated field:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, fine, and very fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many, very fine, interstitial pores and common, very fine and fine, tubular pores; few 5-millimeter worm channels and casts; moderately calcareous; mildly alkaline; abrupt, smooth boundary.

C1—8 to 15 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many, very fine and fine, tubular pores and few, medium and coarse, tubular pores; few worm casts; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2—15 to 22 inches, light-gray (10YR 7/2) and light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores and few, medium and coarse, tubular pores; few worm casts; strongly calcareous; few fine spots and ½-inch splotches of lime; moderately alkaline; gradual, wavy boundary.

C3—22 to 29 inches, light brownish-gray (10YR 6/2) light fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; many, very fine, tubular pores; strongly calcareous; moderately alkaline, abrupt, wavy boundary.

IIC4—29 to 33 inches, light-gray (2.5Y 6/1) silt loam, dark grayish brown (2.5Y 4/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many, very fine and fine, tubular pores; strongly calcareous; few fine spots of lime; moderately alkaline; clear, wavy boundary.

IIC5—33 to 55 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many, very fine, tubular pores; strongly calcareous; few fine spots and veins of lime; moderately alkaline; clear, wavy boundary.

IIC6—55 to 70 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; few, fine, faint, very pale brown (10YR 7/4) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; no roots; common, very fine, tubular pores; strongly calcareous; moderately alkaline.

The A1 or Ap horizon ranges from 6 to 10 inches in thickness and from about 1 to 2 percent in organic-matter content. The hue is 10YR, and the chroma is 2 to 3. The C1 and C2 horizons are dominantly fine sandy loam but can be sandy loam in places. They range from 5 to 7 in color value when dry and from 3 to 5 when moist. The soil is calcareous throughout. It ranges from slightly to moderately calcareous in the A horizon.

Included are small areas where the slope is more than 2 percent and where the texture of the surface layer is sandy loam or loamy sand. Also included are areas of Wolverine sand, rolling; Presto loamy sand; and Firth sandy loam.



Permeability is moderate, and the available water capacity is about 9 to 10 inches. Surface runoff is slow, and the hazard of water erosion is moderate. Roots can penetrate to a depth of more than 60 inches.

This soil is used for irrigated potatoes, hay, pasture, and small grain. (Capability unit IIe-4, irrigated; wind-break suitability group 1)

**Wapello fine sandy loam, 2 to 4 percent slopes (WcB).**—This soil is similar to Wapello fine sandy loam, 0 to 2 percent slopes, except for the slope. It is on stream terraces in areas 5 to 40 acres in size. Surface runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

Included are small areas where the slope is less than 2 percent or more than 4 percent. Also included are areas of Wolverine sand, rolling; Presto loamy sand; and Firth sandy loam.

This soil is used for irrigated potatoes, hay, pasture, and small grain. (Capability unit IIe-3, irrigated; wind-break suitability group 1)

## Wardboro Series

The Wardboro series consists of somewhat excessively drained, nearly level and very gently sloping soils 10 to 20 inches deep over very gravelly coarse sand. The texture is sandy loam. These soils formed in alluvium. They are on bottom lands and low river terraces of the Recent epoch. The vegetation consists mainly of cottonwoods, willows, big sagebrush, and grasses. Wardboro soils are associated with soils of the Heiseton, Hayeston, and Blackfoot series.

Elevations range from 4,200 to 4,400 feet. The annual precipitation is 10 to 13 inches. The mean annual air temperature is 42° to 45° F., and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is grayish-brown sandy loam about 2 inches thick. The underlying material is light brownish-gray sandy loam underlain by water-worn gravel and sand at a depth of about 11 inches. The soils are limy throughout.

Wardboro soils are used mainly for range, but some areas are used for irrigated pasture.

**Wardboro soils (0 to 4 percent slopes) (Wb).**—These soils are on bottom lands and low river terraces of the Recent epoch. The areas are 20 to 200 acres in size.

Representative profile: 1,500 feet east of the southwest corner of sec. 6, T. 3 S., R. 35 E., in an area of cottonwoods and grasses:

A1—0 to 2 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many interstitial pores; few rounded pebbles; slightly calcareous; mildly alkaline; clear, smooth boundary.

C1—2 to 11 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots, and few medium roots; many, very fine and fine, tubular pores; few pebbles; slightly calcareous; mildly alkaline; abrupt, smooth boundary.

IIC2—11 to 60 inches, light brownish-gray (10YR 6/2) very gravelly coarse sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry or moist; about 75 percent of horizon is multicolored rounded

gravel, mostly quartzite; slightly calcareous; gravel is coated or only very slightly coated on lower side with lime; mildly alkaline.

The A1 horizon is 1 to 6 inches thick. It has a color value of 5 or 6 when dry, a chroma of 2 or 3, and a hue of 10YR or 2.5Y. The C1 horizon is generally 10 to 18 inches thick. It ranges from 5 to 7 in color value when dry and from 3 to 5 when moist. A stratum of loose sand and gravel has its upper boundary at a depth between 10 and 20 inches, commonly at 12 to 14 inches.

Included are small areas where the texture of the surface soil is sandy loam or loamy sand, as well as gravelly and cobbly areas. Also included are areas where the slope is more than 4 percent and areas of Heiseton sandy loam, Hayeston sandy loam, and Riverwash.

Permeability is moderately rapid in the upper 10 inches and very rapid below this depth. The available water capacity is about 3 inches. Surface runoff is slow, and the hazard of water erosion is slight. Roots can penetrate into the underlying layer of gravel and sand.

These soils are used mainly for range and are cultivated only where they adjoin deeper soils. (Capability unit IVs-1, irrigated; VIIe-1, dryland; River Bottom range site, 8 to 12 inches precipitation)

## Waycup Series

The Waycup series consists of well-drained, nearly level to moderately sloping, loamy soils. These soils formed in colluvium and local alluvium. The vegetation consists mainly of big sagebrush and bunchgrass. Waycup soils are associated with Declo, Portneuf, and Portino soils.

Elevations range from 4,200 to 4,600 feet. The mean annual precipitation is 8 to 11 inches. The mean annual air temperature is 46° to 50° F., and the frost-free season is 110 to 130 days.

In a representative profile the surface layer is light brownish-gray extremely stony loam 8 inches thick. The subsoil is pale-brown extremely stony loam 8 inches thick. The substratum is pale-brown, light-gray, and white extremely stony loam that overlies basalt bedrock at a depth of 50 inches. These soils are limy throughout, but they have more lime in the substratum than in the other parts of the profile.

Waycup soils are used for range.

**Waycup extremely stony loam, 0 to 12 percent slopes (WcD).**—This soil is on basalt plains and terraces in areas that range from 50 to 200 acres in size.

Representative profile: 200 feet south and 950 feet west of the southeast corner of sec. 27, T. 3 S., R. 33 E., in an area of native grasses:

A11—0 to 3 inches, light brownish-gray (10YR 6/2) extremely stony loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure parting to weak, fine, granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many, fine, vesicular and interstitial pores; slightly calcareous; moderately alkaline; gradual, smooth boundary.

A12—3 to 8 inches, light brownish-gray (10YR 6/2) extremely stony loam, brown (10YR 4/3) when moist; weak, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, interstitial pores; slightly calcareous; moderately alkaline; gradual, smooth boundary.

B2—8 to 16 inches, pale-brown (10YR 6/3) extremely stony loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable,



slightly sticky and slightly plastic; common fine and medium roots; many, very fine and fine, tubular pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

C1ca—16 to 24 inches, pale-brown (10YR 6/3) extremely stony loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many, very fine and fine, tubular pores; strongly calcareous; rocks have a moderate coating of lime on lower side; moderately alkaline; gradual, wavy boundary.

C2ca—24 to 32 inches, light-gray (10YR 7/2) extremely stony loam, brown (10YR 5/3) when moist; weak prismatic structure parting to weak, fine, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many, very fine and fine, tubular pores; strongly calcareous; rocks have a thick coating of lime on under side; moderately alkaline; gradual, wavy boundary.

C3ca—32 to 50 inches, white (10YR 8/2) extremely stony loam, light brownish-gray (10YR 6/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common, fine, tubular pores; stones have a thick coating of lime; strongly calcareous; strongly alkaline; abrupt, wavy boundary.

IIR—50 inches, basalt bedrock that has a thick coating of lime on surface and in cracks and pores.

The A horizon has a chroma of 2 or 3. It ranges from 4 to 8 inches in thickness. The B horizon ranges from 4 to 6 in color value when dry and from 2 to 3 in chroma. It is slightly to moderately calcareous. The Cca horizon begins at a depth below 12 to 20 inches. It is strongly calcareous and contains 18 to 35 percent lime. It extends to basalt bedrock at a depth below 40 inches. Hues in all horizons are mainly 10YR but are 2.5Y in some soils. Gravel makes up 15 to 25 percent of the A and B horizons and 15 to 40 percent of the C horizon.

Included are areas of Portino silt loam and Portino stony silt loam.

Permeability is moderate, and the available water capacity is about 5 inches. Surface runoff is slow to medium, and the erosion hazard is slight to moderate. The soil is more than 40 inches deep.

This soil is used for range. (Capability unit VIIc-2, dryland; Stony range site, 8 to 12 inches precipitation)

## Weeding Series

The Weeding series consists of moderately well-drained, nearly level soils that formed in calcareous alluvium or eolian deposits. These soils are on river terraces. They are loamy sand in texture. Roots can penetrate to a depth of 60 inches or more. The vegetation consists mainly of big sagebrush and bunchgrass. Weeding soils are associated with soils of the Firth, Wapello, Presto, and Wolverine series.

Elevations range from 4,200 to 5,400 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 40° to 45° F., and the frost-free period is 110 to 125 days.

In a representative profile the surface layer is grayish-brown loamy sand 20 inches thick. The underlying layer is light brownish-gray slightly calcareous loamy sand to a depth of 45 inches. It is light-gray sand at a depth of 45 to 60 inches. The profile is limy throughout.

Weeding soils are used for irrigated hay, pasture, and small grain.

**Weeding loamy sand** (0 to 2 percent slopes) (We).—This soil is on river terraces in areas 10 to 100 acres in size.

Representative profile: 1,350 feet east and 750 feet

south of the center of sec. 28, T. 2 S., R. 36 E., in a cultivated area:

Ap—0 to 7 inches, grayish-brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) when moist; weak, very fine, granular structure; soft, very friable; many very fine and fine roots; many, very fine, interstitial pores; slightly calcareous; mildly alkaline; gradual, smooth boundary.

A1—7 to 20 inches, grayish-brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) when moist; massive; soft, very friable; common very fine and fine roots; many, very fine, interstitial pores; slightly calcareous; mildly alkaline; gradual, smooth boundary.

C1—20 to 30 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) when moist; common, medium, faint, very dark grayish-brown (when moist) mottles; massive; soft, very friable; common very fine and fine roots; many, very fine, interstitial pores; slightly calcareous; mildly alkaline; gradual, smooth boundary.

C2—30 to 45 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry or moist; common very fine and fine roots; many, very fine, interstitial pores; slightly calcareous; mildly alkaline; gradual, smooth boundary.

IIC3—45 to 60 inches, light-gray (10YR 7/1) sand, gray (10YR 5/1) when moist; single grain; loose when dry or moist; few very fine and fine roots; many, very fine, interstitial pores; moderately calcareous; mildly alkaline.

The A horizon ranges from 10 to 20 inches in thickness. The soils are mottled at a depth of 20 to 40 inches. The texture is loamy sand, loamy fine sand, or loamy coarse sand at a depth between 10 and 40 inches. The A1 and Ap horizons have a color value of 4 or 5 when dry and a chroma of 2 or 3.

Included are small areas where the slope is more than 2 percent. Also included are areas of Firth sandy loam, Wapello fine sandy loam, Presto loamy sand, and Wolverine sand, rolling.

Permeability is rapid, and the available water capacity is about 5 inches. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This soil is used for irrigated hay, pasture, and small grain. (Capability unit IVE-5, irrigated; windbreak suitability group 4)

## Wolverine Series

The Wolverine series consists of excessively drained, nearly level to moderately steep, sandy soils that formed in eolian sands. These soils are on terraces. Roots can penetrate to a depth of 60 inches or more. The vegetation consists mainly of bunchgrass and big sagebrush. Wolverine soils are associated with Weeding, Wapello, Firth, and Presto soils.

Elevations range from 4,400 to 4,600 feet. The annual precipitation is 11 to 13 inches. The mean annual air temperature is 40° to 45° F., and the frost-free period is 110 to 125 days.

In a representative profile, the soil is limy, light brownish-gray sand to a depth of 60 inches or more.

Wolverine soils are used for range.

**Wolverine sand, rolling** (0 to 30 percent slopes) (WO).—This soil is on elongated sand dunes that are oriented with the prevailing winds in areas 10 to 200 acres in size.

Representative profile: 700 feet west and 130 feet north of the southeast corner of sec. 30, T. 2 S., R. 36 E., in an area of range:



A1—0 to 6 inches, light brownish-gray (2.5YR 6/2) sand, very dark grayish brown (10YR 3/2) when moist; single grain; loose when dry or moist; many very fine and fine roots; many, very fine, interstitial pores; slightly calcareous; mildly alkaline; gradual, smooth boundary.

C1—6 to 17 inches, light brownish-gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry or moist; common very fine and fine roots; many, very fine, interstitial pores; slightly calcareous; mildly alkaline; gradual, smooth boundary.

C2—17 to 60 inches, light brownish-gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry or moist; few fine, medium, and coarse roots; many, very fine, interstitial pores; slightly calcareous; mildly alkaline.

The A horizon ranges from 1 to 8 inches in thickness. It has a color value of 5 to 6 when dry.

Included are small areas where the slope is more than 30 percent. Also included are areas of Wapello fine sandy loam, Firth sandy loam, Presto loamy sand, and Weeding loamy sand.

Permeability is very rapid, and the available water capacity is about 4 inches. Surface runoff is slow. The hazard of water erosion is slight, but the hazard of soil blowing is severe. (Capability unit VIIe-1, dryland; Sands range site, 8 to 12 inches precipitation)

## Use and Management of the Soils

This section begins with an explanation of the system of capability grouping used in the Soil Conservation Service to classify soils according to their relative suitability for crops. Following this explanation are discussions of the management of the soils by irrigated and dryland capability units. Next are tables in which are shown estimated yields of the principal crops grown in the Survey Area. These are followed by discussions of the use and management of the soils for range and for woodland and windbreaks. Then comes a discussion of the use of the soils for wildlife. The last part of the section concerns use of the soils in engineering. This part consists mainly of tables that give engineering test data, descriptions of soil properties significant in engineering, and interpretations of these properties as they affect the suitability of the soils for specified engineering uses.

## Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when 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 land-forming 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 requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, forest trees, or engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

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, defined as follows:

Class I soils have few limitations that restrict their use. (None in the Bingham Area)

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

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

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

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

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 can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability unit are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-12. Thus, in one symbol, the Roman numeral designates the capability



class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

## Management by Capability Units

In the following pages, the capability units in the Bingham Area are described, and suggestions for the use and management of the soils are given. Texture as used in this section refers to the texture of the surface layer, unless otherwise stated. Also, unless otherwise stated, depth means depth to bedrock or to a hardpan, which restricts root development of common plants. The available water capacity is given to a depth of 5 feet or to the depth of bedrock, whichever is less.

The names of the soil series represented are mentioned in the description of each capability unit, but the listing of the series name does not necessarily indicate that all the soils of a series are in the same capability unit.

In the Bingham Area, the capability units are set up and numbered within a system of capability classification that is used throughout the State. Not all the capability units in this system are applicable, and for this reason the numbering of the capability units is not consecutive in all cases.

To find the capability unit in which a given mapping unit has been placed, refer to the "Guide to Mapping Units" at the back of this survey.

### CAPABILITY UNIT IIc-1, IRRIGATED

This unit consists of medium-textured soils of the Ammon, Bock, Declo, Fingal, Panheri, and Portneuf series. These soils are more than 40 inches deep. Slopes are 2 to 4 percent. The soils are well drained or moderately well drained.

Permeability is moderate to slow. The available water capacity is more than 7.5 inches. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

These soils are used for sugar beets, potatoes, small grain, alfalfa-grass hay, and pasture. The frost-free season ranges from 100 to 130 days.

Tilth can be improved by using soil-improving crops at least 30 percent of the time and plowing under all crop residue. An example of a suitable cropping system is 2 to 3 years of alfalfa or alfalfa-grass, 2 years of potatoes or sugar beets, and 2 years of grain. A new seeding of alfalfa or grass is seeded with the second year of grain. Fall tillage is advisable preceding the use of row crops.

Irrigation water can be applied by gravity or sprinkler systems. It should be distributed with care to control erosion.

### CAPABILITY UNIT IIc-3, IRRIGATED

This unit consists of medium-textured and moderately coarse textured soils of the Bannock, Declo, Heiseton, Matheson, Stan, and Wapello series. These soils generally are more than 40 inches deep. The Bannock soil is underlain by gravel at a depth of 20 to 40 inches. Slopes are 2 to 4 percent. The soils are well drained and moderately well drained.

Permeability is moderate to moderately rapid. The

available water capacity is more than 5 inches. Runoff is slow to medium. The hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

These soils are used for potatoes, small grain, alfalfa, alfalfa-grass, and pasture. The frost-free season ranges from 110 to 130 days.

Tilth can be improved by using soil-improving crops at least 30 percent of the time and utilizing all crop residue. An example of a suitable cropping system is 3 years of alfalfa or alfalfa-grass, 1 year of potatoes, 1 year of grain, 1 year of potatoes, and 1 year of grain with a new seeding of alfalfa or grass seeded with the grain. Rough tillage and crop residue left on the surface help control soil blowing in winter.

Irrigation water can be applied by sprinkler or gravity systems. Careful distribution of irrigation water helps control erosion and limit water loss.

### CAPABILITY UNIT IIc-4, IRRIGATED

This unit consists of moderately coarse textured soils of the Declo, Firth, Heiseton, Matheson, Stan, and Wapello series. These soils are more than 40 inches deep. Slopes are 0 to 2 percent. The soils are well drained or moderately well drained.

Permeability is moderate or moderately rapid. The available water capacity is more than 6 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

These soils are used for potatoes, small grain, alfalfa, alfalfa-grass, and pasture. The frost-free season ranges from 110 to 130 days.

The use of soil-improving crops at least 30 percent of the time and utilization of all crop residue helps maintain or improve tilth. Areas used for row crops or left bare in winter can be protected from soil blowing by using rough tillage and leaving crop residue on the surface. Windbreak plantings can also be used to protect the soils from blowing.

Irrigation water can be applied by sprinkler or gravity systems. It should be distributed with care to control erosion and limit water loss.

### CAPABILITY UNIT IIc-11, IRRIGATED

This unit consists of medium-textured and stony soils of the Knull, Polatis, and Portino series. These soils are underlain by basalt at a depth of 20 to 40 inches. Slopes are 2 to 4 percent. The soils are well drained.

Knull silt loam is somewhat deeper to bedrock and has a higher available water capacity than the other soils, but its use and management are generally the same as that for Portino silt loam. Polatis and Portino stony silt loams have a dominantly stony surface layer but are used and managed in a manner similar to that of the other soils.

Permeability is moderate to slow. The available water capacity is mostly 5 to 8 inches but ranges to 4 inches. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate.

These soils are used for sugar beets, potatoes, small grain, alfalfa, and pasture. The frost-free season ranges from 100 to 130 days.

The use of soil-improving crops at least 50 percent of the time, plowing under all crop residue, keeping



tillage to a minimum, and fall plowing after row crops help maintain crop yields and control erosion. Removal of stones from the Polatis and Portino stony soils will facilitate cultivation and harvest of row crops.

An example of a suitable cropping system is 3 to 4 years of alfalfa or alfalfa-grass, 1 to 2 years of sugar beets or potatoes, and 2 years of grain. A new seeding of alfalfa or grass is seeded with the second year of grain.

Irrigation water can be applied by sprinkler or gravity systems. It should be distributed with care to control erosion.

#### CAPABILITY UNIT IIw-2, IRRIGATED

This unit consists of moderately coarse textured, medium-textured and moderately fine textured soils of the Blackfoot, Firth, Fulmer, and LaJara series. These soils are more than 60 inches deep. Slopes are less than 2 percent. These are somewhat poorly drained soils and drained phases of poorly drained soils.

Blackfoot loam, saline, has lower crop yields than the other soils because of its salt content, but its use and management are similar.

Permeability is moderately slow to moderately rapid. The available water capacity is more than 7 inches. The frost-free season ranges from 110 to 130 days. Surface runoff is slow, and the hazard of erosion is none to slight.

Using soil-improving crops at least 50 percent of the time, returning all crop residue to the soil, practicing minimum tillage, and providing a system of surface drainage helps maintain crop yields, maintain the organic-matter content, and improve soil tilth.

An example of a suitable cropping system is 3 years of alfalfa or alfalfa-grass, 2 years of sugar beets, and 2 years of grain. A new seeding of alfalfa or grass is seeded with the second year of grain.

Irrigation water can be applied by sprinkler or gravity systems. Carefully planned irrigation helps control the water table. Drainage may be needed to reduce the risk of salt accumulations and to control extreme fluctuations of the water table, which can be injurious to crop roots.

#### CAPABILITY UNIT IIb-1, IRRIGATED

This unit consists of medium-textured soils of the Banock, Hayeston, Knull, Paesl, Polatis, Paniogue, and Portino series. These soils are 20 to 40 inches deep to bedrock or sand and gravel. Slopes are less than 2 percent. The soils are well drained.

The Knull soil in this unit is somewhat deeper to bedrock than the other soils, and it has a higher available water capacity; but its use and management are generally the same as that for Portino silt loam. Stoniness in the stony phases of the Polatis and Portino silt loams is mainly a surface feature, and use and management are otherwise similar to that of the other soils.

Permeability is slow to moderately rapid. The available water capacity is 4 to 8 inches. Surface runoff is slow, and the hazard of erosion is none to slight.

These soils are used for sugar beets, potatoes, small grain, alfalfa, and pasture. The frost-free season ranges from 100 to 130 days.

Returning all crop residue to the soil, using minimum tillage, and fall plowing after row crops help control erosion, maintain the organic-matter content, and improve soil tilth. Stones can be removed from the surface

layer of the Polatis and Portino soils after tillage operations to facilitate cultivation and harvest of row crops.

An example of a suitable cropping system is 2 to 3 years of alfalfa or alfalfa-grass, 1 to 2 years of sugar beets or potatoes, and 2 years of grain. A new seeding of alfalfa or grass is seeded with the second year of grain. Care is needed in land leveling to avoid cutting to the underlying gravel or bedrock. Irrigation water can be applied by sprinkler or gravity systems.

#### CAPABILITY UNIT IIb-9, IRRIGATED

This unit consists of medium-textured and moderately fine textured soils of the Fingal series. These soils are more than 60 inches deep. Slopes are 0 to 2 percent. They are moderately well drained.

Permeability is slow, and the available water capacity is about 11 inches. Surface runoff is slow, and the hazard of erosion is none to slight.

This soil is used for sugar beets, potatoes, small grain, alfalfa, and pasture. The frost-free season ranges from 100 to 110 days.

The use of soil-improving crops at least 30 percent of the time, plowing under all crop residue, providing an adequate surface drainage system, practicing fall plowing after row crops, and using minimum tillage help maintain crop yields, control erosion, and improve soil tilth. An example of a suitable cropping system is 2 to 3 years of alfalfa or alfalfa-grass, 2 years of sugar beets or potatoes, and 2 years of grain. A new seeding of alfalfa or grass is seeded with the second year of grain.

Irrigation water can be applied by the gravity system.

#### CAPABILITY UNIT IIc-2, IRRIGATED

This unit consists of medium-textured soils of the Ammon, Blackfoot, Bock, Declo, Heiseton, Kimama, Pancheri, and Portneuf series. These soils are more than 40 inches deep. Slopes are less than 2 percent. The soils are well drained or moderately well drained.

Permeability is moderate, and the available water capacity is about 7.5 to 12 inches. Runoff is slow, and the hazard of erosion is none to slight.

These soils are used for potatoes, sugar beets, small grain, alfalfa, or pasture. The frost-free season ranges from 100 to 130 days.

Using soil-improving crops at least 30 percent of the time, plowing under all crop residue, and fall rough plowing after row crops help control erosion and improve tilth. An example of a suitable cropping system is 3 years of alfalfa or alfalfa-grass, 2 years of sugar beets or potatoes, and 2 years of grain. A new seeding of alfalfa or grass is seeded with the second year of grain.

Irrigation water can be applied by sprinkler or gravity systems.

#### CAPABILITY UNIT IIId-1, IRRIGATED

This unit consists of medium-textured soils of the Declo, Pancheri, and Portneuf series. These soils are more than 40 inches deep. Slopes are 4 to 8 percent. The soils are well drained.

Permeability is moderate. The available water capacity is more than 10 inches. Surface runoff is medium, and the hazard of erosion is moderate.

These soils are used for sugar beets, potatoes, small grain, alfalfa, and pasture. The frost-free season ranges from 110 to 130 days.



The use of soil-improving crops at least 50 percent of the time, plowing under all crop residue, keeping tillage to a minimum, and plowing in fall help maintain crop yields, control erosion, and improve tilth.

An example of a suitable cropping system is 3 years of alfalfa or alfalfa-grass, 1 year of sugar beets or potatoes, and 2 years of grain. A new seeding of alfalfa or grass is seeded with the second year of grain. Where sprinkler irrigation is used, row crops can be increased 1 year.

Irrigation water can be applied by sprinkler or gravity systems. Careful application of irrigation water and cross-slope irrigation helps control erosion.

#### CAPABILITY UNIT IIIe-12, IRRIGATED

This unit consists of medium-textured soils of the Bannock, Polatis, and Portino series. Slopes are 4 to 8 percent. The soils are well drained.

The Polatis and Portino soils are 20 to 40 inches deep to bedrock. The Bannock soil is 20 to 40 inches deep to sand and gravel. Stoniness in the stony phases of the Portino and Polatis silt loams is mainly in the surface layer, and use and management are otherwise similar to that of the other soils.

Permeability is moderate. The available water capacity is 4 to 7 inches. Runoff is medium, and the hazard of erosion is moderate.

These soils are used for sugar beets, potatoes, small grain, alfalfa or alfalfa-grass, and pasture. The frost-free season ranges from 110 to 130 days.

The use of soil-improving crops at least 50 percent of the time, plowing under all crop residue, practicing minimum tillage, and the fall plowing after row crops help maintain crop yields and control erosion. Stones can be removed from the surface layer of the Polatis and Portino stony silt loams to facilitate cultivation and harvest of row crops.

An example of a suitable cropping system is 3 years of alfalfa or alfalfa-grass, 1 year of sugar beets or potatoes, and 2 years of grain. A new seeding of alfalfa or grass is seeded with the second year of grain.

Irrigation water can be applied by sprinkler or gravity systems. It should be applied with extreme care to control erosion.

#### CAPABILITY UNIT IIIe-13, IRRIGATED

This unit consists of moderately coarse textured soils of the Declo, Hayeston, Malm, Matheson, and Sasser series. These soils are mostly more than 40 inches deep to either bedrock or sand and gravel. Slopes are 2 to 8 percent. These soils are well drained.

The Malm soil in this unit has basalt at a depth of 20 to 40 inches, and the available water capacity is slightly less where basalt is nearer the surface. The use and management of this soil and crop yields are similar to those of the other soils.

Permeability is moderate to moderately rapid. The available water capacity is more than 4 inches. Surface runoff is medium, and water erosion and soil blowing are moderate hazards.

These soils are used for potatoes, small grain, alfalfa or alfalfa-grass, and pasture. The frost-free season ranges from 110 to 130 days.

The use of soil-improving crops at least 50 percent of

the time, plowing under all crop residue, and fall plowing after row crops help maintain crop yields and control erosion.

An example of a suitable cropping system is 4 or 5 years of alfalfa or alfalfa-grass, 1 year of potatoes, and 2 years of grain. A new seeding of alfalfa or grass is seeded with the second year of grain. Leaving crop residue on the surface helps control soil blowing. Deep leveling cuts should be avoided because of the limited soil depth.

Irrigation water can be applied more safely by sprinklers, but gravity systems can be used. Gravity irrigation systems should be carefully controlled to prevent severe erosion, particularly on the steeper slopes. Irrigation water should be applied with care to control erosion.

#### CAPABILITY UNIT IIIe-3, IRRIGATED

This unit consists of moderately coarse textured soils of the Hayeston, Malm, Paesl, and Sasser series. Most of these soils are 20 to 40 inches deep over basalt gravel, but some of them have basalt at a depth of 20 to 40 inches. Slopes are less than 2 percent.

Permeability is moderate to moderately rapid. The available water capacity is 4 to 7 inches. Runoff is slow, and the hazard of water erosion is slight. Soil blowing is a moderate hazard.

These soils are used for potatoes, small grain, forage crops, and pasture. The frost-free season ranges from 110 to 130 days.

The use of soil-improving crops at least 50 percent of the time, returning all crop residue to the soil, and fall plowing after row crops help maintain the organic-matter content, control erosion, and improve tilth.

An example of a suitable cropping system is 3 to 4 years of alfalfa or alfalfa-grass, 1 year of potatoes, and 2 years of grain. A new seeding of alfalfa or grass is seeded with the second year of grain. Areas used for row crops or left bare in winter can be protected from soil blowing by leaving crop residue on the surface.

Irrigation water can be applied by sprinkler or gravity systems. At each irrigation, care should be taken to apply only enough water to meet the needs of the crop being grown. Too much irrigation water is likely to leach plant nutrients from the soil or, in some areas, may cause a high water table.

#### CAPABILITY UNIT IIIe-8, IRRIGATED

This unit consists of medium-textured soils in the Fingal series. These soils are moderately saline. They are more than 60 inches deep. Slopes are 0 to 4 percent. The soils are moderately well drained.

Permeability is slow. The available water capacity is about 11 inches. Surface runoff is slow, and the hazard of erosion is slight.

These soils are used for small grain, sugar beets, forage crops, and pasture. The frost-free season ranges from 100 to 110 days.

Returning all crop residue to the soil, providing adequate surface and subsurface drainage, using frequent light irrigations, and growing salt-tolerant grasses and legumes help maintain the organic-matter content and improve crop yields. Drainage and large applications of irrigation water may be needed to remove excess salts.



An example of a suitable cropping system is 3 years of alfalfa or alfalfa-grass, 1 year of sugar beets, and 2 years of grain. A new seeding of alfalfa or grass is seeded with the second year of grain. Irrigation water can be applied by sprinkler or gravity systems.

#### CAPABILITY UNIT IVe-1, IRRIGATED

This unit consists of medium-textured soils of the Declo, Pancheri, and Portneuf series. These soils are more than 40 inches deep to bedrock or sand and gravel. Slopes are 8 to 20 percent. The soils are well drained.

Declo loam, 12 to 20 percent slopes, eroded, is of limited acreage. It is steeper than the other soils of this unit, but its use and management are essentially the same.

Permeability is moderate. The available water capacity is 10 inches or more. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe.

These soils are used for small grain, hay, and pasture. The frost-free season ranges from 110 to 130 days.

An example of a suitable cropping system is 6 years or more of alfalfa or alfalfa-grass, and 2 years of small grain. A new seeding of alfalfa or grass is seeded with the second year of grain. Returning all crop residue to the soil helps maintain the organic-matter content.

These soils are suited to irrigation by sprinklers. Gravity irrigation systems can cause excessive erosion, unless they are carefully designed and managed.

#### CAPABILITY UNIT IVe-2, IRRIGATED

This unit consists of medium-textured soils of the Portino, Tenno, and Thornock series. These soils are 10 to 40 inches deep but are mostly 10 to 20 inches. Slopes are 4 to 12 percent. These soils are well drained. The mean annual precipitation ranges from 8 to 11 inches.

Permeability is moderate. The available water capacity is about 2.5 to 7 inches. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe.

These soils are used for small grain, forage crops, and pasture. The frost-free season ranges from 110 to 130 days.

An example of a suitable cropping system is 4 years or more of alfalfa or alfalfa-grass, and 2 years of small grain. A new seeding of alfalfa or grass is seeded with the second year of grain. Returning all crop residue to the soil helps maintain the organic-matter content.

Irrigation water can be applied by sprinkler or gravity systems. The water is difficult to control if allowed to flow over the surface, and the preferred method of irrigation is by sprinkler. Irrigation water should be distributed with extreme care to control erosion. Only a limited amount of land smoothing can be done, because of the shallowness of the soils.

#### CAPABILITY UNIT IVe-5, IRRIGATED

This unit consists of coarse-textured soils of the Presto and Weeding series. These soils are more than 60 inches deep. Slopes are less than 2 percent. The soils are somewhat excessively drained and moderately well drained. The mean annual precipitation ranges from 8 to 13 inches.

Permeability is moderate or rapid. The available water capacity is 4 to 6 inches. Surface runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate to severe.

These soils are used for small grain, hay, and pasture. The frost-free season ranges from 100 to 126 days.

Using soil-improving crops at least 75 percent of the time and returning all crop residue to the soil help maintain the organic-matter content. Plowing should be done in spring so that the plant cover will be left on the surface during winter. Fall seeding of grasses or legumes in grain stubble helps protect the soils from blowing.

Irrigation water is generally applied by gravity systems, but it can be applied efficiently by sprinkler systems. Frequent irrigations are required.

#### CAPABILITY UNIT IVs-1, IRRIGATED

This unit consists mainly of medium-textured soils that are less than 40 inches deep to gravel and sand or bedrock. These are soils of the Packham, Tenno, Thornock, and Wardboro series. They are stony or gravelly but can be tilled with difficulty. Slopes are less than 4 percent. The soils are well drained. The mean annual precipitation ranges from 8 to 13 inches.

Permeability is moderate to very rapid. The available water capacity is about 2.5 to 4 inches. Surface runoff is slow, and the hazard of erosion is slight.

These soils are used mainly for small grain, forage crops, and pasture. The frost-free season ranges from 110 to 130 days.

Using soil-improving crops at least 75 percent of the time and returning all crop residue to the soil help maintain the organic-matter content, maintain crop yields, and control erosion. Irrigation water can be applied by sprinkler or gravity systems.

#### CAPABILITY UNIT IVs-8, IRRIGATED

Fingal loam, strongly saline, 0 to 2 percent slopes, is the only soil in this unit. This soil is more than 40 inches deep. It is moderately well drained. The mean annual precipitation ranges from 8 to 11 inches.

Permeability is slow. The available water capacity is about 11 inches. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for salt-tolerant crops, such as barley, and for salt-tolerant grasses and legumes for pasture. The frost-free season ranges from 100 to 110 days.

A suitable cropping system consists of 4 or more years of salt-tolerant grasses or legumes, and 2 years of barley. A new seeding of grasses or legumes is seeded with the second year of barley. Plowing under all crop residue, providing adequate surface and subsurface drainage, and leaching excess salts help maintain crop yields.

Irrigation water can be applied by sprinkler or gravity systems. Irrigation to leach salts and light, frequent irrigations to germinate and start new seedlings are desirable.

#### CAPABILITY UNIT Vw-2, IRRIGATED

This unit consists of moderately coarse textured and medium-textured soils of the Fulmer and LaJara series. These soils are more than 40 inches deep. Slopes are less than 2 percent. The soils are poorly drained. They are saturated with water most of the time.

Permeability is moderate. Surface runoff is slow, and the hazard of water erosion is no more than slight.

These soils are too wet for cultivation. They are used for pasture. The frost-free season ranges from 110 to 130 days.



Irrigation is mainly by water spreading and runoff and seepage from higher lying, irrigated areas.

These soils can be used for pasture and range.

#### CAPABILITY UNIT VIIIw-1, IRRIGATED

This unit consists of the miscellaneous land types Marsh and Riverwash. It is mainly on flood plains along streams and rivers where the water table is near or at the surface during much of the year. Most of this unit consists of sand or gravel bars or material of mixed textures.

The areas of this unit are too wet for use other than for wildlife habitat, watershed, and recreation. The principal vegetation is cattails, rushes, sedges, watercress, and scattered willows.

These soils should be protected to maintain or increase their suitability as wildlife habitat and recreational areas. Protection of the areas from fire and trampling by livestock is important.

#### CAPABILITY UNIT IIIc-4, DRYLAND

This unit consists of medium-textured soils of the Lanark and Rexburg series. These soils are more than 60 inches deep. Slopes are 4 to 20 percent. The soils are well drained. The mean annual precipitation ranges from 13 to 18 inches.

Permeability is moderate to moderately slow. The available water capacity is 11 inches or more. Surface runoff is medium, and the hazard of erosion is slight to severe.

These soils are used for small grain, hay, and pasture. The frost-free season ranges from 80 to 110 days.

A suitable cropping system consists of alternate small grain and summer fallow for 8 to 10 years followed by 4 to 6 years of a legume and grass mixture. Stubble mulching should be used following a winter wheat crop to control soil blowing. Minimum tillage and plowing under of all crop residue help improve soil structure and reduce compaction. Grassed waterways are needed where there is a concentration of runoff. All seeding and tillage operations should be done on the contour to increase the water-intake rate, control runoff, and reduce erosion. On long slopes, diversions help control erosion. Diversion terraces are not recommended for soils that have slopes of more than 12 percent. Chiseling and subsoiling improve water intake and reduce compaction. Small grain responds to applications of nitrogen. New seedlings of legumes respond to applications of phosphorus.

#### CAPABILITY UNIT IIIc-9, DRYLAND

This unit consists of medium-textured soils of the Robin and Sessions series. These soils are on uplands. They are more than 40 inches deep. Slopes are 4 to 20 percent. The soils are well drained. The mean annual precipitation ranges from 16 to 19 inches.

Permeability is moderate or slow. The available water capacity is 9 to 11 inches. Surface runoff is medium, and the erosion hazard is moderate to severe.

These soils are used for small grain, hay, and pasture. Specific choice of legume to be grown for hay or pasture is restricted to frost-tolerant species because of the short

growing season. The frost-free season ranges from 50 to 80 days.

A suitable cropping system consists of alternate small grain and summer fallow for 8 to 10 years, followed by a grass-legume mixture for 4 to 8 years. It is possible for small grain to be grown each year on the soils of this unit. Returning all crop residue to the soil helps maintain the organic-matter content. Stubble mulching, contour tillage, and seeding operations help reduce runoff and erosion. Chiseling and subsoiling increase the intake of moisture and reduce soil compaction. Minimum tillage operations help maintain soil structure and reduce soil compaction. Diversions may be needed on long slopes. Grassed waterways are needed where there is concentration of runoff. Small grain responds to applications of nitrogen. Legumes respond to applications of phosphorus.

#### CAPABILITY UNIT IIIc-45, DRYLAND

This unit consists of medium-textured soils of the Newdale series. These soils are more than 60 inches deep. Slopes are 4 to 20 percent. The soils are well drained. The mean annual precipitation ranges from 11 to 13 inches.

Permeability is moderate. The available water capacity is about 11 inches. Surface runoff is medium to rapid, and the hazard of erosion is moderate to severe.

These soils are used for small grain and pasture. The frost-free period ranges from 80 to 110 days.

An alternate small grain-summer fallow system of farming is commonly used on these soils because of the limited precipitation. Stubble mulching should be practiced during the fallow period to control erosion. All tillage and seeding operations should be done on the contour to increase the water-intake rate, reduce runoff, and control erosion. Minimum tillage and plowing under most crop residue help improve tilth and reduce compaction. Diversions on the longer slopes help control runoff and erosion. Diversion terraces are not suitable for slopes of more than 12 percent. Grassed waterways are needed where there is a concentration of runoff water. Chiseling and subsoiling should be used to improve the water-intake rate and reduce runoff. Stripcropping should be practiced where the size of fields permits. Small grain responds to applications of nitrogen.

#### CAPABILITY UNIT IIIc-4, DRYLAND

Lanark silt loam, 0 to 4 percent slopes, is the only soil in this capability unit. It is more than 60 inches deep and is well drained. The mean annual precipitation ranges from 14 to 18 inches.

Permeability is moderately slow. The available water capacity is about 12 inches. Surface runoff is slow to medium, and the hazard of erosion is slight.

This soil is used for small grain, alfalfa, and grass for hay and pasture. The frost-free season ranges from 80 to 100 days.

An example of a suitable cropping system is alternate small grain and summer fallow for 8 to 10 years, followed by 4 to 6 years of legume and grass mixture. Contour tillage and seeding are not necessary. Returning all crop residue to the soil and practicing minimum till-



age help maintain soil structure and reduce compaction. Grassed waterways are needed where there is a concentration of runoff. Chiseling and subsoiling improve the water-intake rate and reduce compaction. Small grain responds to applications of nitrogen. New seedings of alfalfa respond to applications of phosphorus.

#### CAPABILITY UNIT IIIc-9, DRYLAND

Robin silt loam, 0 to 4 percent slopes, is the only soil in this unit. It is more than 40 inches deep. Slopes are less than 4 percent. This soil is well drained. The mean annual precipitation ranges from 17 to 19 inches.

Permeability is moderate. The available water capacity is about 11 inches. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for small grain, hay, and pasture. The specific choice of legume for hay or pasture is restricted to frost-tolerant species because of the short frost-free season. The frost-free season ranges from 50 to 80 days.

The commonly used cropping system consists of alternate small grain and summer fallow for 8 to 10 years, followed by a grass-legume hay or pasture mixture for 4 to 8 years. It is possible for the soil of this unit to be used for small grain each year. Returning all crop residue to the soil helps maintain the organic-matter content. Stubble mulching will increase moisture intake and reduce runoff and should be used on small grain. Chiseling and subsoiling reduce runoff and soil compaction. A minimum of tillage operations helps maintain soil structure and reduce compaction. Diversions may be needed on long slopes. Grassed waterways are needed where there is a concentration of runoff. Small grain responds to applications of nitrogen, and a legume responds to applications of phosphorus.

#### CAPABILITY UNIT IIIc-45, DRYLAND

Newdale silt loam, 0 to 4 percent slopes, is the only soil in this capability unit. It is more than 60 inches deep and is well drained. The mean annual precipitation ranges from 11 to 13 inches.

Permeability is moderate. The available water capacity is about 11 inches. Surface runoff is slow, and the hazard of erosion is slight.

This soil is used for small grain, hay, and pasture. The frost-free season ranges from 95 to 110 days.

A suitable cropping system consists of alternate small grain and summer fallow. Return of all crop residue to the soil and use of a stubble mulch are desirable practices on small grain. Chiseling and subsoiling in fall reduce runoff and increase moisture intake. Minimum tillage helps reduce compaction and retain soil structure. Diversions may be needed on long slopes. Grassed waterways are needed where there is a concentration of runoff. Contour tillage and seeding are not necessary, but they can be used to reduce runoff and increase moisture intake. Small grain responds to applications of nitrogen.

#### CAPABILITY UNIT IVw-9, DRYLAND

This unit consists of medium-textured to moderately fine textured soils of the Enochville and Outlet series. These soils have a water table at a depth of 1 to 2 feet

in spring. They are more than 60 inches deep. Slopes are less than 4 percent. The soils are somewhat poorly drained. The mean annual precipitation ranges from 16 to 22 inches, and additional moisture is received from adjacent areas.

Permeability is moderately slow. The available water capacity is more than 6 inches. Surface runoff is slow, and the hazard of erosion is slight.

These soils are used principally for permanent hay and pasture. Some small grain is grown. The frost-free season ranges from 50 to 80 days. In some years grain will mature, but if an early frost prevents ripening, the crop is cut for hay. Alfalfa is generally short lived because of the high water table in spring. Moisture is generally sufficient for cultivated crops, but the short growing season and wetness in spring delay planting to the extent that production of cultivated crops is risky.

These soils can be used for permanent grasses and legumes for hay and pasture; they should be plowed only to reestablish the stand. Tillage operations should be limited to the fall season to offset spring wetness.

#### CAPABILITY UNIT VIc-1, DRYLAND

This unit consists of medium-textured soils of the Alpon, Araveton, Dranyon, Knull, Lanark, Newdale, Pancheri, Pavohroo, Polatis, Portino, Portneuf, Ricrest, Robin, Sessions, Tetonia, Turnerville, and Wahtigup series. These soils are more than 20 inches deep. Slopes are 2 to 30 percent. The soils are well drained. The mean annual precipitation is 8 to 25 inches.

Permeability is moderate or moderately slow. Surface runoff is medium to rapid, and the hazard of erosion is slight to severe.

These soils are used mostly for range, woodland, and wildlife habitat. The average frost-free season ranges from none to 130 days.

#### CAPABILITY UNIT VIc-3, DRYLAND

This unit consists of stony, medium-textured and moderately coarse textured soils of the Knull, Malm, Matheson, Polatis, and Portino series. These soils are more than 20 inches deep. Slopes are 0 to 8 percent. The soils are well drained. The mean annual precipitation ranges from 8 to 11 inches.

Permeability is moderate or moderately rapid. The available water capacity is about 4 to 7 inches. Surface runoff is slow to medium, and the hazard of erosion is none to moderate.

These soils are used for grazing, but they can be tilled sufficiently to prepare a seedbed for suitable plant species. The frost-free season ranges from 110 to 130 days. Care must be used to control erosion when seeding. All crop residue should be left on the surface at this time to protect the soils from blowing.

These soils are suited to grazing.

#### CAPABILITY UNIT VIc-1, DRYLAND

This unit consists of medium-textured soils of the Kimama, Pancheri, and Portneuf series. These soils are well drained and more than 40 inches deep. Slopes are less than 2 percent. The mean annual precipitation ranges from 8 to 11 inches.



Permeability is moderate or moderately slow. The available water capacity is more than 10 inches. Surface runoff is slow, and the hazard of erosion is no more than slight.

These soils are used mainly for range, but they can be tilled sufficiently to seed suitable grass species. The frost-free season ranges from 110 to 130 days.

#### CAPABILITY UNIT VIIc-0, DRYLAND

This unit consists of stony, medium-textured soils of the Alpon, Dranyon, Newdale, Pavohroo, Rexburg, Ricrest, Robin, Tetonia, and Wahtigup series. These soils are well drained and more than 40 inches deep. Slopes are 30 to 60 percent. The mean annual precipitation ranges from 11 to 24 inches.

Permeability is moderate or moderately slow. The available water capacity is more than 6 inches. Surface runoff is medium to rapid under natural vegetation, and the hazard of erosion is moderate to very severe.

These soils are used for grazing, timber production, and wildlife habitat. The slopes are too steep to be safely tilled for seeding.

#### CAPABILITY UNIT VIIe-1, DRYLAND

This unit consists mainly of moderately coarse textured and coarse textured soils of the Bondbranch, Matheson, Presto, Wardboro, and Wolverine series. These soils are well drained to excessively drained and are more than 10 inches deep. Slopes are generally less than 4 percent. The mean annual precipitation ranges from 8 to 13 inches.

Permeability is moderate to very rapid. The available water capacity is 1 to 6 inches. Surface runoff is slow to medium, and the hazard of soil blowing is severe.

These soils have a cover of grasses and sagebrush and are used for range. They are too droughty and erodible to be tilled for reseeding to more desirable plant species. The frost-free season ranges from 100 to 130 days.

#### CAPABILITY UNIT VIIs-2, DRYLAND

This unit consists mostly of extremely stony, medium-textured soils of the Araveton, Dranyon, Gilispie, Hymas, Mike, Nielsen, Polatis, Portino, Ricrest, Robin, Sessions, Sheege, Spaa, Swanner, Tenno, Thornock, and Waycup series. These soils are variable in depth to bedrock. Slopes are generally 0 to 60 percent but range to 80 percent in places. The soils are well drained. The mean annual precipitation ranges from 8 to 22 inches.

Permeability is moderate or moderately slow. Surface runoff is slow to rapid, and the hazard of erosion is slight to severe.

These soils are used mainly for grazing. They are too stony or too shallow to be seeded. The frost-free season ranges from 50 to 130 days.

#### CAPABILITY UNIT VIIIe-1, DRYLAND

This unit consists of the land type Terrace escarpments. It is on the terrace breaks on the alluvial terraces along the Snake and Blackfoot Rivers. Slopes range from about 20 to 60 percent or more. Runoff is rapid to very rapid, and the hazard of erosion is severe.

These escarpments are not suitable for farming. Reclamation is not feasible, but the existing plant cover should

be protected and encouraged to prevent further erosion. The areas are suited mainly to use as wildlife habitat and watershed.

#### CAPABILITY UNIT VIIIs-1, DRYLAND

This unit consists of the miscellaneous land types Gravel pit, Lava flows, Limestone rock land, and Stony rock land. There is little or no vegetation, and these land types have little value for farming. Because of the rough surface and scarcity of vegetation, these land types are generally avoided by livestock. Their chief value is for use as wildlife habitat, watershed, and recreational areas.

### Estimated Yields

The estimated yields given in this survey are based on observations of soil scientists who surveyed the Area and also on information furnished by farmers, by the county agricultural extension agent, by representatives of companies that process agricultural products, by personnel of the local office of the Agricultural Stabilization and Conservation Service, and by available census data. If information for a particular soil was not available, estimates were made on the basis of information pertaining to a similar soil. Table 2 gives estimates of yields of the principal crops grown in the Area on irrigated soils. Table 3 gives estimates of principal crops grown on dryland soils.

Some farmers obtain high yields of irrigated crops. To obtain these yields, a systematic cropping system is used. Alfalfa and grass used for hay and pasture are commonly grown for 2 to 4 years, then a crop such as potatoes, sugar beets, or small grain, followed by grain and a new seeding of alfalfa and grass. Generally, fertilizer is applied according to need as indicated by soil tests. All available barnyard manure is used, and the application of commercial fertilizer is reduced accordingly. Irrigation water generally is adequate for all crops. Water is applied by the border, corrugation, furrow, or sprinkler methods. Crops are irrigated as they need water. The length of runs is limited, to ensure uniform wetting of the soil to the rooting depth of the crop being grown. The soil is prepared for irrigation by leveling or smoothing. Insects and weeds are controlled. In areas of sandy soils that have low available water capacity, the farmer has obtained a higher level of management by eliminating row crops from the rotation and basing his enterprise primarily on livestock; such soils are used principally for hay and pasture.

The farmers obtaining yields given in table 2 use a grain-fallow cropping system and stubble-mulch tillage during the fallow year. In addition, their tillage operations generally are on the contour or across the slopes, and more attention is given to control of weeds, disease, and insects and to timeliness of planting, cultivating, and harvesting.

The crop yields are averages expected over a period of years. Thus, yields higher than those given in table 2 are not uncommon. They can be obtained in favorable seasons, especially if heavier fertilization is practiced. Also, expected yields may change greatly in the future as new crop varieties and cultural practices are introduced or as new plant diseases or insect pests appear.



TABLE 2.—*Estimated average yields per acre of principal crops on irrigated soils*

[Absence of a yield figure means that the crop is not generally grown or is not suited to the soil specified]

Soil	Potatoes	Sugar beets	Alfalfa	Barley	Spring wheat	Irrigated pasture
	<i>Cwt.</i>	<i>Tons</i>	<i>Tons</i>	<i>Bu.</i>	<i>Bu.</i>	<i>A.U.M.</i> <sup>1</sup>
Ammon silt loam, 0 to 2 percent slopes.....	280	19.6	6.0	100	85	12.0
Ammon silt loam, 2 to 4 percent slopes.....	280	19.6	6.0	100	80	12.0
Bannock loam, 0 to 2 percent slopes.....	265	19.0	5.5	90	65	7.0
Bannock loam, 2 to 4 percent slopes.....	230	18.6	5.0	85	65	7.0
Bannock loam, 4 to 8 percent slopes.....	200	15.0	4.5	80	60	6.0
Blackfoot loam.....		19.6	5.0	100	80	5.0
Blackfoot loam, drained.....	280	19.6	6.0	100	80	12.0
Blackfoot loam, saline.....		15.0	4.0	70	50	5.0
Blackfoot silty clay loam.....		19.5	5.5	90	70	10.0
Bock loam, 0 to 2 percent slopes.....	280	19.6	6.0	100	80	12.0
Bock loam, 2 to 4 percent slopes.....	280	19.6	6.0	100	80	12.0
Declo fine sandy loam, 0 to 2 percent slopes.....	280		6.2	100	85	10.0
Declo fine sandy loam, 2 to 4 percent slopes.....	280		6.2	100	85	10.0
Declo fine sandy loam, 4 to 8 percent slopes.....	240		5.0	80	70	8.0
Declo loam, 0 to 2 percent slopes.....	270	19.6	6.0	100	80	12.0
Declo loam, 2 to 4 percent slopes.....	280	19.8	6.2	100	85	12.0
Declo loam, 4 to 8 percent slopes.....	270	19.2	5.8	90	70	10.0
Declo loam, 8 to 12 percent slopes.....			5.0	85	65	7.0
Declo loam, 12 to 20 percent slopes, eroded.....			5.0			6.0
Fingal loam, 0 to 2 percent slopes.....	240	19.0	5.5	90	70	10.0
Fingal loam, 2 to 4 percent slopes.....	240	19.0	5.5	90	70	10.0
Fingal loam, saline, 0 to 2 percent slopes.....		14.0	3.5	65	45	4.0
Fingal loam, saline, 2 to 4 percent slopes.....		14.0	3.5	65	45	4.0
Fingal loam, strongly saline, 0 to 2 percent slopes.....				40		5.0
Fingal clay loam, 0 to 2 percent slopes.....		19.0	5.5	85	65	9.0
Firth sandy loam.....		15.5	4.0	80	60	5.0
Firth sandy loam, drained.....	270		5.5	85	65	9.5
Fulmer loam.....						3.0
Fulmer loam, drained.....		18.0	5.0	90	70	5.0
Hayeston sandy loam, 0 to 2 percent slopes.....	220		5.0	80	60	8.0
Hayeston sandy loam, 2 to 4 percent slopes.....	210		5.0	70	60	8.0
Hayeston loam, 0 to 2 percent slopes.....	225	18.5	5.0	85	65	7.0
Heiseton sandy loam, 0 to 2 percent slopes.....	240		5.0	90	70	8.0
Heiseton sandy loam, 2 to 4 percent slopes.....	240		5.0	90	70	8.0
Heiseton loam, 0 to 2 percent slopes.....	240	19.0	5.5	90	70	10.0
Kimama silt loam.....	280	19.6	6.0	100	85	12.0
LaJara sandy loam.....						3.0
LaJara sandy loam, drained.....		19.0	5.0	90	70	5.0
Malm fine sandy loam, 0 to 2 percent slopes.....	220		5.0	80	60	8.0
Malm fine sandy loam, 2 to 4 percent slopes.....	220		5.0	75	60	8.0
Matheson fine sandy loam, 0 to 2 percent slopes.....	260		5.5	100	80	9.0
Matheson fine sandy loam, 2 to 4 percent slopes.....	260		5.5	100	80	9.0
Matheson fine sandy loam, 4 to 8 percent slopes.....	230		5.0	80	60	8.5
Packham gravelly loam, 0 to 2 percent slopes.....			3.0	45	30	3.5
Packham gravelly loam, 2 to 4 percent slopes.....			3.0	45	30	3.0
Paesl silt loam.....	230	18.0	5.5	90	70	10.0
Paesl fine sandy loam.....	240		5.0	90	70	8.0
Pancheri silt loam, 0 to 2 percent slopes.....	280	19.6	6.0	100	70	12.0
Pancheri silt loam, 2 to 4 percent slopes.....	280	19.6	6.0	100	70	12.0
Pancheri silt loam, 4 to 8 percent slopes.....	270	19.0	5.6	90	70	10.0
Pancheri silt loam, 8 to 12 percent slopes.....			5.0	80	60	7.0
Paniogue loam, 0 to 2 percent slopes.....	265	18.5	5.5	90	75	9.0
Polatis silt loam, 0 to 2 percent slopes.....	230	18.5	5.0	85	65	7.0
Polatis silt loam, 2 to 4 percent slopes.....	230	18.5	5.0	85	65	7.0
Polatis silt loam, 4 to 8 percent slopes.....	180	14.5	4.5	75	55	6.0
Polatis stony silt loam, 0 to 2 percent slopes.....	220	18.0	5.0	85	65	7.0
Polatis stony silt loam, 2 to 4 percent slopes.....	220	18.0	5.0	85	65	7.5
Polatis stony silt loam, 4 to 8 percent slopes.....	160	14.0	4.0	70	50	5.0
Portino silt loam, 0 to 2 percent slopes.....	230	18.5	5.0	85	65	7.0
Portino silt loam, 2 to 4 percent slopes.....	230	18.5	5.0	85	65	7.0
Portino silt loam, 4 to 8 percent slopes.....	180	14.5	4.5	75	55	6.0
Portino stony silt loam, 0 to 2 percent slopes.....	220	18.0	5.0	85	65	7.0
Portino stony silt loam, 2 to 4 percent slopes.....	225	18.0	5.0	85	65	7.5
Portino stony silt loam, 4 to 8 percent slopes.....	160	14.0	4.0	70	50	5.5
Portino stony silt loam, 8 to 12 percent slopes.....			4.0	70	50	5.0
Portino-Knull silt loams, 0 to 2 percent slopes.....	220	18.0	5.0	85	65	7.0
Portino-Knull silt loams, 2 to 4 percent slopes.....	220	18.0	5.0	85	65	7.0
Portneuf silt loam, 0 to 2 percent slopes.....	280	19.6	6.0	100	70	12.0
Portneuf silt loam, 2 to 4 percent slopes.....	280	19.6	6.0	100	70	12.0

See footnote at end of table.



TABLE 2.—*Estimated average yields per acre of principal crops on irrigated soils*—Continued

Soil	Potatoes	Sugar beets	Alfalfa	Barley	Spring wheat	Irrigated pasture
	<i>Cwt.</i>	<i>Tons</i>	<i>Tons</i>	<i>Bu.</i>	<i>Bu.</i>	<i>A. U. M.<sup>1</sup></i>
Portneuf silt loam, 4 to 8 percent slopes.....	270	19.6	5.6	90	70	10.0
Portneuf silt loam, 8 to 12 percent slopes.....			5.0	80	60	7.0
Presto loamy sand.....			3.5	55	40	4.0
Sasser fine sandy loam, 0 to 2 percent slopes.....	220		5.0	80	60	8.0
Sasser fine sandy loam, 2 to 4 percent slopes.....	220		5.0	75	60	8.0
Sasser fine sandy loam, 4 to 8 percent slopes.....			4.5	70	50	7.0
Stan fine sandy loam, 0 to 2 percent slopes.....	235		5.0	95	75	8.0
Stan fine sandy loam, 2 to 4 percent slopes.....	225		5.0	90	70	8.0
Tenno stony loam, 0 to 4 percent slopes.....			4.0	55	40	3.5
Tenno stony loam, 4 to 8 percent slopes.....			3.5			3.0
Thornock stony loam, 0 to 4 percent slopes.....			4.0	55	40	3.5
Thornock stony loam, 4 to 8 percent slopes.....			3.5			3.0
Wapello fine sandy loam, 0 to 2 percent slopes.....	250		5.0	90	70	8.0
Wapello fine sandy loam, 2 to 4 percent slopes.....	250		5.0	90	70	8.0
Wardboro soils.....			3.0	45	30	3.0
Weeding loamy sand.....			3.5	55	40	4.0

<sup>1</sup> A. U. M. stands for animal-unit-month. It is a term used to express the carrying capacity or grazing value of a pasture. It is the number of months 1 acre will support one animal unit, such as one cow, one steer, one horse, five hogs, or seven sheep or goats, without injury to the pasture, or the product of the number of animal units to the acre multiplied by the number of months of grazing.

TABLE 3.—*Estimated average yields per acre of principal crops on dryland soils*

Soil	Alfalfa	Barley	Winter wheat
	<i>Tons</i>	<i>Bu.</i>	<i>Bu.</i>
Lanark silt loam, 0 to 4 percent slopes.....	2.5	40	36
Lanark silt loam, 4 to 12 percent slopes.....	2.5	40	36
Lanark silt loam, 12 to 20 percent slopes.....	2.5	40	36
Newdale silt loam, 0 to 4 percent slopes.....		28	28
Newdale silt loam, 4 to 12 percent slopes.....		25	25
Newdale silt loam, 12 to 20 percent slopes.....		25	25
Rexburg silt loam, 4 to 12 percent slopes.....	2.0	35	35
Rexburg silt loam, 12 to 20 percent slopes.....	2.0	35	35
Robin silt loam, 0 to 4 percent slopes.....	2.5	45	40
Robin silt loam, 4 to 12 percent slopes.....	2.5	45	40
Robin silt loam, 12 to 20 percent slopes.....	2.5	45	40
Sessions silt loam, 4 to 12 percent slopes.....	2.5	45	35
Sessions silt loam, 12 to 20 percent slopes.....	2.0	45	35

## Management of the Soils for Range <sup>3</sup>

Soils used for range are extremely variable. They range from coarse to moderately fine in texture, from very shallow to deep, and from level to steep. Precipitation ranges from about 8 to about 22 inches. In the western part of the Area, the frost-free season is as much as 130 days; in the eastern part, frosts may occur each month of the year. The combination of these factors

largely determines the use, management, and productivity of the soils as range.

Rangeland makes up 387,000 acres of the Survey Area, and grazable woodland 82,000 acres. Grass is predominant on 139,700 acres, and various shrubs or juniper on the rest.

Livestock and wildlife graze both the public and private rangeland. In the early years, grazing was heavy and caused a considerable decline in the key forage plants and an increase in the less desirable plants. The grazing lands contribute substantially to the economy of the Area.

Range, range site, and range condition are defined in the following paragraphs.

Range is land on which the climax (or native potential) plant community consists principally of grasses, grass-like plants, forbs, and shrubs valuable for grazing and of sufficient quality and quantity to justify grazing use.

A range site is a distinctive kind of rangeland that differs from other kinds of rangeland in its potential to produce native plants. It is the product of all the environmental factors responsible for its development. In the absence of abnormal disturbances and physical site deterioration, a range site supports a plant community characterized by an association of plants different from that of other range sites in terms of kind or proportion of plants and total annual yield.

Range condition measures the degree to which the present composition, expressed in percent, has departed from that of the potential plant community. Four range condition classes are recognized: excellent, good, fair, and poor. A range is in excellent condition if 75 percent of the vegetation is the same as that of the climax vegetation. It is in good condition if the percentage is 50 to 75, in fair condition if the percentage is 25 to 50, and in poor condition if the percentage is less than 25.

The components of a plant community are placed in



on specific range sites. These groups are decreaser, increaser, and invader plants.

Decreaser plants tend to decrease in relative abundance when subjected to excessive or continued grazing use, or when the plants are highly preferred by the grazing animals during the season of use involved.

Increaser plants tend to increase in relative abundance when the plant community is subject to continued or excessive grazing use. Under prolonged excessive grazing, increaser plants may dominate the site and, if abuse continues, they too will begin to decrease.

Invader plants are not members of the potential plant community for the site. They invade the community when the better plants have been weakened or eliminated by grazing, fire, or other disturbance.

### **Range management practices**

Although range sites differ, certain principles of management apply to all sites. The following are applicable practices.

*Proper range use.*—Range plants live and grow on the food manufactured in their leaves, and a healthy plant makes more leaves or twigs than it needs to carry on its life processes. The extra top growth is available for use by livestock and wildlife. Under proper range use, only this extra top growth is used and the rest is left so the plant can maintain itself.

The type of grazing system used has an important bearing on degree of range use. Generally, however, no more than 50 percent of the current year's growth of the dominant decreaser plants should be grazed if the range is in good or excellent condition, and no more than 40 percent if the range is in fair condition.

Shallowness of soils and steepness of slope also affect range management. For example, if the range is in excellent condition and the slope is no more than 30 percent, as much as 50 percent of the current year's growth can be grazed; but this percentage decreases as the slope increases, and on a slope of 60 percent, no more than 20 percent should be grazed. A slope of 70 percent generally is too steep for grazing, except for a limited amount by sheep and wildlife.

*Planned grazing systems.*—There are many different kinds of grazing systems. Each kind must be designed to fit the specific range unit and the objective of the manager. These systems are usually designed to include two or more grazing units so that one of the units is rested from grazing in a planned sequence throughout the year or during the growing season of the key plants. For best results, the range generally should be divided into three or more units of nearly equal forage production. On summer ranges, two units may be adequate. Fencing may be required on cattle ranges. Natural barriers and herding may be sufficient on sheep ranges. A grazing system is flexible and can be adapted to almost any field size and condition. It can be designed to take advantage of existing or easily developed subdivisions. Because of the complexity of this management practice, professional assistance is usually needed.

*Livestock distribution.*—Livestock must be evenly distributed so that forage will be grazed uniformly. Fencing, salting, water development, herding, and the use of grazing systems all help to improve livestock distribution.

Fencing is especially helpful on a cattle range, and it is generally needed when a grazing system is used. Fencing should take into account natural barriers, differences in range sites, topography, natural drift, and size of units.

Salt, if properly placed, commonly improves livestock distribution. It should not be placed at watering places, along creek bottoms, or in other places where livestock gather. Livestock do not need water immediately after salting; therefore, salt should be placed in the less accessible parts of the range, away from water.

Watering places should be developed in a manner to encourage livestock distribution. If wells or stock ponds are being considered, there may be considerable choice in location. The use of a pipeline and a trough can be very helpful in livestock distribution.

On most sheep ranges, a good herder is essential. On many cattle ranges, an alert rider can make the difference between good and poor livestock distribution.

*Time of use.*—Livestock should not be turned out until the forage is ready for use. The date varies with the range site and with current weather conditions. The forage is ready for use when the soil is dry enough that it will not be damaged by trampling and when the key forage plants have reached a height of 4 to 6 inches.

*Number of livestock.*—Forage production on any range site varies from year to year with weather conditions. Ranchers should keep the herd size flexible, to avoid serious damage in dry years and to take advantage of higher production in wet years. Herd flexibility is necessarily limited; however, a spare pasture or a feed surplus is helpful in dry years. The herd size should be such that in most years only one-half or less of the current year's growth of key forage plants will be grazed.

*Brush control.*—Big sagebrush is the most common shrub on the range of the Bingham Area. It can be controlled by burning, chemical spraying, roto-beating, or railing, or by manipulating the grazing season. The best method to use depends on plant cover, type of equipment available, slope, and soil surface. Burning, spraying, and roto-beating should be used only if there is a good understory of native grass.

Burning can be effective on big sagebrush, but it must be handled carefully. Burning is used only in special situations, because it damages Idaho fescue and other important forage plants.

Spraying with approved chemicals is an effective method of controlling big sagebrush and three-tip sagebrush, but it also kills many desirable broad-leaved plants. Other important factors, such as the effect on wildlife, should be considered before spraying large areas of big sagebrush.

Roto-beating is generally more expensive than burning or spraying. This method, together with burning, leaves the site clear of brush and makes the forage readily accessible. Beating is not practical, however, where there are stones on the surface.

Railing with heavy rail drags or anchor chain is an inexpensive method of thinning out stands of big sagebrush. Under good conditions, it kills 40 to 60 percent of the shrubs.

None of these methods is effective on rabbitbrush, horsebrush, and other shrubs that sprout from the root



crown. Plowing at least twice is necessary for effective control of these plants.

Big sagebrush is sensitive to grazing and can be controlled by heavy grazing by sheep late in fall after the grass is dormant. Grazing can be used as a supplement to other methods.

**Seeding.**—Seeding is a means of quickly restoring deteriorated range to productivity. Hundreds of acres in the Bingham Area have been seeded successfully. Seeding is expensive and must be done carefully to obtain a good stand. The following general rules apply:

1. Prepare a clean, firm seedbed; summer fallow if necessary, or plant an annual crop and then seed into the stubble.
2. Use seed of high quality, and drill no deeper than three-fourths of an inch.
3. Do not use a companion crop.
4. Plant late in fall or early in spring.
5. Protect the seeded area from grazing for at least two grazing seasons.
6. Manage the seeded area carefully to insure continued high production.

### **Descriptions of range sites**

The range sites in the Bingham Area are described in this section. Soils that have the potential to produce similar kinds and amounts of native vegetation are grouped into the same range site. The sites are grouped by three precipitation zones: 8 to 12 inches annually, 12 to 16 inches annually, and 16 to 22 inches annually. The range in precipitation shown in the section "Descriptions of the Soils" differs slightly from that given in the descriptions of the range sites. In this section, important climatic and topographic features of each precipitation zone are described, and a brief description of each site within the zone is given.

Unless a site consists of only one soil, the soils are identified only by the name of the series. Listing of the series name does not mean that all the soils of that series are in the particular site. To find the classification of the individual soils, refer to the "Guide to Mapping Units" at the back of this soil survey.

#### **PRECIPITATION ZONE 8 TO 12 INCHES**

The climate in this zone is characterized by hot, dry summers and cold winters. Moisture conditions are generally favorable for plant growth in April, May, and June. About 60 percent of the annual precipitation occurs during December through May. Elevations range from about 4,200 to 5,000 feet. The average frost-free period is about 110 to 130 days.

Range sites within this zone are:

Loamy	Sands
Shallow Loamy	Sandy
Stony	Steep Slopes
Shallow Stony	Saline-Alkali Meadow
Very Shallow	River Bottom

#### **LOAMY RANGE SITE, 8 TO 12 INCHES PRECIPITATION**

This range site consists of soils of the Bondbranch, Kimama, Malm, Matheson, Newdale, Pancheri, Polatis, Portino, and Portneuf series. These soils are moderately deep to very deep, well drained, and medium textured or

moderately coarse textured. Slopes are 0 to 12 percent. Permeability is moderate or moderately rapid. The available water capacity ranges from about 4 to 11 inches. Control of runoff and erosion can be serious problems if the vegetation is depleted. Kimama silt loam differs from other soils in the site by occasionally receiving additional run-in water from adjacent areas. This results in slightly higher percentages of Great Basin wildrye on this soil than on the others.

The potential native plant community consists of 40 to 50 percent grasses, 20 to 30 percent forbs, and 20 to 30 percent shrubs. Decreaser plants, dominantly bluebunch wheatgrass, makes up 50 to 60 percent of the vegetation. Other decreaseers are tapertip hawksbeard, prairie junegrass, and Thurber needlegrass. Increaser plants, such as Sandberg bluegrass, squirreltail, western wheatgrass, arrowleaf balsamroot, lupine, big sagebrush, and three-tip sagebrush, make up the rest of the vegetation in climax condition.

Deterioration of the range site brings about a noticeable increase in big sagebrush, Sandberg bluegrass, and rabbitbrush. Severe use causes rapid depletion of decreaseer species and gradual invasion of annuals, such as cheatgrass and Russian-thistle.

If this site is in fair or poor range condition, it is well suited to seedbed preparation and range seeding.

Frequent fires result in the loss of big sagebrush and its replacement by annuals, such as cheatgrass, and sprouting shrubs, such as rabbitbrush, broom snakeweed, and three-tip sagebrush.

Halogeton, a poisonous plant, is a serious problem in depleted areas of this site, especially along the roads and trails and in areas that do not have a cover of brush or perennial grass.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 1,350 pounds per acre in years when the amount of moisture is favorable to 450 pounds per acre when the amount of moisture is unfavorable. Approximately 60 percent of the plants on this site furnish at least some forage for livestock and wildlife.

#### **SHALLOW LOAMY RANGE SITE, 8 TO 12 INCHES PRECIPITATION**

This range site consists of soils of the Bondbranch, Ten no, and Thornock series. These soils are shallow, well drained, and medium textured. They are stony or extremely stony. Slopes range from 0 to 12 percent. The available water capacity is about 2 inches, and the hazard of erosion is slight to moderate.

The potential native plant community consists of 65 to 75 percent grasses, 2 to 10 percent forbs, and 10 to 20 percent shrubs. Decreaser plants make up 10 to 60 percent of the vegetation. Bluebunch wheatgrass and Nevada bluegrass are the dominant decreaseers. Other decreaseers are tapertip hawksbeard and bitterbrush. Increaser plants, such as Sandberg bluegrass, squirreltail, western wheatgrass, phlox, big sagebrush, rabbitbrush, and broom snakeweed, make up 40 to 50 percent of the potential plant cover.

Extended heavy grazing results in a decrease in bluebunch wheatgrass, tapertip hawksbeard, and other desirable plants and an increase in big sagebrush, Sandberg bluegrass, squirreltail, and other increaser plants. If the range condition continues to deteriorate, annual weeds and grasses invade the site.



Because of variations in soil, onsite investigations are needed before extensive range improvement projects are undertaken.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 900 pounds per acre in years when the amount of moisture is favorable, to 350 pounds per acre when the amount of moisture is unfavorable.

#### STONY RANGE SITE, 8 TO 12 INCHES PRECIPITATION

Waycup extremely stony loam, 0 to 12 percent slopes, is the only soil in this range site. This soil is well drained. Permeability is moderate, and the available water capacity is about 6 inches. The hazard of erosion is slight to moderate.

The potential native plant community consists of 40 to 50 percent grasses, 20 to 30 percent forbs, and 20 to 30 percent shrubs. Decreaser plants make up 50 to 70 percent of the potential native plant community. Bluebunch wheatgrass is the dominant decreaser. Other decreaseers are prairie junegrass, Nevada bluegrass, bitterbrush, and tapertip hawksbeard. Increaser plants, such as Sandberg bluegrass, squirreltail, arrowleaf balsamroot, and big sagebrush, make up 30 to 50 percent of the potential plant cover.

Bluebunch wheatgrass decreases if the range is heavily used, and Sandberg bluegrass, big sagebrush, and other plants increase. Under continued heavy use or other disturbance, big sagebrush and rabbitbrush continue to increase and low-value forbs and annual grasses invade the site.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 1,100 pounds per acre in years when the amount of moisture is favorable to 400 pounds per acre when the amount of moisture is unfavorable. Approximately 70 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

#### SHALLOW STONY RANGE SITE, 8 TO 12 INCHES PRECIPITATION

This range site consists of soils of the Mike, Tenno, and Thornrock series. These soils are well drained, medium textured, and extremely stony. Slopes range from 0 to 30 percent but are mostly less than 12 percent. The soils are moderately permeable, and the available water capacity is about 2 inches. The hazard of erosion is slight to severe.

The potential native plant community consists of 40 to 60 percent grasses, 25 to 30 percent forbs, and 15 to 20 percent shrubs. Decreasers, such as bluebunch wheatgrass, needle-and-thread, Great Basin wildrye, tapertip hawksbeard, and arrowleaf balsamroot, make up 40 to 60 percent of the potential production. Increaseers, such as Sandberg bluegrass, squirreltail, big sagebrush, and several forbs, make up the rest.

Continuous heavy grazing or other disturbance results in a decrease in bluebunch wheatgrass and the other decreaser plants and corresponding increases in such plants as big sagebrush and Sandberg bluegrass. Severe deterioration of range condition opens the way for such invaders as cheatgrass and Russian-thistle and a marked increase of big sagebrush and rabbitbrush.

This site is not suited to the use of mechanical equipment for improvement.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 850 pounds per acre in years when the amount of moisture is favorable to 250 pounds per acre when the amount of moisture is unfavorable. Approximately 60 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

#### VERY SHALLOW RANGE SITE, 8 TO 12 INCHES PRECIPITATION

This range site consists of the land type Lava rock land. The soils are well drained, medium textured, shallow and very shallow, and extremely stony or rocky. Slopes range from 0 to 12 percent. Permeability is moderate, and the available water capacity is about 1 to 2 inches. The hazard of erosion is slight to moderate. Stones and rock outcrops limit grazing, and forage production is low. The ground surface generally is very rough and irregular because of the shallow, rocky soils and rock outcrops.

The potential native plant community consists of 40 to 50 percent grasses, 15 to 20 percent forbs, and 20 to 40 percent shrubs. Decreaser plants make up 50 to 60 percent of the potential plant community. They include bluebunch wheatgrass, big bluegrass, needle-and-thread, tapertip hawksbeard, and bitterbrush. Increaser plants, such as low sagebrush, shrubby buckwheat, rabbitbrush, and several grasses and shrubs, make up the rest of the composition in climax condition.

Continuous heavy use by livestock or game animals results in a reduction of the decreaser plants and an increase in the less desirable ones. This site is not suited to mechanical treatment.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 800 pounds per acre in years when the amount of moisture is favorable to 200 pounds per acre when the amount of moisture is unfavorable. Approximately 60 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

#### SANDS RANGE SITE, 8 TO 12 INCHES PRECIPITATION

Wolverine sand, rolling, is the only soil in this range site. This soil is excessively drained. Slopes range from 0 to 30 percent. Permeability is very rapid, and the available water capacity is about 4 inches. The site consists of long, narrow sand dunes that are oriented in the direction of the prevailing winds. The dunes are 50 to 100 feet wide and range to several hundred feet in length. The soil is more than 60 inches deep and is subject to severe blowing where vegetation is not sufficient to stabilize it. The droughty, easily disturbed nature of the soil affects grazing, herbage production, and species composition and prevents conventional tillage operations.

The potential native plant community is about 50 percent grasses, 10 to 15 percent forbs, and 25 to 35 percent shrubs. Decreasers make up 45 to 55 percent of the potential plant production and include Indian ricegrass, Great Basin wildrye, needle-and-thread, and bitterbrush. Increaseers, such as sand dropseed, thickspike wheatgrass, dunegrass, arrowleaf balsamroot, big sagebrush, and rabbitbrush, make up the rest of the plant composition.

This site will withstand only light use because of the unstable soil. It should be grazed only after plants mature so that the plant cover will be adequate for soil protec-



tion. Heavy use results in rapid loss of decreaser species and in soil blowing.

Mechanical treatment to improve this range site is not practical. Seeding can be done if heavy mulches are used.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 1,000 pounds per acre in years when the amount of moisture is favorable to about 500 pounds per acre when the amount of moisture is unfavorable.

#### SANDY RANGE SITE, 8 TO 12 INCHES PRECIPITATION

Presto loamy sand is the only soil in this range site. This soil is somewhat excessively drained. Slopes range from 0 to 2 percent. Permeability is moderate, and the available water capacity is about 4 to 6 inches. Soil blowing is a severe hazard.

The potential native plant community consists of 60 to 70 percent grasses, 10 to 15 percent forbs, and 20 percent shrubs. The dominant decreaseers are Indian ricegrass, bluebunch wheatgrass, prairie junegrass, big bluegrass, milkvetch, and bitterbrush. They make up 40 to 50 percent of the vegetation. Increaseers, such as needle-and-thread, sand dropseed, Sandberg bluegrass, several forbs, big sagebrush, and three-tip sagebrush, make up the rest.

If range condition deteriorates, decreaser grasses decline and rabbitbrush, big sagebrush, and three-tip sagebrush increase. Frequent fires cause invasion of cheatgrass, Russian-thistle, and other annuals.

This site can be treated by using conventional methods of brush control and seeding.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 850 pounds per acre in years when the amount of moisture is favorable to 350 pounds per acre when the amount of moisture is unfavorable. Approximately 80 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

#### STEEP SLOPES RANGE SITE, 8 TO 12 INCHES PRECIPITATION

This site consists of soils of the Newdale and Wahtigup series. It has primarily, but not exclusively, southern, southwestern, and western exposures. The soils are well drained. Slopes range from 30 to 60 percent. The available water capacity is about 11 inches. The hazard of erosion is severe.

The potential native plant community consists of 60 to 70 percent grasses, 10 to 20 percent forbs, and 5 to 10 percent shrubs. Predominant decreaser plants are bluebunch wheatgrass, Great Basin wildrye, Indian ricegrass, tapertip hawksbeard, and bitterbrush. Important increaseers are Sandberg bluegrass, needle-and-thread, western wheatgrass, arrowleaf balsamroot, lupine, big sagebrush, and rabbitbrush.

If the range condition deteriorates, the decreaser plants are replaced by increaseers, especially big sagebrush and Sandberg bluegrass. Further deterioration results in thick stands of increaseer shrubs and an understory of cheatgrass and other annuals. Frequent fires eliminate the big sagebrush, and the sagebrush is replaced by shrubs that sprout, such as rabbitbrush and horsebrush. Cheatgrass also invades very quickly after a fire.

Slopes generally are too steep for mechanical treatment.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 1,000 pounds per acre in years when the amount of moisture is favorable to 500 pounds per acre when the amount of moisture is unfavorable. Approximately 70 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

#### SALINE-ALKALI MEADOW RANGE SITE, 8 TO 12 INCHES PRECIPITATION

Fingal loam, strongly saline, 0 to 2 percent slopes, is the only soil in this range site. This soil is moderately well drained and has a seasonal high water table at a depth of 3 to 6 feet. Permeability is moderately slow. The hazard of erosion is slight.

The potential native plant community consists of 80 to 90 percent grasses, sedges, and rushes, 5 to 10 percent forbs, and 10 to 20 percent shrubs. Decreasers make up 50 to 60 percent of the vegetation. These are dominantly alkali sacaton, alkali bluegrass, and Great Basin wildrye. Increaseer plants, such as western wheatgrass, squirreltail, sedges, greasewood, rabbitbrush, and rose, make up the rest.

Heavy grazing use causes an increase in sod-forming sedges and rushes. It also results in an increase in greasewood and rabbitbrush.

This site can be improved by renovation and seeding to salt-tolerant grasses if supplemental water is available. If supplemental water is not available, improvement by renovation and seeding is very risky.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 1,200 pounds per acre when the amount of moisture is favorable to 800 pounds per acre when the amount of moisture is unfavorable. Approximately 70 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

#### RIVER BOTTOM RANGE SITE, 8 TO 12 INCHES PRECIPITATION

Wardboro soils is the only mapping unit in this range site. These soils are shallow and moderately coarse textured and are underlain by sand and gravel. Slopes range from 0 to 4 percent but are mostly less than 2 percent. Permeability is moderately rapid, and the available water capacity is about 2 inches. The hazard of erosion is slight.

The potential native plant community is complex and variable because the soil patterns on this site are not uniform. Grasses generally make up about 50 percent of the vegetation; forbs, 10 percent; and trees and shrubs, 40 percent. Dominant grasses are redtop, western wheatgrass, streambank wheatgrass, Kentucky bluegrass, Great Basin wildrye, sedges, and wiregrass. Perennial forbs include aster, yarrow, herbaceous sage, lupine, mountain golden pea, sawtooth butterweed, parsnip, and vetch. Tree and shrub species, such as cottonwood, hawthorn, willow, dogwood, rose, and wild currants, are generally associated with the site along drainageways and stream channels.

Possibilities for mechanical treatment are limited, but selected areas can be treated by clearing and seeding.



If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 2,000 pounds per acre in years when the amount of moisture is favorable to 1,000 pounds per acre when the amount of moisture is unfavorable. Approximately 60 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

These soils also support mixed stands of cottonwood, willow, aspen, and other broad-leaved tree species. Productivity is extremely variable because of soil differences.

The trees are valuable for streambank protection, wildlife habitat, and esthetic reasons. Scattered areas have been cleared for farming, but they are subject to flooding.

#### PRECIPITATION ZONE 12 TO 16 INCHES

The climate in this zone is characterized by warm, dry summers and relatively moist springs. Approximately 38 percent of the total annual precipitation occurs during the main growing season of March, April, May, and June. The elevations range from about 4,500 to 6,500 feet. The average frost-free period is about 105 days.

Range sites within this zone are:

- Loamy
- Stony
- Shallow Stony
- Steep Stony Slopes
- Steep Slopes

#### LOAMY RANGE SITE, 12 TO 16 INCHES PRECIPITATION

This range site consists of soils of the Araveton, Rexburg, Tetonia, and Wahtigup series. These soils are medium textured and well drained or somewhat excessively drained. In places they are stony. Slopes generally range from 0 to 30 percent. Permeability is moderate, and the available water capacity is about 6 to 11 inches. The hazard of erosion is slight to severe.

The potential native plant community consists of 60 to 70 percent grasses, 10 to 15 percent forbs, and 10 to 25 percent shrubs. Decreaser plants make up 50 to 60 percent of the vegetation. Dominant decreaseers are bluebunch wheatgrass, prairie junegrass, native clovers, vetch, sawtooth butterweed, and bitterbrush. Subdominant decreaseers include Idaho fescue, big bluegrass, and several forbs. Increaseers make up the rest of the composition. They include western wheatgrass, Letterman needlegrass, Columbia needlegrass, arrowleaf balsamroot, geranium, snowberry, big sagebrush, and other forbs, grasses, and shrubs.

Prolonged heavy grazing or other disturbance causes a decrease in the better plants and an increase in shrubby species and undesirable forbs. As the range condition deteriorates further, Letterman needlegrass, Kentucky bluegrass, and big sagebrush begin to be dominant.

This site is well suited to conventional methods of brush control and range seeding. Many kinds of plants are suitable for seeding on this site. The choice depends on the intended season of use and the class of livestock.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 1,800 pounds per acre in years when the amount of moisture is favorable to 1,000 pounds per acre when the amount of moisture is unfavorable.

#### STONY RANGE SITE, 12 TO 16 INCHES PRECIPITATION

Araveton extremely stony loam, hilly, is the only soil in this range site. This soil is deep. Slopes range from 0 to 30 percent. Permeability is moderate, and the available water capacity is about 7 or 8 inches. The hazard of erosion is slight to moderate.

The potential native plant community consists of about 50 to 60 percent grasses, 15 to 20 percent forbs, and 20 to 30 percent shrubs. Decreaser plants make up about 40 to 50 percent of the composition in climax condition. Major decreaseers are bluebunch wheatgrass, Nevada bluegrass, big bluegrass, tapertip hawksbeard, and bitterbrush. Minor decreaseers are Idaho fescue and prairie junegrass. Increaseers, such as arrowleaf balsamroot, big sagebrush, rabbitbrush, chokecherry, and needlegrasses, comprise the major part of the remaining vegetation.

Heavy grazing use causes the same type of deterioration as that described for Loamy range site.

This site is difficult to improve by mechanical means because of stoniness. Selected areas can be treated.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 1,250 pounds per acre in years when the amount of moisture is favorable to about 750 pounds when the amount of moisture is unfavorable. Approximately 70 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

#### SHALLOW STONY RANGE SITE, 12 TO 16 INCHES PRECIPITATION

This range site consists of soils of the Hymas and Swanner series. These soils are well drained or somewhat excessively drained and are extremely stony. Slopes range from 9 to 30 percent. Permeability is moderate, and the available water capacity is about 1 or 2 inches. The hazard of erosion is moderate to severe.

The potential native plant community consists of 60 to 70 percent grasses, 10 to 20 percent forbs, and 10 and 20 percent shrubs. Dominant decreaseer plants, such as bluebunch wheatgrass, prairie junegrass, big bluegrass, tapertip hawksbeard, and bitterbrush, make up 40 to 60 percent of the vegetation. The rest is made up of increaseers dominated by Sandberg bluegrass, squirreltail, western wheatgrass, lupine, arrowleaf balsamroot, big sagebrush, three-tip sagebrush, and rabbitbrush.

If the range condition deteriorates through successive stages to poor condition, the desirable decreaseer plants become scarce. They are replaced by the less desirable increaseer grasses, forbs, and shrubs.

This site is difficult to improve by mechanical means because of shallowness and an extremely stony condition.

If this site is in excellent condition the total annual yield (air-dry weight) ranges from 1,000 pounds per acre in years when the amount of moisture is favorable to 600 pounds per acre when the amount of moisture is unfavorable. Approximately 70 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

#### STEEP STONY SLOPES RANGE SITE, 12 TO 16 INCHES PRECIPITATION

This range site consists of soils of the Araveton, Hymas, and Swanner series. These soils are well drained and somewhat excessively drained, extremely stony, and medium textured. Slopes range from 30 to 60 percent.



Permeability is moderate. Erosion is a severe hazard if the soils are denuded by fire or excessive grazing by livestock or big game.

The potential native plant community consists of 50 to 60 percent grasses, 15 to 20 percent forbs, and 20 to 25 percent shrubs. The dominant decreaser plants are bluebunch wheatgrass, Great Basin wildrye, cutleaf balsamroot, and tapertip hawksbeard. Important increasers are Sandberg bluegrass, needle-and-thread, big sagebrush, and rabbitbrush. Depletion of the dominant decreaser plants allows the less desirable grasses, forbs, and shrubs to invade the site and take the place of the more desirable plants.

This site is difficult to improve by mechanical means because of the steep slopes and the stoniness.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 1,000 pounds per acre in years when the amount of moisture is favorable to 400 pounds per acre when the amount of moisture is unfavorable.

#### STEEP SLOPES RANGE SITE, 12 TO 16 INCHES PRECIPITATION

This range site consists of soils of the Rexburg and Tetonia series. These soils are well drained and medium textured. Slopes range from 30 to 60 percent. Permeability is moderate, and the available water capacity is about 11 inches. The hazard of erosion is severe.

The potential native plant community consists of 50 to 60 percent grasses, 20 to 30 percent forbs, and 15 to 25 percent shrubs. Dominant decreaser plants are bluebunch wheatgrass, prairie junegrass, little bluebells, deervetch, and bitterbrush. Other decreaseers include slender wheatgrass, Nevada bluegrass, and several palatable forbs. Increasers include Letterman needlegrass, Sandberg bluegrass, snowberry, big sagebrush, and rabbitbrush. Deterioration of range condition results in an increase in shrubs and Letterman needlegrass and loss of the decreaser plants. Frequent fires eliminate the big sagebrush but cause corresponding increases of rabbitbrush and cheatgrass.

This site is difficult to improve by mechanical means because of the steep slopes.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 1,800 pounds per acre in years when the amount of moisture is favorable to 900 pounds per acre when the amount of moisture is unfavorable. Approximately 80 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

#### PRECIPITATION ZONE 16 TO 22 INCHES

The climate in this zone is characterized by moderately warm summers and long, cold winters. The highest precipitation occurs in May and June, and summer showers are rather common. Winter snowfall is usually heavy. Range sites in this zone are an important watershed for the lower irrigated valleys. Elevations range from 5,500 to 7,300 feet. The optimum growing season is from about June 15 to September 1, but frost can occur at any time.

Range sites within this zone are:

- Loamy
- Steep Slopes
- Shallow Stony
- Steep Stony Slopes

#### LOAMY RANGE SITE, 16 TO 22 INCHES PRECIPITATION

This range site consists of soils of the Lanark, Robin, and Sessions series. These soils are deep and very deep, well drained, and medium textured. Slopes range from 0 to 30 percent. Permeability is slow, and the available water capacity is 9 to 12 inches. The hazard of erosion is slight to severe.

The potential native plant community consists of 50 to 60 percent grasses, 15 to 20 percent forbs, and 15 to 20 percent shrubs. Dominant decreaser plants are Idaho fescue, bearded wheatgrass, slender wheatgrass, oniongrass, and big bluegrass. Important increasers are the needlegrasses, western wheatgrass, yarrow, lupine, phlox, big sagebrush, and snowberry.

A decline in range condition is marked by an increase of the needlegrasses, western wheatgrass, yarrow, and big sagebrush. Idaho fescue is one of the first plants to disappear, especially if the range is burned every 2 or 3 years.

This site is well suited to plowing and seeding, if needed. Production is good if the soils of this range site are seeded to any of the several suitable grasses and legumes.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 3,000 pounds per acre in years when the amount of moisture is favorable to 1,600 pounds per acre when the amount of moisture is unfavorable. Approximately 80 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

The soils of this range site also support scattered patches of aspen in the transition area between the woodland and grassland zones.

#### STEEP SLOPES RANGE SITE, 16 TO 22 INCHES PRECIPITATION

This range site consists of soils of the Ricrest and Robin series. These soils are well drained and medium textured and have a stony surface layer. Slopes are mostly 30 to 60 percent, but in small areas they are 20 to 30 percent. Permeability is moderate, and the available water capacity is about 6 to 11 inches. The hazard of erosion is moderate to very severe.

The potential native plant community consists of 40 to 50 percent grasses, 15 to 20 percent forbs, and 30 to 40 percent shrubs. The general aspect of the site is shrubby, but the understory consists of grasses and forbs. Dominant decreaser plants are Idaho fescue, prairie junegrass, slender wheatgrass, and several palatable forbs. Important increasers are snowberry, serviceberry, bitterbrush, Letterman needlegrass, western wheatgrass, big sagebrush, dryland sedges, yarrow, and lupine.

Range deterioration to poor condition results in almost complete elimination of the decreaser plants and a noticeable increase in the shrubby species, except bitterbrush. The site also becomes weedy as such plants as thistle and stickseed invade. This site frequently is heavily used by deer and elk in winter and, under some conditions, can be severely damaged by them.

This site is not generally suited to mechanical treatment, because of the steep slopes.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 2,000 pounds per acre in years when the amount of moisture is favorable



to 1,200 pounds per acre when the amount of moisture is unfavorable. Approximately 70 percent of the native plants on this site furnish at least some forage for livestock and wildlife. The shrubs are especially important to deer and elk for winter feed.

#### SHALLOW STONY RANGE SITE, 16 TO 22 INCHES PRECIPITATION

This range site consists of soils of the Gilispie, Nielsen, Sheege, and Spaa series. These soils are shallow, well drained, and medium textured. They are extremely stony, and in some places they are extremely rocky. Slopes range from 0 to 30 percent. The available water capacity is about 1 to 2 inches. Bedrock outcrops are common. The hazard of erosion is slight to severe.

The potential native plant community consists of 55 to 65 percent grasses, 10 to 20 percent forbs, and 20 to 30 percent shrubs. The vegetative composition is similar to that of the Loamy range site, except that the ground cover and total yield are much less and low sagebrush is present instead of big sagebrush. Prolonged heavy use removes the bluebunch wheatgrass, Idaho fescue, and other palatable grass. They are replaced by increasers, such as Sandberg bluegrass, western wheatgrass, needlegrasses, and invader weeds and grasses.

This site is not suited to mechanical treatment, because of the shallowness and stoniness of the soils.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 1,200 pounds per acre in years when the amount of moisture is favorable to about 750 pounds per acre when the amount of moisture is unfavorable. Approximately 70 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

#### STEEP STONY SLOPES RANGE SITE, 16 TO 22 INCHES PRECIPITATION

This range site consists of soils of the Gilispie, Nielsen, and Sheege series. These soils are well drained, medium textured, and extremely stony or extremely rocky. Slopes range from 30 to 60 percent. Permeability is moderate or moderately slow, and the available water capacity is 1 to 2 inches. The hazard of erosion is moderate or severe.

The potential native plant community consists of 50 to 60 percent grasses, 10 to 25 percent forbs, and 30 to 40 percent shrubs. Dominant decreaser plants are bluebunch wheatgrass, Idaho fescue, Nevada bluegrass, and big bluegrass. Important increasers are western wheatgrass, Letterman needlegrass, arrowleaf balsamroot, big sagebrush, serviceberry, and snowberry.

Prolonged heavy grazing removes the decreaser species and makes possible increases in the less palatable plants and invasion of thistle, cheatgrass, and other annual weeds.

This site is frequently used by deer and elk for winter range. Where this occurs, use by livestock must be carefully managed to prevent rapid deterioration of the site.

The site is not suited to mechanical treatment.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 1,800 pounds per acre in years when the amount of moisture is favorable to 900 pounds per acre when the amount of moisture is unfavorable. Approximately 80 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

### ALL PRECIPITATION ZONES

The following range sites occur in all precipitation zones:

Wet Meadow Range Site

Semiwet Meadow Range Site

These are discussed in the following paragraphs.

#### WET MEADOW RANGE SITE

This range site consists of soils of the Fulmer and LaJara series. These soils are poorly drained and medium textured or moderately coarse textured. Slopes range from 0 to 2 percent. Permeability is moderate or moderately rapid. The annual precipitation has little effect on the kind and amount of vegetation because a seasonal high water table is at or near the surface most of the year.

The potential native plant community consists of 80 to 90 percent grasses and grass-like plants and 10 to 20 percent forbs. Important decreaser grasses are tufted hairgrass, fineleaf sedge, Trisetum, and native clovers. Increasers include Nebraska sedge, meadow barley, wiregrass, and many other sedges and rushes. Prolonged heavy grazing removes the better plants and the less palatable, sod-forming sedges and rushes take over the site. Ground cover is dense, even in the lower condition classes.

This site is suited to mechanical treatment to improve its production. Drainage, renovation, seeding, and fertilization are feasible under some conditions.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 3,000 pounds per acre in years when the amount of moisture is favorable to 1,500 pounds per acre when the amount of moisture is unfavorable. Approximately 70 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

#### SEMIWET MEADOW RANGE SITE

This range site consists of soils of the Enochville and Outlet series. It occupies drainageways, stream channels, and low-lying areas. This site receives more than normal amounts of moisture from flooding or a fluctuating water table. The soils are somewhat poorly drained and are medium textured or moderately fine textured. Slopes range from 0 to 4 percent but are generally less than 2 percent. Permeability is moderately slow. The seasonal high water table is at a depth of 2 to 4 feet.

The potential native vegetation is complex because of variations in soil and moisture conditions. It is made up dominantly of grasses and sedges, which make up 80 percent of the composition. Rhizomatous species, such as western wheatgrass and various sedges, are prominent. Great Basin wildrye, tufted hairgrass, and redtop also are present in some places. Forbs include lupine, aster, butterweed, potentilla, and herbaceous sage. Shrubs, such as big sagebrush and big rabbitbrush, are on the fringes of the site and tend to increase if the site deteriorates.

Where needed, renovation and seeding are suitable practices on this site. The site also responds well to irrigation.

If this site is in excellent condition, the total annual yield (air-dry weight) ranges from 3,000 pounds per acre in years when the amount of moisture is favorable to



1,000 pounds per acre when the amount of moisture is unfavorable. Approximately 80 percent of the native plants on this site furnish at least some forage for livestock and wildlife.

## Management of the Soils for Woodland<sup>4</sup>

The forested areas are mainly at the more mountainous, higher elevations in the eastern part of the Survey Area. In these areas, which are influenced by aspect and slope, lodgepole pine and Douglas-fir grow on the north, east, and northeast slopes. Subalpine fir grows in pure stands, but mixed stands of Douglas-fir and lodgepole pine grow at the highest elevations. A few spruce grow in the cooler draws.

The forested areas were originally logged by the early settlers. There have been some signs of recent cutting for home use, and corral poles, fenceposts, and timber have been used locally at a limited rate. Nearly all the forested areas have been grazed, and some areas show evidence of deterioration of vegetation and accelerated soil erosion caused by overgrazing.

### Soil properties affecting tree production

The soils in the Bingham Area vary greatly in their ability to support various tree species and to yield timber products. Soil depth, fertility, elevation, aspect, climate, and other soil properties and qualities have a marked influence on the site and determine the kinds of trees and amounts of timber production that can be expected.

Storage of soil moisture is of major importance on woodland sites, but soils differ in their ability to store moisture. Some of the gravelly and stony soils have reduced available water capacity and low potential productivity. Deep, permeable soils offer little hindrance to the downward extension of roots, and if they receive adequate moisture, they are high timber-producing sites. In contrast, some soils have an impermeable layer, such as bedrock, that is a barrier to the roots. This layer restricts the growth of trees and limits the kinds of vegetation that can grow.

Soil productivity is rated by determining the average site index of even-aged, fully stocked, unmanaged stands growing on different soils. Site index refers to the average height ( $\beta$ ) of the dominant trees at 100 years of age for Douglas-fir and 80 years of age for lodgepole pine and aspen.

### Woodland suitability groups

The woodland soils of the Bingham Area have been placed in four woodland suitability groups. Each group is made up of soils that produce similar kinds of wood crops, need similar management to produce these crops, and have about the same potential productivity.

Each group is given a site index rating and a productivity rating in terms of high, medium, or low. The following are productivity ratings in terms of height of the dominant trees at a definite age.

Productivity		Height Feet
For aspen at 80 years of age:		
High	-----	66 or more
Medium	-----	50 to 65
Low	-----	49 or less
For lodgepole pine at 80 years of age:		
High	-----	76 or more
Medium	-----	56 to 75
Low	-----	55 or less
For Douglas-fir at 100 years of age:		
High	-----	95 or more
Medium	-----	80 to 94
Low	-----	79 or less

The productivity ratings are interpreted in quantitative terms of volume growth and yields, expressed in cubic feet, board feet, or other common units of wood measure. In addition, for each group, there are ratings for four hazards and limitations that affect woodland management—plant competition, seedling mortality, equipment limitation, and erosion hazard. The composition of the potential understory vegetation is given. The results of grazing are indicated because woodland areas are grazed by livestock in this Survey Area. The effect of overgrazing on plant composition and the expected yields of herbage and usable forage are indicated for each group.

The hazards and limitations affecting management are discussed in the following paragraphs.

Plant competition refers to the invasion and rate of growth of undesirable plants when openings are made in the forest canopy. Competition is *slight* if it does not interfere with adequate development of planted seedlings. A rating of *moderate* means that competition from undesirable plants hinders but does not prevent the growth and establishment of desirable tree seedlings and the eventual development of a fully stocked stand. A rating of *severe* means that undesirable plants prevent adequate natural or artificial regeneration without intensive preparation and maintenance of the site.

Seedling mortality refers to the loss or naturally occurring or planted tree seedlings as influenced by kinds of soil or topography when plant competition is assumed not to be a limiting factor. A rating of *slight* means that the expected seedling mortality is 0 to 25 percent; a rating of *moderate* means that the expected seedling mortality is between 25 and 50 percent; and a rating of *severe*, that it is more than 50 percent.

Equipment limitations refer to those soil characteristics that restrict the use of logging equipment so that damage to the soils or trees will be prevented. A rating of *slight* means that heavy equipment should not be used in wet periods. A rating of *moderate* means that uses of equipment are moderately restricted by gradient, wetness, stoniness, or other physical properties of the soils, and by the risk of injury to the soils or trees. A rating of *severe* means that special equipment is needed for managing or harvesting the trees, and that the use of this equipment is severely restricted by one or more of the soil characteristics listed for moderate limitations.

Erosion hazard refers to the degree of potential soil erosion. The rating is *slight* where problems of erosion control are not important. A rating of *moderate* means that some attention must be given to prevent unnecessary soil erosion. A rating of *severe* means that intensive treat-

<sup>4</sup>By MELVIN R. CARLSON, woodland conservationist, Soil Conservation Service, Boise.



ments and specialized equipment must be used and that methods of operation must be planned to minimize deterioration of the soils.

#### WOODLAND SUITABILITY GROUP 1

The largest areas of soils in this group are on uplands in the northeastern part of the Survey Area. The soils formed in deep loess. They have a surface layer of silt loam and a subsoil of silty clay loam. The slope is 0 to 30 percent. The vegetation is dominantly lodgepole pine. Permeability is moderately slow, and roots can penetrate to a depth of more than 60 inches.

Productivity for lodgepole pine is medium; the average site index is 75 for these soils. At 70 years of age, a normal, fully stocked stand contains approximately 28,560 board feet, or 53 cords, per acre. At this rate the mean annual growth is 408 board feet per acre. Aspen grows in small groups or as scattered trees. Productivity for aspen is high; the average site index is 75.

The degree of plant competition from brush and other plants following the removal of the overstory is moderate. Competition develops but does not prevent the establishment of an adequate stand of lodgepole pine.

Seedling mortality during the first few years is slight if plant competition is controlled. Ordinarily, adequate natural regeneration takes place under proper management practices.

The hazard of plant disease is moderate. The removal of trees affected by mistletoe is necessary. Some aspen on these sites have cankers and rots, and these trees should be removed.

Equipment limitation is moderate because of slope. If equipment is used during wet weather in areas where the slope is more than 20 percent, runoff causes the formation of gullies and of channels on roads and skid trails. Construction and maintenance of roads, skid trails, and landings need to be planned carefully with this limitation in mind, especially in the steeper areas. Winter logging can be accomplished safely if operations are discontinued at the end of March.

The erosion hazard is moderate under natural vegetation, but it is severe if the vegetative cover is disturbed. Locating roads where they will have only moderate grades and seeding skid trails and landings to suitable vegetation help to check erosion and to reduce the silt pollution of streams.

The potential understory vegetation consists of about 85 percent grasses, mainly pinegrass, blue wildrye, big bluegrass, mountain brome, and slender wheatgrass. About 10 percent of the vegetation consists of shrubs, mainly snowberry, rose, myrtle, chokecherry, and spirea. The remaining 5 percent consists of forbs, mainly lupine, meadowrue, Oregongrape, potentilla, geranium, and heartleaf arnica.

In overgrazed areas, the plants that decrease are blue wildrye, big bluegrass, mountain brome, slender wheatgrass, and lupine, and those that increase are pinegrass, shrubs, and trees.

If the understory has not been overgrazed and is in excellent condition, the total annual yields of herbage are as follows:

<i>Class of canopy</i>	<i>Herbage Pounds per acre</i>
Open (0 to 10-percent shade) -----	600 to 800
Sparse (10- to 40-percent shade) -----	450 to 600
Medium (40- to 70-percent shade) -----	200 to 450
Dense (70- to 100-percent shade) -----	0 to 200

Usable forage is about 40 percent of these yields.

#### WOODLAND SUITABILITY GROUP 2

The soils of this group are in the foothills of the mountains in the southeastern part of the Survey Area. They have a surface layer of silt loam and a subsoil of clay loam. They are more than 40 inches deep to sandstone. The slope is 0 to 60 percent. The vegetation is dominantly aspen, but there are scattered Douglas-fir trees. Permeability is moderately slow, and a few roots penetrate the sandstone.

Productivity is high for aspen; the average site index is 68 for these soils. At 70 years of age, a normal, fully stocked stand of aspen yields approximately 2,750 cubic feet of cord wood or 6,500 linear feet of mining props per acre. The mean annual growth is 39 cubic feet per acre.

Plant competition is moderate, but it does not prevent aspen from becoming established. Aspen sprouts must be protected from overgrazing if proper stocking is to be achieved.

Equipment limitation is moderate. Roads should be generally on the contour and have a grade of not more than 6 percent. After the timber is harvested, the site should be properly drained by ditching and by removing debris from normal drainage channels.

The erosion hazard is slight under natural vegetation, but it is moderate to severe if vegetation is removed.

The potential understory vegetation consists of about 70 percent grasses, mainly Kentucky bluegrass, pinegrass, slender wheatgrass, elk sedge, and mountain brome. About 20 percent of the vegetation consists of forbs, mainly geranium, bitterweed, horsemint, sweet-anise, lupine, bluebells, and aster. The remaining 10 percent consists of shrubs, mainly rose, snowberry, chokecherry, and myrtle boxleaf.

In overgrazed areas, the plants that decrease are bluegrass, elk sedge, mountain brome, bluebells, and sweet-anise, and those that increase are pinegrass and tree seedlings.

If the understory has not been overgrazed and is in excellent condition, the total annual yields of herbage are as follows:

<i>Class of canopy</i>	<i>Herbage Pounds per acre</i>
Open (0 to 10-percent shade) -----	1,800 to 2,000
Sparse (10- to 40-percent shade) -----	1,500 to 1,800
Medium (40- to 70-percent shade) -----	500 to 1,500
Dense (70- to 100-percent shade) -----	0 to 500

Usable forage is about 40 percent of these yields.

#### WOODLAND SUITABILITY GROUP 3

The soils of this group are in the foothills of the mountains in the southeastern part of the Survey Area. They have a surface layer of silt loam and a subsoil of clay loam. They are more than 60 inches deep. The slope is 20 to 60 percent. Permeability is moderately slow. Roots penetrate the subsoil, but their numbers decrease somewhat with depth. The vegetation is dominantly Douglas-fir, lodgepole pine, and subalpine fir.



Productivity is medium for Douglas-fir; the average site index is 90 for these soils. At 80 years of age, a normal, fully stocked stand contains 18,500 board feet of sawtimber. At this rate the mean annual growth is 230 board feet per acre.

Plant competition is moderate, but it does not inhibit the establishment or growth of desired tree species. Brush encroachment is a moderate problem.

Generally, seedling mortality is slight or less than 25 percent for tree seedlings. Natural regeneration is good if an adequate source of seed is available.

Machinery can be used in summer and early in fall. Early rain and snow limit operations in these areas. Damage to soil structure and tree roots may result if equipment is used during wet periods.

The erosion hazard is moderate to severe if the vegetation is removed. If roads and skid trails are in areas where the grade is less than 30 percent, only limited maintenance is required to control erosion. If they cross areas where the slope is short and the gradient is as much as 60 percent, special attention must be given to the control of erosion in their construction and maintenance. A grade of not more than 8 percent is desirable for roads in steep areas. Following logging operations, excessive runoff must be drained from roads by properly placed ditches and barriers.

The potential understory vegetation consists of about 85 percent grasses, mainly pinegrass, big bluegrass, beargrass, mountain brome, slender wheatgrass, and bearded wheatgrass. About 8 percent of the vegetation consists of forbs, mainly lupine, aster, and butterweed. The remaining 7 percent consists of shrubs, mainly snowberry, serviceberry, and chokecherry.

In overgrazed areas, nearly all the understory vegetation decreases. The density of tree stands may increase if erosion is not severe. This site is marginal for livestock grazing; it is more important for watershed and wildlife habitat.

If the understory has not been overgrazed and is in excellent condition, the total annual yields of herbage are as follows:

<i>Class of canopy</i>	<i>Herbage Pounds per acre</i>
Open (0 to 10-percent shade)-----	300 to 500
Sparse (10- to 40-percent shade)-----	150 to 300
Medium (40- to 70-percent shade)-----	50 to 150
Dense (70- to 100-percent shade)-----	0 to 50

Usable forage is about 35 percent of these yields.

#### WOODLAND SUITABILITY GROUP 4

The soils of this group are mainly on the north, east, and northeast slopes of high mountain ridges in the central and southeastern parts of the Survey Area. These soils are more than 40 inches deep. They have a surface layer of loam and silt loam and a subsoil of clay loam. The slope is 0 to 60 percent. Permeability is moderately slow. Trees are predominantly Douglas-fir; aspen grows at the toe of the slopes.

Productivity for Douglas-fir is low; the average site index is 80 for these soils. At 80 years of age, a normal, fully stocked stand contains approximately 12,200 board feet per acre. At this rate the mean annual growth is 152 board feet per acre.

Plant competition does not prevent Douglas-fir from becoming established on these soils. Seedling mortality is

medium to severe because of the high summer temperatures.

Mistletoe on Douglas-fir is a serious problem near the ridgetops. The affected trees should be removed when trees are cut for improvement and harvest.

Equipment limitation is medium to severe because of slope. Rain and snow limit the use of equipment to summer and early in fall. Erosion is a hazard if equipment is used on these soils when they are wet. Roads should be constructed on the contour.

The hazard of erosion is slight to severe, and roads and skid trails erode if they are in areas where water concentrates and is channeled into them. After logging, care must be taken to ditch and drain the roads properly.

The potential understory vegetation consists of about 80 percent grasses, mainly pinegrass, big bluegrass, mountain brome, and slender wheatgrass. About 15 percent of the vegetation consists of shrubs, mainly snowberry, myrtle boxleaf, maple, willow, and rose. The remaining 5 percent consists of forbs, mainly geranium, strawberry, sweet-anise, and Oregongrape.

In overgrazed areas, the plants that decrease are bluegrass, mountain brome, and wheatgrass and those that increase are pinegrass and shrubs. Naturally regenerated stands of trees become dense.

If the understory has not been overgrazed and is in excellent condition, the total annual yields are as follows:

<i>Class of canopy</i>	<i>Herbage Pounds per acre</i>
Open (0 to 10-percent shade)-----	900 to 1,200
Sparse (10- to 40-percent shade)-----	650 to 900
Medium (40- to 70-percent shade)-----	250 to 650
Dense (70- to 100-percent shade)-----	0 to 250

Usable forage is about 50 percent of these yields.

### Management of the Soils for Windbreaks <sup>5</sup>

This section discusses the establishment and management of field and farmstead windbreaks for soils on which they are considered most useful. The suitability of trees, by windbreak suitability groups, is given in table 4.

Originally, native trees—species of cottonwood and willow—occupied much of the steambanks and flood plains along the larger streams. The uplands of the Snake River plains supported mainly big sagebrush and grass vegetative communities. A small proportion of the area supported saltgrass and greasewood. A limited area of marsh supported sedges, rushes, and water-tolerant grasses.

#### Field windbreaks

Field plantings have been used sparingly in the Bingham Area, although they are potentially valuable in controlling soil blowing. Their benefits are most evident on sandy soils where, in combination with other conservation measures, they are especially effective in controlling soil blowing, reducing evaporation from soils, and protecting crops from drying out and from physical damage.

Evergreen trees, such as pine and spruce, make the most effective and enduring windbreaks, but they have a relatively slow growth rate and are difficult to establish. Consequently, deciduous species, such as Russian-olive and black locust, are the trees mainly used.

<sup>5</sup> By MELVIN R. CARLSON, woodland conservationist, SCS, Boise.



TABLE 4.—*Guide to species suitable for windbreak plantings*

Windbreak suitability group	Species suitable for planting		
	Deciduous trees	Shrubs	Evergreens
Group 1: Deep and moderately deep, nearly level to gently sloping, loamy soils that are either naturally well drained or have been artificially drained. AmA, AmB, BaA, BaB, BoA, BoB, DcA, DcB, DcC, DeA, DeB, Fs, HaA, HaB, HeA, Km, MaA, MaB, MnA, MnB, Pd, Pe, PhA, PhB, PnA, PoA, PoB, PrA, PrB, PsA, PsB, PtA, PtB, PvA, PvB, SaA, SaB, StA, StB, WaA, WaB.	Russian-olive, golden willow, black locust, green ash, hybrid poplar.	Caragana, Nanking cherry, lilac, southernwood, mulberry, cotoneaster, Tatarian honeysuckle, common privet, western mountain ash, mugo pine.	Rocky Mountain juniper, <sup>1</sup> Douglas-fir, Austrian pine, Scotch pine, Norway spruce, ponderosa pine, blue spruce.
Group 2: Deep and moderately deep, nearly level to gently sloping, loamy soils that are moderately well drained or somewhat poorly drained. BaC, DcC, DeC, DeD, MnC, PhC, PhD, PoC, PrC, PsC, PtC, PtD, PvC, Pvd, SaC.	Russian-olive, golden willow, black locust, green ash, hybrid poplar.	Caragana, Nanking cherry, lilac, southernwood, mulberry, cotoneaster, Tatarian honeysuckle, common privet, western mountain ash, mugo pine.	Rocky Mountain juniper, <sup>1</sup> Douglas-fir, Austrian pine, Scotch pine, Norway spruce, ponderosa pine, blue spruce.
Group 3: Deep, nearly level to gently sloping, loamy soils that are naturally moderately well drained or somewhat poorly drained or soils that have been artificially drained. Bc, Bd, Bk, Fr, Fv, HsA, HsB, HtA, Ld.	Poplars, willows, Russian-olive.	Cotoneaster-----	Lodgepole pine, Norway spruce.
Group 4: Deep, nearly level to gently sloping, moderately well drained to somewhat poorly drained soils that are slightly to moderately saline. Bf, FgA, FgB, FIA, FIB, FnA, We.	Green ash, Russian-olive---	Cotoneaster-----	Rocky Mountain juniper, <sup>1</sup> Norway spruce.
Group 5: Deep and moderately deep, nearly level to gently sloping, somewhat excessively drained or well-drained, sandy soils and gravelly loamy soils. PaA, PaB, Pw.	Black locust, hybrid poplar, green ash, Russian-olive.	Caragana, southernwood, Nanking cherry, lilac.	Rocky Mountain juniper. <sup>1</sup>

<sup>1</sup> Juniper is a host tree for cedar-apple rust disease. These trees should not be planted in communities where there are apple orchards.

Field windbreaks should fit the needs of the soil. They should be carefully planned and located in relation to the field boundaries and the irrigation system. An example of an effective major three-row windbreak placed along the windward border consists of a shrub row on the windward side, a row of tall trees in the middle, and a row of evergreens on the lee side. Single-row supplemental windbreaks can be placed across the field as needed. Spacing of trees in field windbreaks is the same as described under "Farmstead Windbreaks."

### **Farmstead windbreaks**

To provide maximum protection for the farmstead, livestock, orchards, and gardens, careful consideration of the following is important so that maximum benefits can be obtained from the windbreak.

**Location of windbreaks.**—Windbreaks are most effective if placed at right angles to the prevailing wind. Plantings should be about 100 feet from the buildings and extend 50 feet beyond the building boundaries to prevent wind from whipping around the ends of the windbreak into the area that needs protection.

**Number of rows.**—A five-row planting makes an effi-

cient farmstead windbreak. If limited space prevents use of five rows, use fewer rows rather than crowding the trees.

**Arrangement of rows.**—A combination of trees and shrubs should be used to form a dense, year-round wind barrier from ground level to the height of the windbreak. This can be achieved by planting from the windward side, first a row of shrubs, second a row of medium-size trees, third a row of tall trees, fourth a row of tall evergreens, and fifth a row of dense-growing evergreens.

**Kinds of trees.**—Only trees and shrubs that will grow and do well on the soils should be used. Suitable species of deciduous trees, shrubs, and evergreens are listed, by windbreak suitability groups, in table 4.

**Spacing.**—Trees should be given room to grow by allowing adequate growing space, which tends to keep trees thrifty, and by using the spacing that has been proved sound through experiment. Shrubs should be planted 3 feet apart in the row; tall trees and evergreens should be planted 8 to 12 feet apart. The distance between rows should be at least 16 feet for optimum growth. Wider spacings can be used to accommodate cultivation equipment.



### ***Planting and management of windbreaks***

Trees grow best in firm, moist soil that is free of weeds and grasses. The planting site may be summer-fallowed, if necessary, to eliminate weeds.

The tree seedlings need prompt attention when they arrive from the nursery. They should be kept moist and cool.

The trees in the young windbreak should be cultivated often enough to control the weeds. If irrigated, they should be cultivated over a period of at least 3 years. For optimum growth, the trees should be cultivated from the time they are planted until their tops close and shade out competitive weeds and grasses. They should be protected from the damage caused by livestock, poultry, and fire, as well as that caused by mice, gophers, rabbits, porcupines, insect pests, plant diseases, and some kinds of herbicides.

The young seedlings should be irrigated immediately after planting. Frequent light applications of irrigation water are needed to keep the root zone moist during the first year. The young windbreak should be irrigated every 7 to 10 days during the peak irrigation season of July through August. The frequency of peak-season irrigation needed after the first year depends on the texture and depth of soil and annual growth of the tree roots.

### ***Windbreak suitability groups***

In the Bingham Area the soils have been placed in five windbreak suitability groups, according to their suitability for field or farmstead windbreak plantings. The soils in each group are described, and the hazards, limitations, and management needs are briefly discussed. The trees, shrubs, and evergreens suitable for planting are listed in table 4. The group in which each soil has been placed is shown in the "Guide to Mapping Units" at the back of this survey.

The groups are discussed in the following paragraphs.

#### **WINDBREAK SUITABILITY GROUP 1**

This group consists of fine sandy loam, sandy loam, silt loam, and loam soils. These soils are more than 20 inches deep. They occur on the broad, medium and high terraces, benches, and uplands adjacent to the major rivers. They are naturally well drained or have been drained artificially. The slope ranges from 0 to 4 percent.

Trees grow well on these soils, once they are established. They require cultivation for the first 4 or 5 years. Irrigation should be frequent enough to keep plants growing actively all summer.

#### **WINDBREAK SUITABILITY GROUP 2**

Soils of this group occur near the edges of the terraces and uplands, and along sides of drainageways, in the same general area as the soils in suitability group 1. They have fine sandy loam, loam, and silt loam texture, are well drained, and are more than 20 inches deep. The slope ranges from 4 to 12 percent.

Trees do well on these soils once they are established. Erosion is a moderate to severe hazard in irrigated areas. A permanent cover crop of grass is needed to control erosion after the windbreak has been established, but the soils require clean cultivation for the first 4 to 5 years during the establishment period.

#### **WINDBREAK SUITABILITY GROUP 3**

Soils of this group occur on low terraces and alluvial fans. They have a surface layer of sandy loam to loam, are more than 60 inches deep, and are nearly level to gently sloping. These soils are naturally moderately well drained or somewhat poorly drained, or they have been artificially drained.

With good management, trees will grow successfully on these soils. Wetness limits the kinds of trees and shrubs that can grow on these soils. In places drainage is needed before selected trees and shrubs can be grown successfully. Plantings should be cultivated to keep them free of weeds until the trees have grown enough to limit the growth of the weeds.

#### **WINDBREAK SUITABILITY GROUP 4**

Soils of this group occur on the low terraces and alluvial fans near the rivers and principal drainageways. They have a surface layer of loamy sand to silty clay loam. The soils are more than 60 inches deep, moderately well drained to somewhat poorly drained, slightly to moderately saline, and nearly level to gently sloping.

With good management, salt-tolerant trees grow well in these areas. Drainage may be needed before trees and shrubs can be grown successfully. Wetness and salinity of some soils restrict the kinds of trees and shrubs that can be grown. Erosion is also a hazard in irrigated areas where the slope is more than 2 percent. Plantings should be cultivated to keep them free of weeds until the trees have grown enough to limit the growth of weeds.

#### **WINDBREAK SUITABILITY GROUP 5**

Soils of this group occur on the terraces and uplands. They are either loamy sand or gravelly loam. They are more than 60 inches deep and somewhat excessively drained or well drained. The slope ranges from 0 to 4 percent.

Good management is required to obtain fair or good growth of windbreak plantings on these soils. The low available water capacity and the high rate of water intake are problems in irrigated areas. Frequent applications of irrigation water are needed for successful establishment of trees and shrubs. Erosion is a hazard in irrigated areas where the slope is more than 2 percent. The sandy soils are subject to soil blowing in spring. Plantings must be kept free of weeds by shallow cultivation. Onsite investigation is needed to check species suitability before planting.

### **Management of the Soils for Wildlife<sup>6</sup>**

Most soils in the Bingham Area are suited to and support one or more kinds of wildlife. Chukars, mourning doves, ducks, geese, gray partridges, ring-necked pheasants, blue grouse, sage grouse, ruffed grouse, sharp-tailed grouse, and many nongame birds find habitat in the Survey Area. Elk, deer, and bear are game animals living in the Area. Beaver and muskrat are fur-bearing animals that inhabit areas along streams and around ponds. Coyotes and bobcats are found in many parts of the Area. Fish are in the reservoirs, ponds, and streams.

Most wildlife species cannot be related directly to an individual soil or group of soils. Instead, each significant

<sup>6</sup> By CLYDE A. SCOTT, biologist, Soil Conservation Service, Boise.



kind of wildlife is related to its important foods, cover, and water supply. The development of these elements of each animal's habitat is dependent upon the suitability of the soils and the management of the soils.

The local offices of the Soil Conservation Service maintain technical guides for important kinds of wildlife and fish and for significant plants that provide food and cover for wildlife.

The following is a summary of the needs of the more important wildlife species in the county as they relate to the soil associations described in the section "General Soil Map."

*Deer and elk.*—These big game animals have seasonal variation in their choice of foods. Browse is preferred throughout the summer, fall, and early winter months, but grass makes up much of their diet late in winter and in spring. Elk are more of a grazing animal than are deer.

Deer and elk are in the mountainous parts of the Survey Area. The soil associations capable of providing suitable habitat are the Newdale-Swanner-Tetonia, the Sheege-Pavohroo, the Dranyon-Sessions-Nielsen, the Wahtigup-Ricrest-Hymas, and the Robin-Lanark associations. In summer the animals are at the higher elevations in all of the named associations. In winter the Newdale-Swanner-Tetonia and the Wahtigup-Ricrest-Hymas associations are used most extensively.

*Other game and furbearers.*—Bear, beaver, and muskrat are common in parts of the Survey Area. Bear frequent the same general area as deer and elk, but not in large numbers. Beaver and muskrat are important furbearing animals and find habitat along most of the streams in the Sheege-Pavohroo, Dranyon-Sessions-Nielsen, Wahtigup-Ricrest-Hymas, and Robin-Lanark soil associations.

*Predatory animals.*—Bobcats and coyotes mainly frequent the Pancheri-Polatis association, but to a lesser extent, find habitat in other associations. They help keep the wildlife population in balance.

*Blue grouse.*—The principal foods of the blue grouse are leaves, seeds, and buds. Choice foods are bearberry, bitter cherry, chokecherry, currant, Douglas-fir, huckleberry, larch, Rocky Mountain maple, mountain-ash, ponderosa pine, red raspberry, serviceberry, snowberry, sunflower, thimbleberry, and wheat. Fairly well suited foods are aspen, clover, dandelion, elder, eriogonum, hawthorn, oats, and rose. Blue grouse also eat grasshoppers and other insects. They inhabit forested uplands, preferring mountains where mature stands of pine, fir, and other conifers offer good winter cover. These birds depend primarily on vegetation for their water requirements.

Soils of the Sheege-Pavohroo and the Dranyon-Sessions-Nielsen associations are suitable for growing food and cover for the blue grouse.

*Chukar.*—This game bird was introduced from southern Asia. Choice plant foods are barley, bristlegrass, mountain brome, cheatgrass, clover, corn, currant, oats, pigweed, Indian ricegrass, serviceberry, grain sorghum, sunflower, and wheat. Fairly well suited foods are alfalfa, barnyardgrass, Kentucky bluegrass, chokecherry, millet, potato, rose, and teasel. These birds also eat many kinds of insects. Their needs for cover are met largely by rocky slopes and steep, grassy terrain.

Soils of the Wahtigup-Ricrest-Hymas and the New-

dale-Swanner-Tetonia associations provide suitable habitat for large numbers of chukars.

*Ducks.*—The surface-feeding ducks (mallard, pintail, and widgeon) are closely related to field grains and aquatic habitat. Foods are chiefly aquatic plants, insects, seeds, and green forage. Among these foods, the choice ones are barley, barnyardgrass, bulrush, corn, millet, sago potamogeton, smartweed, grain sorghum, and wheat. Fairly well suited foods are clover, dandelion, peas, and oats. Ducks are attracted most readily to seeds that are covered with shallow water. Nesting success is related to the aquatic habitat of marshes, lakes, and ponds. Therefore, important soils are those suitable for water impoundment and management.

Soils of the Bannock-Bock, Declo-Fingal, and Robin-Lanark associations are well suited to the maintenance or development of food and water supply for ducks. Many soils suitable for shallow water impoundments and feeding areas are near the Blackfoot and Snake Rivers, and near the sloughs and numerous drainageways. Soils of several of the associations are suitable for grain fields, which provide food for ducks. Grays Lake, Blackfoot River Reservoir, and American Falls Reservoir are large water impoundments that provide both food and nesting areas.

*Geese (principally the Canada goose).*—A good population of resident Canada geese nest on islands in the Snake and Blackfoot Rivers and on the American Falls and Blackfoot River Reservoirs and Grays Lake. Tender green forage is an important food. These plants are alfalfa, barley, Kentucky bluegrass, clover, dandelion, sago potamogeton, rye, timothy, and wheat. Other choice foods are the seeds of alfalfa, barnyardgrass, corn, millet, rye, grain sorghum, and wheat. Fairly well suited foods include bulrush, cheatgrass, oats, pigweed, and smartweed.

Soils of the Bannock-Bock, Declo-Fingal, and Robin-Lanark soil associations provide nesting areas on rivers and reservoirs. Soils in most parts of the Survey Area provide food in areas where the geese feed in fields of grain and green forage.

*Gray partridge (formerly called Hungarian partridge).*—This European game bird was introduced about 1930. Its habitat is closely related to grainfields and range areas. Choice plant foods are barley, barnyardgrass, bristlegrass, millet, grain sorghum, teasel, and wheat. Fairly well suited plant foods are alfalfa, cheatgrass, corn, dandelion, oats, pigweed, Indian ricegrass, rose, rye, sunflower, and timothy. The gray partridge also eats insects. The vegetation for nesting cover includes alfalfa, grassy fence rows, and weed patches.

Habitat for the gray partridge can be maintained or developed in each soil association.

*Mourning dove.*—These migratory game birds eat only seeds; they do not eat forage plants, fruits, or insects. Choice foods are barnyardgrass, bristlegrass, reed canarygrass, corn, geranium, millet, pigweed, pine seed, ragweed, rape, Indian ricegrass, grain sorghum, sunflowers, and wheat. Fairly well suited foods are barley, oats, rye, and vetch. Black locust and orchard trees are favorite nesting sites, but doves will also nest in other trees and on the ground in well-drained sites. Doves need drinking water daily.



Habitat for doves can be maintained or developed in all parts of the Survey Area.

*Ring-necked pheasant.*—This bird, native to China, was successfully introduced in the 1930's. The best habitat for this popular game bird is diversified cropland and adjacent cover composed of grassy ditches and shrubs or trees along fence rows and streams. Pheasants eat grasshoppers and other insects. Choice plant foods are the seeds of barley, barnyardgrass, bristleglass, corn, millet, oats, pigweed, Indian ricegrass, grain sorghum, teasel, and wheat. Fairly well suited foods include alfalfa, Kentucky bluegrass, chokecherry, clover, currants, dandelion, raspberry, rose, Russian-olive, serviceberry, and sunflowers.

Soils of the Bannock-Bock, Declo-Fingal, Pancheri-Polatis, Robin-Lanark, and Wolverine-Sasser-Stan soil associations are well suited to habitat favorable for pheasants.

*Sage grouse.*—Choice foods of these birds are alfalfa, clover, dandelion, prickly lettuce, big sagebrush, salsify, serviceberry, and sunflower. Fairly well suited foods are biscuitroot, sweetclover, rose, and skunkbush. Sage grouse also eat ants, grasshoppers, and other insects. Range areas consisting of big sagebrush, grass, and forbs are basic habitat for sage grouse. Seasonal requirements vary in amount and kinds of each.

Soils of the Pancheri-Polatis and Robin-Lanark associations are suitable for growing food and cover for sage grouse.

*Nongame birds.*—Many kinds of nongame birds live in the Survey Area. They, like game birds, thrive best when they have choice foods and adequate nesting sites. The nation's most dense nesting population of sandhill cranes is in the Bingham Area. Robins and certain other songbirds eat insects, worms, and fruit. Flycatchers, hawks, herons, and swallows feed almost entirely on fish, frogs, insects, rodents, and snakes. A few nongame birds eat weed seeds and grains. Several include animal foods, fruits, and seeds in their diets.

All the associations are suitable for providing food and habitat for one or more nongame species.

*Fish.*—The principal game fish in the ponds, streams, and reservoirs are trout. All permanent streams, ponds, and lakes are suitable for fish. Trout thrive best in streams that are adequate in size, have gravel bottoms, and are unpolluted. Many of the larger streams are regularly stocked with trout.

## Engineering Uses of the Soils <sup>7</sup>

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation material upon which structures are built.

In this section are described those properties of the soils that affect construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, sewage disposal systems, and irrigation systems. Among the soil properties most important in engineering are permeability, shear strength, density, shrink-swell poten-

tial, available water capacity, grain-size distribution, plasticity, and reaction.

Information concerning these and related soil properties is given in tables 5, 6, and 7. Table 5 gives engineering test data, table 6 gives estimated soil properties significant in engineering, and table 7 gives engineering interpretations.

Information in this section of the soil survey can be used to—

1. Make soil and land-use studies that will aid in selecting and developing industrial, commercial, residential, and recreational sites.
2. Make preliminary estimates of soil properties that are important in planning agricultural drainage systems, farm ponds, irrigation systems, terraces and diversions, and waterways.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables; and in planning detailed investigations at the selected locations.
4. Locate probable source of material suitable for road and highway construction.
5. Locate probable sources of sand, gravel, or rock suitable for use as construction material.
6. Correlate performance of engineering structures with soil mapping units so as to develop information for overall planning that will be useful in designing structures and in planning engineering practices.
7. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
8. Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.
9. Develop other preliminary estimates for construction purposes pertinent to a particular area.

With the use of the soil map for identification, the engineering interpretations reported here can be useful for many purposes. It should be emphasized that they do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. Even in these situations, however, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

In the Bingham Area, Fingal soils, which are underlain by lake sediments, are dominant in the area known as the Sterling Bench. These soils contain soluble salts, and some areas are strongly saline because irrigation water from surrounding areas moves laterally through the soil. Adequate natural drainage outlets are fairly limited, and draining the soils presents some problems. The Soil Conservation Service has published material on this subject entitled "The Drainage Problems of the Sterling Bench."

Areas of coarse-textured soils, which include those of the Firth, LaJara, and Weeding series, are in an area known as Northeast Blackfoot. These soils are underlain by lake sediments and have a slowly permeable substratum. Some of them are irrigated. Adequate natural drain-

<sup>7</sup>By DONALD P. STEWART, area engineer, Soil Conservation Service.

age outlets are severely limited, and in most places pumping is necessary to remove excess water. The coarse texture of the soils causes the banks of drains to be unstable. The Soil Conservation Service has published material on this subject, entitled "The Drainage Problems of the Northeast Blackfoot Area."

The silt loam soils in the area north of Blackfoot have been, until recently, in range and sagebrush. Under irrigation, these soils tend to have a slower intake rate. Under sprinkler irrigation, the application rate should not exceed 0.25 inches per hour.

Some of the terms used in this soil survey have special meaning to soil scientists and a somewhat different meaning to engineers. The Glossary defines several of these terms according to their meaning in soil science.

### ***Engineering classification systems***

Three systems of classifying soils are used in this survey. These are the system used by the U.S. Department of Agriculture; the AASHTO system (1, 4) adopted by the American Association of State Highway Officials; and the Unified system (9) used by the Department of Defense and others.

The system of soil classification used by the Department of Agriculture is based partly on the texture of the soil. In some ways it is comparable to the two systems used by engineers.

The AASHTO system is based on the field performance of soils. In this system, classification is based on the gradation, liquid limit, and plasticity index of the soil. The performance of materials for highway construction has been related to this system of classification. All soil materials are classified in seven principal groups. The groups range from A-1 (gravelly soils of high bearing capacity, the best soils for subgrades), to A-7 (clayey soils that have low strength when wet, the poorest soils for subgrades). Within each group, the relative engineering value of the soil material is indicated by a group index number. The group index number is shown in parentheses following the soil group symbol. The AASHTO classification for tested soils, with index numbers in parentheses, is shown in table 5. The estimated classification for all soils mapped in the Survey Area is given in table 6.

The Unified system of soil classification, which was developed by the Department of Defense, is based on identification of soils according to their texture and plasticity and their performance as engineering construction materials. Soil materials are identified as coarse grained (eight classes), fine grained (six classes), or highly organic. In the Unified system, the symbols SM and SC represent sand with fines of silt and clay; ML and CL, silt and clay of low liquid limit; MH and CH, silt and clay of high liquid limit; GW and GP, gravels and mixtures of gravel and sand. Some soil materials have characteristics that are borderline between the major classes and are given a borderline classification, such as ML-CL.

### ***Engineering test data***

Soil samples from nine of the principal soil series of the Bingham Area were tested by standard AASHTO procedures, to help evaluate the soils for engineering pur-

poses. The samples were tested by the Materials Division, U.S. Bureau of Public Roads. The results of these tests are given in table 5. The table shows the specific locations where samples were taken, the depth to which sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soils engineering.

The engineering soil classifications in table 5 are based on data obtained by mechanical analyses and by tests to determine liquid limit and plastic limit.

The tests for liquid limit and plastic limit measure the effect of water on the consistence of soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from a semisolid to a plastic. The liquid limit is the moisture content at which the material changes from a plastic to a liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which the soil is in a plastic state. Some silty and sandy soils are nonplastic; that is, they will not become plastic at any moisture content.

### ***Estimated properties of the soils***

Table 6 gives estimated properties of all the soils of the Bingham Area. It also gives the USDA textural classification and estimates of the Unified classification and the AASHTO classification. In addition, grain-size distribution, permeability, available water capacity, reaction, salinity, shrink-well potential, and corrosion hazards for steel and concrete are estimated.

USDA texture is determined by the relative proportion of sand, silt, and clay in soil material. Some of the terms used in the USDA textural classification system are defined in the Glossary.

Permeability, as used in table 6, relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available water capacity (also termed available moisture capacity) is that amount of capillary water in the soil available for plant growth after all free water has drained away.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and relative terms used to describe soil reaction are defined in the Glossary.

Salinity of the soil is based on the electrical conductivity of the saturated soil extract, as expressed in millimhos per centimeter at 25° C. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its corrosiveness to other materials.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with a change in moisture content. Shrinking and swelling of soil causes much damage to building foundations, roads, and other structures. A high shrink-well potential indicates hazards to the maintenance of structures constructed in, on, or with such material.



TABLE 5.—*Engineering*

[Tests performed by the Materials Division, U.S. Bureau of Public Roads, in accordance with

Soil name and location	Parent material	Depth from surface	Mechanical analysis data <sup>1</sup>			
			Percentage passing sieve—			
			1 in.	¾ in.	½ in.	No. 4 (4.7 mm.)
Bannock loam: 300 ft. S. and 200 ft. E. of NW. corner of SW¼ sec. 11, T. 2 S., R. 36 E. (Modal)	Alluvium (river terrace).	In. 0-6 6-11 16-24	97 97 95	92 93 92	79 81 81	75 79 79
Blackfoot loam: 800 ft. E. and 600 ft. S. of NW. corner of NE¼ sec. 20, T. 3 S., R. 34 E. (Modal)	Alluvium (river terrace).	0-8 8-18 40-51	----- ----- -----	----- ----- -----	----- ----- -----	----- ----- -----
Declo loam: 100 ft. N. and 1,620 ft. E. of SW. corner of SE¼ sec. 33, T. 5 S., R. 31 E. (Modal)	Alluvium from loess and lake-laid sediments.	0-7 14-25 44-64	----- ----- -----	----- ----- -----	----- ----- -----	----- ----- -----
Paesl silt loam: 500 ft. W. and 50 ft. S. of NE. corner of sec. 27, T. 1 S., R. 37 E. (Modal)	Alluvium from sandstone.	3-9 9-17	99 97	98 96	96 94	96 94
Portneuf silt loam: 150 ft. N. and 60 ft. W. of SE. corner of SW¼ sec. 34, T. 5 S., R. 30 E. (Modal)	Loess.	0-4 4-10 29-42	----- ----- -----	----- ----- -----	----- ----- -----	----- ----- -----
Rexburg silt loam: 1,520 ft. N. and 1,320 ft. E. of SW. corner of sec. 5, T. 4 S., R. 39 E. (Modal)	Loess.	0-7 12-17 25-40	----- ----- -----	----- ----- -----	----- ----- -----	----- ----- -----
Robin silt loam: 580 ft. E. and 1,550 ft. N. of the center of sec. 9, T. 3 S., R. 40 E. (Modal)	Loess over basalt.	2-11 30-48	----- -----	----- -----	----- -----	----- -----
Wapello fine sandy loam: 800 ft. S. and 800 ft. E. of NW. corner of sec. 24, T. 2 S., R. 36 E. (Modal)	Alluvium over old lake sediments.	0-8 8-15 33-55	----- ----- -----	----- ----- -----	----- ----- -----	----- ----- -----

<sup>1</sup> Analysis according to AASHTO Designation: T 88-57 (1). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters

## test data

standard procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis data <sup>1</sup> —Continued						Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Cont.			Percentage smaller than—					AASHO	Unified
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.				
74	67	50	46	16	12	<i>Pct.</i> 24	4	A-4(3)	SM-SC
78	72	54	49	15	11	23	4	A-4(4)	ML-CL
78	72	54	50	18	15	22	4	A-4(4)	ML-CL
100	99	80	74	36	26	34	12	A-6(9)	ML-CL
100	99	82	76	34	23	34	14	A-6(10)	CL
-----	100	55	43	17	13	( <sup>2</sup> )	( <sup>2</sup> )	A-4(4)	ML
100	96	72	67	24	18	25	6	A-4(7)	ML-CL
100	97	68	63	16	13	24	4	A-4(7)	ML-CL
-----	-----	99	98	46	32	45	20	A-7-6(13)	ML-CL
96	94	83	80	40	28	34	13	A-6(9)	CL
94	92	78	74	36	26	31	14	A-6(10)	CL
-----	100	89	78	23	16	25	3	A-4(8)	ML
-----	-----	96	88	27	20	27	7	A-4(8)	ML-CL
100	99	93	86	22	16	31	9	A-4(8)	ML-CL
-----	-----	97	90	27	22	29	5	A-4(8)	ML-CL
-----	-----	98	91	27	21	30	8	A-4(8)	ML-CL
-----	-----	99	93	25	<sup>3</sup> 19	28	6	A-4(8)	ML-CL
100	99	95	88	23	15	34	7	A-4(8)	ML
-----	-----	98	93	27	24	33	11	A-6(8)	ML-CL
100	97	41	35	19	16	( <sup>2</sup> )	( <sup>2</sup> )	A-4(1)	SM
100	98	44	39	20	18	20	3	A-4(2)	SM
-----	100	86	75	24	18	28	3	A-4(8)	ML

in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for use in naming textural classes for soils.

<sup>2</sup> Nonplastic.

<sup>3</sup> Includes finely divided, clay-size particles of lime.



TABLE 6.—*Estimated soil properties*

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

Soil series and map symbols	Depth to—		Depth from surface in typical profile	Classification		
	Bed-rock	Seasonal water table		USDA texture	Unified	AASHO
Alpon: ALF, ALG-----	<i>Ft.</i> >5	<i>Ft.</i> (2)	<i>In.</i> 0-45 45-66 66	Silt loam----- Clay loam----- Sandstone bedrock.	ML to CL CL	A-4 A-7 or A-6
Ammon: AmA, AmB-----	(1)	(2)	0-60	Silt loam-----	ML to CL	A-4
Araveton: AVF, AVG, ArD-----	(1)	(2)	0-66	Extremely stony loam-----	ML to CL	A-4
Bannock: BaA, BaB, BaC-----	(1)	(2)	0-36 36-60	Loam and gravelly loam----- Very gravelly coarse sand-----	ML or GM GW or GP	A-4 A-1
Blackfoot: Bc, Bd, Bf, Bk-----	(1)	2-4	0-70	Stratified sandy loam and silty clay loam.	ML or CL	A-6 or A-4
Bock: BoA, BoB-----	(1)	(2)	0-47 47-60	Loam----- Very gravelly coarse sand-----	ML GW or GP	A-4 A-1
Bondbranch: BRB-----	1-1½	(2)	0-16 16	Sandy loam----- Basalt.	SM	A-2 or A-4
Declo: DcA, DcB, DcC, DeA, DeB, DeC, DeD, DeE2.	(1)	(2)	0-64	Loam and silt loam-----	ML to CL	A-4
*Dranyon: DRF, DRG, DSF----- For Gilispie part of DSF, refer to Gilispie series.	>3½	(2)	0-20 20-67	Silt loam----- Clay loam-----	ML-CL CL or ML	A-4 A-6
Enochville: En-----	(1)	1-2	0-53 53-60	Silty clay loam----- Gravelly sandy clay loam-----	CL SC or GC	A-7 or A-6 A-2
Fingal: FgA, FgB, FIA, FIB, FmA, FnA.	(1)	2-4	0-22 22-60	Loam and clay loam----- Stratified silty clay and heavy silty clay loam.	ML or CL CH or CL	A-4 or A-6 A-7 or A-6
Firth: Fr, Fs-----	(1)	2-4	0-40 40-60	Sandy loam----- Silt loam-----	SM ML or CL	A-2 or A-4 A-4
Fulmer: Fu, Fv-----	(1)	1-2	0-60	Stratified loam and silt loam-----	ML-CL or CL	A-4 or A-6
Gilispie: GLF, GMF-----	1-2	(2)	0-6 6-16 16	Stony loam----- Stony clay loam----- Basalt.	ML CL	A-4 A-6
Hayeston: HaA, HaB, HeA-----	(1)	(2)	0-30 30-60	Sandy loam----- Very gravelly coarse sand-----	SM GP or GW	A-2 or A-4 A-1
Heiseton: HsA, HsB, HtA-----	(1)	(2)	0-45 45-65	Stratified sandy loam and fine sandy loam. Very gravelly coarse sand-----	SM or ML GP or GW	A-2 or A-4 A-1
Hymas: HYF, HYG-----	1-1½	(2)	0-18 18	Gravelly loam----- Limestone.	GM or SM	A-2 or A-4
Kimama: Km-----	>4	(2)	0-60	Silt loam-----	ML to CL	A-4

See footnotes at end of table

*significant in engineering*

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions table. The symbol < means less than; the symbol > means more than]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						Uncoated steel	Concrete
95-100 80-100	90-100 75-100	80-100 70-100	70-90 60-80	<i>In. per hr.</i> 0.63-2.0 0.2-0.63	<i>In per in. of soil</i> 0.19-0.21 0.18-0.20	<i>pH</i> 5.1-6.6 6.1-6.5	None-----	Low----- Moderate.	Moderate.	Low.
100	100	95-100	75-90	0.63-2.0	0.19-0.21	7.4-8.4	None-----	Low-----	Moderate.	Low.
<sup>3</sup> 85-100	80-95	65-90	50-70	0.63-2.0	0.14-0.16	6.6-7.8	None-----	Low-----	Moderate.	Low.
60-90 25-35	60-85 15-35	50-75 5-20	40-65 0-5	0.63-2.0 >20.0	0.14-0.16 0.04-0.06	7.9-9.0 7.9-9.0	None-----	Low-----	High-----	Low.
100	100	90-100	70-85	<sup>5</sup> 0.63-2.0	0.16-0.18	7.7-8.4	Low <sup>6</sup> -----	Low to moderate.	High-----	Low.
100 20-50	100 10-30	85-95 5-10	60-75 0-5	0.63-2.0 >20.0	0.16-0.18 0.03-0.05	7.4-8.4 7.4-7.8	None-----	Low----- Very low.	Moderate.	Low.
100	100	60-70	30-40	2.0-6.3	0.11-0.13	7.4-8.4	None-----	Low-----	Moderate to high.	Low.
100	100	85-100	60-75	0.63-2.0	0.16-0.18	7.4-8.4	None to slight.	Low-----	High-----	Moderate.
100 90-100	100 85-100	90-100 80-95	70-90 70-80	0.63-2.0 0.2-0.63	0.19-0.21 0.19-0.21	6.6-7.3 6.6-7.3	None----- None-----	Low----- Moderate.	Moderate.	Low.
100 60-80	100 55-75	95-100 45-60	85-95 25-35	0.2-0.63 0.2-0.63	0.19-0.21 0.11-0.13	6.6-7.3 6.6-7.3	None----- None-----	Moderate----- Moderate-----	Moderate----- Moderate-----	Low. Low.
100	100	85-95	60-75	0.2-0.63	0.19-0.21	7.4-8.4	Slight to strong.	Moderate-----	High-----	Low.
100	100	95-100	75-95	0.06-0.20	0.14-0.16	7.9-9.0	-----	High-----	Very high.	
100	100	60-70	30-40	2.0-6.3	0.11-0.13	7.4-8.4	None to slight.	Low-----	Moderate to high.	Low.
100	100	90-100	80-95	0.2-0.63	0.19-0.21	7.9-8.4	-----	Low.		
100	100	85-95	60-80	0.63-2.0	0.16-0.18	7.4-8.4	None to slight.	Low to moderate.	High-----	Low.
<sup>3</sup> 80-90	80-90	75-90	55-80	0.63-2.0	0.12-0.14	6.1-7.3	None-----	Low-----	Moderate to high.	Low.
<sup>3</sup> 80-90	80-90	70-80	55-70	0.2-0.63	0.12-0.14	6.1-7.3	None-----	Moderate.		
100 20-50	95-100 10-35	55-70 5-20	25-40 0-5	2.0-6.3 >20.0	0.11-0.13 0.03-0.05	7.9-8.4 7.9-8.4	None----- None-----	Low----- Very low-----	Low----- Low-----	Low. Low.
100	100	60-85	30-60	2.0-6.3	0.12-0.14	7.4-8.4	None-----	Low-----	Low-----	Low.
20-50	10-35	5-15	0-5	>20.0	0.03-0.05	-----	None-----	Very low.		
<sup>3</sup> 60-75	60-75	50-70	25-50	0.63-2.0	0.11-0.13	7.4-8.4	None-----	Low-----	Moderate.	Low.
100	100	90-100	70-90	0.20-0.63	0.19-0.21	7.4-9.0	None to slight.	Low-----	Moderate.	Low.



TABLE 6.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface in typical profile	Classification		
	Bed-rock	Seasonal water table		USDA texture	Unified	AASHO
Knull..... Mapped only with Portino series.	<i>Ft.</i> 4-5	<i>Ft.</i> ( <sup>2</sup> )	<i>In.</i> 0-5 5-15 15-49 49	Silt loam..... Clay loam..... Silt loam..... Basalt.	ML to CL CL ML to CL	A-4 A-6 A-4
LaJara: La, Ld.....	( <sup>1</sup> )	<sup>9</sup> 1-2	0-38 38-60	Sandy loam..... Silt loam.....	SM ML	A-2 or A-4 A-4
*Lanark: LkB, LkD, LkE, LNF, LRF. For Robin part of LRF, refer to Robin series.	( <sup>1</sup> )	( <sup>2</sup> )	0-14 14-41 41-66	Silt loam..... Heavy silt loam..... Silt loam.....	ML to CL CL or ML ML to CL	A-4 A-6 A-4
Malm: MaA, MaB.....	1½-3½	( <sup>2</sup> )	0-34 34-39	Fine sandy loam..... Basalt.	SM or ML	A-4
*Matheson: MnA, MnB, MnC, MBC. For Bondranch part of MBC, refer to Bondranch series.	> 3½	( <sup>2</sup> )	0-46 46	Fine sandy loam..... Basalt.	SM or ML	A-4
Mike: MoF.....	1-1½	( <sup>2</sup> )	0-18 18-23	Extremely stony silt loam..... Basalt.	ML	A-4
Newdale: NdB, NdD, NdE, NEF, NEG.	( <sup>1</sup> )	( <sup>2</sup> )	0-65	Silt loam.....	ML to CL	A-4
Nielsen: NLF, NLG.....	1-1½	( <sup>2</sup> )	0-19 19	Extremely stony loam..... Sandstone.	SM	A-4 or A-2
Outlet: Ot.....	( <sup>1</sup> )	1½-3½	0-46	Silty clay loam and clay loam.....	CL	A-6 or A-7
			46-72	Silt loam and loam.....	ML or CL	A-4
Outlet, noncalcareous variant: Ou...	( <sup>1</sup> )	2-4	0-32	Loam and clay loam.....	ML to CL	A-6 or A-4
			32-60	Sand and gravel.....	GP or GW	A-1
Packham: PaA, PaB.....	( <sup>1</sup> )	( <sup>2</sup> )	0-24	Gravel and very gravelly loam.....	GM	A-1 or A-2
			24-60	Gravel and sand.....	GW or GP	A-1
Paesl: Pd, Pe.....	( <sup>1</sup> )	( <sup>2</sup> )	0-27	Silt loam.....	CL	A-6
			27-50	Gravel and sand.....	GW or GP	A-1
Pancheri: PhA, PhB, PhC, PhD....	4-5+	( <sup>2</sup> )	0-71	Silt loam.....	ML to CL	A-4
Paniogue: PnA.....	( <sup>1</sup> )	( <sup>2</sup> )	0-30	Loam.....	ML	A-4
			30-50	Gravelly sand.....	SW-SM or SP-SM	A-2
Pavohroo: PBF, PBG.....	3½-5+	( <sup>2</sup> )	0-17	Loam and silt loam.....	ML or CL	A-4
			17-44 44-56 56-65	Gravelly clay loam..... Gravelly loam..... Limestone.	CL or SC SM	A-4 or A-6 A-2
*Polatis: PoA, PoB, PoC, PrA, PrB, PrC, PCD. For Tenno part of PCD, see Tenno series.	2-4	( <sup>2</sup> )	0-28	Silt loam.....	ML-CL	A-4
			28-33	Basalt.		

See footnotes at end of table.

significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						Uncoated steel	Concrete
100	100	90-100	70-90	<i>In. per hr.</i> 0.63-2.0	<i>In per in. of soil</i> 0.19-0.21	<i>pH</i> 7.9-8.4	Moderate---	Low-----	High-----	Moderate.
100	100	90-100	70-80	0.06-0.20	0.19-0.21	7.9-8.4	-----	Moderate.		
100	100	90-100	70-90	0.20-0.63	0.19-0.21	7.9-9.0	-----	Low.		
100	100	60-70	30-40	2.0-6.3	0.11-0.13	7.4-8.4	None-----	Low-----	High-----	Low.
100	100	75-85	70-80	0.63-2.0	0.19-0.21	7.4-7.8	None-----	Low.		
100	100	90-100	70-90	0.60-2.0	0.19-0.21	6.6-7.8	None-----	Low-----	Moderate.	Low.
100	100	90-100	75-95	0.2-0.6	0.19-0.21	7.4-8.4	None-----	Moderate.		
100	100	90-100	75-95	0.6-2.0	0.19-0.21	7.9-9.0	None-----	Low.		
90-100	90-100	65-85	35-55	2.0-6.3	0.13-0.15	7.4-9.0	None-----	Low-----	Moderate to high.	Low.
100	100	70-85	40-55	2.0-6.3	0.13-0.15	7.4-9.0	None-----	Low-----	Moderate to high.	Low.
95-100	90-100	80-90	65-90	0.63-2.0	0.14-0.16	7.4-8.4	None-----	Low-----	Moderate to high.	Low.
100	100	95-100	75-90	0.63-2.0	0.19-0.21	7.4-8.4	None-----	Low-----	Moderate.	Low.
60-80	30-70	25-60	20-50	0.2-0.63	0.12-0.14	6.6-7.3	None-----	Low-----	Moderate.	Low.
100	100	90-100	75-95	0.2-0.63	0.19-0.21	7.4-8.4	None to slight.	Moderate---	Moderate to high.	Low.
100	100	85-95	65-80	0.63-2.0	0.16-0.18	7.4-7.8		Low.		
90-100	80-90	70-80	50-60	0.20-0.63	0.17-0.19	6.1-7.3	None to slight.	Low-----	Moderate to high.	Low.
20-50	10-40	5-10	0-5	>20.0	0.03-0.05	6.6-7.3	None-----	Low-----		Low.
25-55	20-50	20-40	15-30	0.63-2.0	0.11-0.13	7.4-8.4	None-----	Low-----	Low to moderate.	Low.
20-30	5-15	5-10	0-5	>20.0	0.04-0.06	7.4-7.8	None-----	Very low.		
95-100	95-100	90-100	75-85	0.63-2.0	0.19-0.21	7.4-8.4	None-----	Moderate---	Moderate.	Low.
30-50	30-50	20-40	0-5	>20.0	0.04-0.06	7.9-8.4	None-----	Very low.		
100	100	95-100	85-95	0.63-2.0	0.19-0.21	7.9-9.0	None to slight.	Low-----	Moderate to high.	Low.
100	100	85-95	60-75	0.63-2.0	0.16-0.18	7.9-8.4	None to slight.	Low-----	Moderate.	Low.
70-90	45-65	25-35	5-10	6.3-20.0	0.04-0.06	7.9-8.4	-----	Very low.		
100	95-100	80-95	60-85	0.63-2.0	0.19-0.21	6.1-6.5	None-----	Low-----	Moderate.	Low.
70-90	55-80	50-80	40-60	0.2-0.63	0.16-0.18	6.1-6.5	None-----	Moderate.		
70-90	40-50	35-45	25-35	0.63-2.0	0.05-0.07	7.4-7.8	None-----	Low.		
100	100	95-100	85-95	0.63-2.0	0.19-0.21	7.9-9.0	None to slight.	Low-----	Moderate to high.	Low.



TABLE 6.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface in typical profile	Classification		
	Bed-rock	Seasonal water table		USDA texture	Unified	AASHO
*Portino: PsA, PsB, PsC, PtA, PtB, PtC, PtD, PuA, PuB, PFD. For Knull part of PuA and PuB, see Knull series. For Thornock part of PFD, see Thornock series.	Fl. 1½-3½	Fl. ( <sup>2</sup> )	In. 0-28	Silt loam.....	ML to CL	A-4
			28-33	Basalt.		
Portneuf: PvA, PvB, PvC, PvD.....	3½-5+	( <sup>2</sup> )	0-58	Silt loam.....	ML to CL	A-4
			58	Basalt.		
Presto: Pw.....	( <sup>1</sup> )	( <sup>2</sup> )	0-28	Loamy sand.....	SM	A-2
			28-60	Silt loam.....	ML to CL	A-4
*Rexburg: ReD, ReE, RGF, RGG. For Wahtigup part of RGF and RGG, see Wahtigup series.	( <sup>1</sup> )	( <sup>2</sup> )	0-75	Silt loam.....	ML to CL	A-4
*Ricrest: RHF, RHG, RIG, RLF, RLK. For Wahtigup part of RLF and RLK, see Wahtigup series.	4-5	( <sup>2</sup> )	0-9	Stony loam.....	ML	A-4
			9-23	Clay loam.....	CL	A-6
			23-60	Gravelly loam.....	SM or GM	A-2 or A-4
Riverwash: Rv.....	( <sup>1</sup> )	( <sup>10</sup> )	0-60	Stratified gravel and sand.....	GW or GP	A-1
*Robin: RNF, RNG, RoB, RoD, RoE, RPF, RPG, RSF, RSG. For Gilispie part of RPF and RPG, see Gilispie series. For Swanner part of RSF and RSG, see Swanner series.	( <sup>1</sup> )	( <sup>2</sup> )	0-72	Silt loam.....	ML to CL	A-4 or A-6
Sasser: SaA, SaB, SaC.....	( <sup>1</sup> )	( <sup>2</sup> )	0-38	Fine sandy loam.....	SM or SC	A-4
			38-50	Very gravelly coarse sand.....	GW or GP	A-1
*Sessions: SeD, SeE, SMF, SNF, SNF2. For Nielsen part of SNF and SNF2, see Nielsen series.	( <sup>1</sup> )	( <sup>2</sup> )	0-10	Silt loam.....	ML to CL	A-4
			10-71	Silty clay and silty clay loam.....	CH	A-7
*Sheege: SOF, SOG, SPF, SRF, SRG. For Pavohroo part of SPF, see Pavohroo series; for Robin part of SRF and SRG, see Robin series.	1-2	( <sup>2</sup> )	0-17 17	Extremely stony loam..... Limestone.	SM or GM	A-4
Spaa: SS.....	1-2	( <sup>2</sup> )	0-18 18	Loam..... Travertine.	ML or CL	A-4
Stan: StA, StB.....	( <sup>1</sup> )	( <sup>2</sup> )	0-50	Fine sandy loam.....	SM or ML	A-4
			50-60	Very gravelly sandy loam.....	GW-GM or GM	A-1
Swanner: SWF, SWG.....	1-2	( <sup>2</sup> )	0-18 18	Extremely stony loam..... Rhyolite.	ML or SM	A-4

See footnotes at end of table.

significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						Uncoated steel	Concrete
100	100	95-100	75-90	<i>In. per hr.</i> 0.63-2.0	<i>In per in. of soil</i> 0.19-0.21	<i>pH</i> 7.4-8.4	None to slight.	Low-----	Moderate to high.	Low.
100	100	95-100	85-95	0.63-2.0	0.19-0.21	7.4-8.4	None to slight.	Low-----	Very high.	Low.
100	100	50-75	15-30	6.3-20.0	0.06-0.08	7.4-8.4	None to slight.	Low-----	Low-----	Low.
100	100	90-100	75-90	0.63-2.0	0.19-0.21	7.9-8.4	-----	Low.	-----	-----
100	100	95-100	90-100	0.63-2.0	0.19-0.21	6.6-8.4	None-----	Low-----	Moderate.	Low.
<sup>3</sup> 85-95	80-95	70-90	50-70	0.63-2.0	0.16-0.18	7.4-7.8	None-----	Low-----	Moderate.	Low.
80-95	80-90	75-85	60-70	0.63-2.0	0.14-0.16	7.4-8.4	None-----	Moderate.	-----	-----
50-70	45-65	40-60	30-50	6.3-2.0	0.12-0.14	7.9-8.4	None-----	Low.	-----	-----
40-50	30-50	15-40	0-5	>20.0	0.03-0.05	7.4-8.4	None-----	Very low---	Low-----	Low.
100	100	95-100	90-100	0.63-2.0	0.19-0.21	6.1-7.3	None-----	Low-----	Moderate.	Low.
95-100	75-95	55-75	35-45	2.0-6.3	0.11-0.13	7.4-8.4	None to slight.	Low-----	Low-----	Low.
30-50	30-50	20-40	0-5	>20.0	0.04-0.06	7.9-8.4	None-----	Very low.	-----	-----
100	100	95-100	75-90	0.63-2.0	0.19-0.21	5.6-6.5	None-----	Low-----	Moderate.	Low.
100	100	95-100	85-95	0.06-0.2	0.15-0.17	5.6-8.4	None-----	High.	-----	-----
<sup>3</sup> 60-80	50-75	45-65	35-50	0.63-2.0	0.12-0.14	7.4-8.4	None-----	Low-----	Moderate.	Low.
<sup>3</sup> 80-90	90-90	65-85	50-70	0.63-2.0	0.16-0.18	7.9-8.4	None-----	Low-----	Moderate.	Moderate.
100	100	70-85	40-55	2.0-6.3	0.13-0.15	7.4-7.8	None-----	Low-----	Low-----	Low.
30-50	20-40	10-25	5-15	6.3-20.0	0.07-0.09	7.4-7.8	None-----	Very low.	-----	-----
<sup>3</sup> 60-80	70-90	50-75	35-60	0.63-2.0	0.09-0.11	6.6-7.8	None-----	Low-----	Moderate.	-----



TABLE 6.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface in typical profile	Classification		
	Bed-rock	Seasonal water table		USDA texture	Uniform	AASHO
Tenno: TdB, TdC, TED.....	<i>Ft.</i> 1-2	<i>Ft.</i> ( <sup>2</sup> )	<i>In.</i> 0-17 17-20	Stony loam..... Basalt.	ML	A-4
*Tetonia: TNF, TNG, TOF, TOG... For Gilispie part of TOF and TOG, see Gilispie series.	( <sup>1</sup> )	( <sup>1</sup> )	0-70	Silt loam.....	ML to CL	A-4
Thornock: ThB, ThC, TTD.....	1-2	( <sup>2</sup> )	0-15 15	Stony loam..... Basalt.	ML or SM	A-4
Turnerville: TUF.....	( <sup>1</sup> )	( <sup>2</sup> )	0-23	Silt loam.....	ML to CL	A-4
			23-72	Silty clay loam.....	CL	A-6 or A-7
Wahtigup: WHF, WHG.....	( <sup>1</sup> )	( <sup>2</sup> )	0-45	Stony gravelly loam.....	GM or SM	A-4
			45-60	Gravel.....	GP	A-1
Wapello: WaA, WaB.....	( <sup>1</sup> )	( <sup>2</sup> )	0-29	Fine sandy loam.....	SM	A-4
			29-70	Silt loam.....	ML to CL	A-4
Wardboro: Wb.....	( <sup>1</sup> )	( <sup>2</sup> )	0-11 11-60	Sandy loam..... Very gravelly coarse sand.....	SM GW or GP	A-2 or A-4 A-1
Waycup: WcD.....	4-5	( <sup>2</sup> )	0-50 50	Extremely stony loam..... Basalt.	ML or GM	A-4
Weeding: We.....	( <sup>1</sup> )	2-4	0-45 45-60	Loamy sand..... Sand.....	SM SP-SM or SM	A-2 A-2
Wolverine: WOF.....	( <sup>1</sup> )	( <sup>2</sup> )	0-60	Sand.....	SP-SM or SM	A-2

<sup>1</sup> Bedrock is not present within the depth of observation, which is normally 5 feet unless specified.

<sup>2</sup> Water table is not present within the depth of observation. Normally the depth is 5 feet, unless bedrock is nearer the surface.

<sup>3</sup> Coarse fragments larger than 3 inches in diameter were discarded.

<sup>4</sup> In unit Bd, depth to seasonal high water table is 4 to 6 feet.

<sup>5</sup> In unit Bk, permeability of the surface layer ranges from 0.20 to 0.63 inches per hour.

significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						Uncoated steel	Concrete
<sup>2</sup> 95-100	95-100	80-95	<i>In. per hr.</i> 55-75	<i>In per in. of soil.</i> 0. 63-2. 0	0. 12-0. 14	<i>pH</i> 7. 4-9. 0	None to slight.	Low-----	Moderate to high.	Low.
100	100	95-100	75-90	0. 63-2. 0	0. 19-0. 21	6. 6-8. 4	None-----	Low-----	Moderate.	Low.
<sup>3</sup> 75-85	75-85	65-75	45-60	0. 63-2. 0	0. 14-0. 16	6. 6-8. 4	None-----	Low-----	Moderate.	Low.
100	100	95-100	75-90	0. 63-2. 0	0. 19-0. 21	5. 6-6. 5	None-----	Moderate---	Moderate.	Low.
100	100	95-100	85-95	0. 2-0. 63	0. 19-0. 21	5. 6-6. 5	None-----	Moderate.		
<sup>4</sup> 65-85	50-75	45-65	35-50	0. 63-2. 0	0. 12-0. 14	7. 4-8. 4	None-----	Moderate---	Moderate.	Low.
0-20	0-15	0-10	0-5	>20. 0	0. 02-0. 04	-----	-----	Very low.		
100	100	90-100	35-45	2. 0-6. 3	0. 13-0. 15	7. 4-8. 4	None-----	Low-----	Moderate.	Low.
100	100	90-100	80-90	0. 63-2. 0	0. 19-0. 21	7. 9-8. 4	None-----	Low.		
85-95	85-95	50-65	25-40	2. 0-6. 3	0. 10-0. 12	7. 4-8. 4	None-----	Very low---	Low-----	Low.
10-50	10-50	5-30	0-5	>20. 0	0. 04-0. 06	-----	None-----	Very low.		
<sup>5</sup> 60-85	60-85	50-70	35-50	0. 63-2. 0	0. 09-0. 11	7. 9-9. 0	None-----	Low-----	Moderate.	Moderate.
100	100	50-75	15-30	6. 3-20. 0	0. 06-0. 08	7. 4-7. 8	None to slight.	Very low---	Low-----	Low.
100	100	50-70	5-15	6. 3-20. 0	0. 06-0. 08	7. 4-7. 8	Very low.			
100	100	50-70	5-15	>20. 0	0. 06-0. 08	7. 4-8. 4	None-----	Very low---	Low-----	Low.

<sup>6</sup> In unit Bf, salinity is slight in the surface layer.<sup>7</sup> Drained phase has a water table at a depth below 4 feet.<sup>8</sup> Drained phase has a water table at a depth of 2 to 4 feet.<sup>9</sup> In unit Ld, seasonal high water table is at a depth of more than 3 feet.<sup>10</sup> Depth to water table varies with river level.



TABLE 7.—*Engineering*

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

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Alpon: ALF, ALG.	Good to a depth of 40 inches.	Not suitable: excessive fines.	Poor: moderate shrink-swell potential; A-4, A-7, or A-6 material.	Moderately plastic silts and clays; high susceptibility to frost heaving; hilly and steep.	More than 60 inches of moderately slowly permeable soil over sandstone; hilly and steep.
Ammon: AmA, AmB.	Good-----	Not suitable: excessive fines.	Fair: low shrink-swell potential; A-4 material.	Deep; slightly to moderately plastic silts and clays; high susceptibility to frost heaving.	More than 60 inches of moderately permeable soil.
Araveton: AVF, AVG, ArD.	Poor: extremely stony.	Not suitable: excessive fines.	Not suitable: extremely stony.	Many stones; steep.	More than 40 inches of moderately permeable, extremely stony loam; steep slopes highly limiting.
Bannock: BaA, BaB, BaC.	Fair to a depth of 20 to 40 inches, gravelly; poor at a depth below 40 inches, very gravelly.	Good: gravel and sand at a depth below 20 to 40 inches.	Fair to a depth of 20 to 40 inches: low shrink-swell potential; A-4 material. Good at a depth below 40 inches: A-1 material.	Low-plasticity silts over gravel at a depth of 20 to 40 inches; moderate susceptibility to frost heaving.	About 20 to 40 inches of moderately permeable soil over very rapidly permeable sand and gravel.
Blackfoot: Bc, Bf, Bk-----	Good in Bc and Bk; fair in Bf because of salt content.	Not suitable: excessive fines.	Poor: moderately plastic; wet; A-6 or A-4 material.	Deep; moderately plastic silts; seasonal high water table at a depth of 2 to 4 feet; high susceptibility to frost heaving.	More than 60 inches of moderately permeable soil; water table at a depth of 2 to 4 feet.
Bd-----	Good-----	Not suitable: excessive fines.	Poor: moderately plastic; A-6 or A-4 material; water table at a depth below 4 feet.	Deep; moderately plastic silts; seasonal high water table at a depth below 4 feet; high susceptibility to frost heaving.	More than 60 inches of moderately permeable soil; water table at a depth below 4 feet.

See footnote at end of table.

*interpretations*

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for in the first column of this table]

Soil features affecting—Continued						Limitations to use as filter fields for septic tanks
Farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings <sup>1</sup>	
Fair to poor shear strength; subject to piping.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength.	Severe: hilly and steep.
Fair to poor shear strength; subject to piping.	Not applicable--	High available water capacity; moderate intake rate.	Not needed, because of topography.	High available water capacity; supplemental water may be needed to establish vegetation; moderately erodible on steeper slopes.	Fair to poor bearing capacity and shear strength.	Moderate: moderate permeability.
Extremely stony and limited volume; subject to piping.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Stones difficult to excavate; fair to poor bearing capacity and shear strength; rock at a depth below 60 inches.	Severe: extremely stony; steep.
Fair to poor shear strength; subject to piping at a depth above 20 to 40 inches; high shear strength at a depth below 20 to 40 inches.	Not applicable--	Moderate available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength at a depth above 20 to 40 inches; good to excellent at a depth below 20 to 40 inches.	Slight: moderate permeability at a depth above 20 to 40 inches; very rapid permeability at a depth below 20 to 40 inches; may contaminate water table.
Fair to poor shear strength; subject to piping; drainage needed.	Some drainage needed; slow runoff; moderate permeability.	High available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength; seasonal high water table at a depth of 2 to 4 feet.	Severe: water table at a depth of 2 to 4 feet.
Low to medium shear strength; subject to piping.	Water table at a depth below 4 feet.	High available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength; water table at a depth below 4 feet.	Moderate: moderate permeability; water table at a depth of 4 to 6 feet.



TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Bock: Bo A, Bo B..	Good to a depth of 47 inches; poor at a depth below 47 inches, very gravelly.	Good: gravel and sand at a depth below 40 inches.	Fair: A-4 material. Good at a depth below 20 to 40 inches; A-1 material.	Deep; low-plasticity silts over gravel; moderate susceptibility to frost heaving.	More than 40 inches of moderately permeable soil over gravel.
Bondbranch: BRB..	Poor: shallow to bedrock.	Not suitable: excessive fines.	Poor: A-2 or A-4 material; shallow to bedrock.	Shallow; silty sands over basalt at a depth of less than 20 inches.	Less than 20 inches of moderately permeable soil over basalt bedrock; seams and joints in places.
Declo: Dc A, Dc B, Dc C, De A, De B, De C, De D, De E2.	Good in Dc A, Dc B, Dc C, De A, De B, and De C; fair in De D, slope is more than 8 percent; poor in De E2, slope is more than 15 percent.	Not suitable: excessive fines.	Fair to poor: low shrink-swell potential; moderately plastic at a depth below 25 inches; A-4 material.	Deep; moderately plastic silts; seasonal high water table at a depth below 4 feet; high susceptibility to frost heaving.	Good: more than 40 inches of moderately permeable soil.
*Drayton: DRF, DRG, DSF. For Gilispie part of DSF, see Gilispie series.	Good to a depth of 20 inches.	Not suitable: excessive fines.	Fair to poor: moderately plastic at a depth below 20 inches; A-4 and A-6 material.	Deep; moderately plastic silts; steep; high susceptibility to frost heaving.	More than 40 inches of moderately to moderately slowly permeable soil over sandstone and quartzite.
Enochville: En----	Good to a depth of 7 inches; poor in lower part, shallow to water table.	Poor: clayey gravel at a depth below 40 inches; shallow to water table; excessive fines.	Poor: moderately plastic at a depth below 7 inches; wet; A-7 or A-6 material.	Deep; moderately plastic silts; seasonal high water table at a depth of 2 feet; high susceptibility to frost heaving.	More than 40 inches of moderately slowly permeable soil over gravel; less than 2 feet to water table.
Fingal: Fg A, Fg B, FIA, FIB, FmA, FnA.	Poor: high clay content; shallow to water table.	Not suitable: excessive fines.	Poor: moderately plastic at a depth below 8 inches; wet; A-6 or A-7 material.	Deep; moderately plastic silts and clays; seasonal high water table at a depth of 2 to 4 feet; high susceptibility to frost heaving.	More than 60 inches of slowly permeable soil; less than 4 feet to water table.
Firth: Fr-----	Poor: water table at a depth of 2 to 4 feet.	Not suitable: excessive fines; water table at a depth of 2 to 4 feet.	Fair to poor: shallow to water table.	Deep; low-plasticity silts; seasonal high water table at a depth of 2 to 4 feet; moderate susceptibility to frost heaving.	More than 60 inches of moderately permeable soil; less than 4 feet to water table.

See footnote at end of table.

## interpretations—Continued

Soil features affecting—Continued						Limitations to use as filter fields for septic tanks
Farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings <sup>1</sup>	
Fair to poor shear strength; subject to piping; high shear strength at a depth below 40 inches.	Not applicable--	High available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength at a depth above 40 inches; gravel at a depth below 40 inches.	Slight: moderate permeability to a depth of 40 inches; very rapid permeability at a depth below 40 inches; may contaminate water table.
Moderately rapid permeability; limited soil depth; subject to piping.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Shallow to basalt; good bearing capacity on rock; difficult to excavate.	Severe: shallow to bedrock.
Fair to poor shear strength; subject to piping.	Not applicable--	High available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength.	Moderate: moderate permeability.
Fair to poor shear strength at a depth below 20 inches.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength; sandstone or quartzite at a depth below 40 inches.	Slope limitations: slight on slopes of 0 to 4 percent; moderate on slopes of 4 to 8 percent; severe on slopes of more than 8 percent.
Good shear strength at a depth below 7 to 53 inches; drainage needed.	Needs drainage; slow runoff; moderately slow permeability.	Not applicable--	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength; seasonal high water table at a depth of 1 to 2 feet.	Severe: water table at a depth of 1 to 2 feet.
Fair to poor shear strength; drainage needed.	Needs some drainage; slow permeability; slow runoff.	High available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength; seasonal high water table at a depth of 2 to 4 feet.	Severe: water table at a depth of 2 to 4 feet.
Moderate permeability; drainage needed.	Needs some drainage; slow to medium runoff; moderate permeability.	Moderate available water capacity; moderate intake rate; moderate permeability; seasonal high water table.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength; seasonal high water table at a depth of 2 to 4 feet.	Severe: water table at a depth of 2 to 4 feet.



TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Firth—Continued Fs-----	Fair: water table at a depth below 4 feet.	Not suitable: excessive fines; water table at a depth below 4 feet.	Fair: A-4 or A-2 material; water table at a depth below 4 feet.	Deep; low-plasticity silts; water table at a depth below 4 feet.	Moderately rapid permeability to a depth of 40 inches or more.
Fulmer: Fu-----	Poor: water table at a depth below 2 feet.	Not suitable: excessive fines.	Fair to poor: low to moderate shrink-swell potential; shallow to water table; A-4 or A-6 material.	Deep; low to moderately plastic silts and clays; seasonal high water table at a depth of 1 to 2 feet; high susceptibility to frost heaving.	More than 60 inches of moderately permeable soil; less than 2 feet to water table.
Fv-----	Poor: water table at a depth of 2 to 4 feet.	Not suitable: shallow to bedrock.	Fair to poor: moderate to high shrink-swell potential; water table at a depth of 2 to 4 feet; A-4 or A-6 material.	Deep; low to moderately plastic silts and clays; seasonal high water table at a depth of 2 to 4 feet.	More than 60 inches of moderately permeable soil; 2 to 4 feet to water table.
Gillispie: GLF, GMF.	Not suitable: extremely stony.	Not suitable: shallow to bedrock.	Poor: shallow; stony; A-4 or A-6 material.	Slopes of 0 to 60 percent; shallow; extremely stony over basalt.	Less than 20 inches of moderately permeable soil over basalt; seams and joints in basalt in places.
Hayeston: HaA, HaB, HeA.	Fair: sandy loam at a depth above 20 to 40 inches.	Good: gravel at a depth below 20 to 40 inches.	Good: A-2 or A-4 material to a depth of 30 inches; A-1 material at a depth below 30 inches.	Moderately deep; low-plasticity sands over gravel; moderate susceptibility to frost heaving.	Less than 40 inches of moderately permeable to moderately rapidly permeable soil over gravel.
Heiseton: HsA, HsB, HtA.	Fair: sandy loam---	Good: gravel at a depth below 40 inches.	Good: A-2 or A-4 material to a depth of 45 inches; A-1 material at a depth below 45 inches.	Deep; low plasticity; gravel at a depth below 40 inches.	More than 40 inches of moderately permeable to moderately rapidly permeable soil over gravel.
Hymas: HYF, HYG.	Poor: gravelly; shallow to bedrock.	Not suitable: shallow to bedrock.	Poor: shallow to bedrock.	Shallow; low-plasticity silts over limestone; moderate susceptibility to frost heaving.	Less than 20 inches of moderately permeable soil over limestone bedrock; seams and joints in places; subject to dissolving.

See footnote at end of table.

## interpretations—Continued

Soil features affecting—Continued						Limitations to use as filter fields for septic tanks
Farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings <sup>1</sup>	
Moderate permeability.	Water table at a depth below 4 feet.	Moderate available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength.	Moderate: water table at a depth below 2 feet.
Fair to good shear strength; drainage needed.	Needs drainage; slow runoff; moderate permeability in upper layers; moderate to slow permeability below.	High available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength; seasonal high water table.	Severe: water table at a depth of 1 to 2 feet.
Fair to poor shear strength; drainage needed.	Needs drainage; moderate permeability.	High available water capacity; moderate intake rate; water table.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength; water table.	Severe: water table at a depth of 2 to 4 feet.
Extremely stony and rocky; limited volume.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Fair to good bearing capacity and shear strength at a depth above 10 to 20 inches; basalt at a depth below 10 to 20 inches; difficult to excavate.	Severe: shallow to bedrock.
Moderate to moderately rapid permeability; can be used in filter transition zone.	Not applicable--	Moderate available water capacity; moderately rapid intake rate.	Not applicable--	Not applicable--	Good to fair bearing capacity and shear strength at a depth above 20 to 40 inches; gravel at a depth below 20 to 40 inches.	Slight.
Moderate to moderately rapid permeability; can be used in filter transition zone.	Needs some drainage; slow to medium runoff; moderate to moderately rapid permeability.	Moderate available water capacity; moderately rapid intake rate.	Not applicable--	Not applicable--	Good to fair bearing capacity and shear strength at a depth above 40 inches; good in underlying gravel.	Slight.
Fair shear strength; subject to piping.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Shallow to bedrock; good bearing capacity and shear strength at a depth below 20 inches; difficult to excavate; limestone at a depth below 20 inches.	Severe: slopes; shallow to bedrock.



TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Kimama: Km-----	Good-----	Not suitable: excessive fines.	Fair: A-4 material.	Deep; moderately plastic silts; high susceptibility to frost heaving.	More than 60 inches of moderately slowly permeable soil.
Knull----- Mapped only with Portino series.	Fair: 5 inches of silt loam underlain by clay loam.	Not suitable: excessive fines.	Poor to fair: moderate to low shrink-swell potential.	Deep; moderately to highly plastic; high susceptibility to frost heaving.	More than 40 inches of moderately to moderately slowly permeable soils.
LaJara: La, Ld---	Poor: shallow to water table.	Poor for sand to a depth of about 38 inches; not suitable at a depth below 38 inches; not suitable for gravel.	Poor: high organic-matter content; high water table; A-2 or A-4 material.	Seasonal high water table at a depth of 1 to 2 feet.	About 10 to 60 inches of moderately permeable soil over silt loam; water table at a depth of less than 2 feet.
*Lanark: LkB, LkD, LkE, LNF, LRF. For Robin part of LRF, see Robin series.	Good to a depth of 28 inches; fair at a depth below 28 inches, silty clay loam.	Not suitable: excessive fines.	Fair: low to moderate shrink-swell potential; A-4 and A-6 material.	Deep; moderately plastic silts; slopes of 0 to 30 percent; high susceptibility to frost heaving.	More than 60 inches of moderately permeable soil.
Malm: MaA, MaB.	Fair: and fine sandy loam; bedrock at a depth of 20 to 40 inches.	Poor sand; excessive fines; not suitable for gravel.	Fair: A-4 material.	Moderately deep; low-plasticity silty sands over basalt; low susceptibility to frost heaving.	About 20 to 40 inches of moderately rapidly permeable soil over basalt; seams and joints in places.
*Matheson: MnA, MnB, MnC, MBC. For Bondbranch part of MBC, see Bondbranch series.	Fair: fine sandy loam; bedrock at a depth below 40 inches.	Not suitable: excessive fines.	Fair: A-4 material.	Deep; low plasticity; low susceptibility to frost heaving.	More than 40 inches of moderately rapidly permeable soil over basalt; seams and joints in places.
Mike: MoF-----	Poor: extremely stony; shallow to bedrock.	Not suitable: excessive fines; shallow to bedrock.	Poor: shallow; A-4 material.	Shallow; extremely stony over basalt.	Less than 20 inches of moderately permeable, stony soil over basalt; seams and joints in places.

See footnote at end of table.

*interpretations—Continued*

Soil features affecting—Continued						Limitations to use as filter fields for septic tanks
Farm ponds—Con.	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings <sup>1</sup>	
Embankment						
Fair shear strength; subject to piping.	Not applicable--	High available water capacity; moderate to moderately slow intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength.	Moderate: moderate permeability.
Fair to poor shear strength; subject to piping.	Not applicable--	High available water capacity; slow intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength; bedrock at a depth below 40 to 60 inches.	Severe: slow permeability.
Upper part of soil moderately rapidly permeable; drainage needed.	Drainage needed; moderately permeable soil, but drainage is slow because of high water table.	High available water capacity; moderate intake rate; poorly drained.	Not applicable--	Not applicable--	Shallow to water table.	Severe: water table at a depth of 1 to 2 feet.
Fair shear strength; subject to piping.	Not applicable--	Not applicable--	Soil material favorable; no limitations; steeper slopes necessitate careful selection of outlets.	High available water capacity; moderately erodible soils on steep slopes.	Fair to poor bearing capacity and shear strength.	Moderate: moderate permeability. Severe: slopes of more than 8 percent.
Fair shear strength; subject to piping.	Not applicable--	Moderately low available water capacity; moderately rapid intake rate.	Not applicable--	Not applicable--	Fair to good bearing capacity and shear strength at a depth above 20 to 40 inches; basalt at a depth below 20 to 40 inches.	Severe: moderately deep to bedrock.
Fair shear strength; subject to piping.	Not applicable--	Moderately low available water capacity; moderately rapid intake rate.	Not applicable--	Not applicable--	Good to fair bearing capacity and shear strength at a depth above 40 inches; basalt bedrock at a depth below 40 inches.	Slight: 0 to 4 percent slopes. Moderate: 4 to 8 percent slopes.
Extremely stony soil; limited volume.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Shallow; good bearing capacity and shear strength at a depth below 20 inches; difficult to excavate.	Severe: shallow to bedrock.



TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Newdale: NdB, NdD, NdE, NEF, NEG.	Good to a depth of 20 inches; fair at a depth below 20 inches.	Not suitable: excessive fines.	Fair: A-4 material.	Deep; low-plasticity silts; slopes of 2 to 60 percent; high susceptibility to frost heaving.	More than 40 inches of moderately permeable soil.
Nielsen: NLF, NLG.	Poor: extremely stony; shallow to rock.	Not suitable: excessive fines; shallow to bedrock.	Poor: stony; shallow; A-4 material.	Slopes of 0 to 60 percent; shallow; extremely stony over sandstone.	Less than 20 inches of moderately to moderately slowly permeable, stony soil over sandstone.
Outlet: Ot-----	Fair: high clay content; water table.	Not suitable: excessive fines.	Poor: plastic; wet; A-6 and A-7 material to a depth of 46 inches; moderate shrink-swell potential.	Moderately plastic silts and clays; seasonal high water table at a depth of 2 to 4 feet; moderate susceptibility to frost heaving.	More than 40 inches of moderately to slowly permeable soil; less than 40 inches to water table.
Outlet, noncalcareous variant: Ou.	Good to a depth of 20 to 40 inches; poor at a depth below 20 to 40 inches, very gravelly.	Good to a depth of 20 to 40 inches.	Fair to a depth of 20 to 40 inches; good at a depth below 20 to 40 inches; seasonal high water table at a depth of 2 to 4 feet.	Seasonal high water table at a depth of 2 to 4 feet; high susceptibility to frost heaving.	About 20 to 40 inches of moderately slowly permeable soil underlain by sand and gravel.
Packham: PaA, PaB.	Poor: very gravelly.	Good: gravel and sand at a depth below 20 to 35 inches.	Good: A-1 material.	Shallow; moderately plastic silty gravel; moderate susceptibility to frost heaving; gravel at a depth below 20 inches.	Less than 20 inches of moderately permeable soil over gravel.
Paesl: Pd, Pe-----	Good to a depth of 27 inches; poor at a depth below 27 inches.	Good: gravel and sand at a depth below 20 to 40 inches.	Fair to a depth of 27 inches: moderate shrink-swell potential; A-6 material. Good at a depth below 27 inches: A-1 material.	Moderately deep; moderately plastic silts and clays; high susceptibility to frost heaving at a depth above 20 inches.	Less than 40 inches of moderately permeable soil over gravel.
Pancheri: PhA, PhB, PhC, PhD.	Good to a depth of 13 inches; fair at a depth below 13 inches.	Not suitable: excessive fines.	Fair: low shrink-swell potential; A-4 material.	Deep; moderately plastic silts and clays; high susceptibility to frost heaving.	More than 40 inches of moderately permeable soil over basalt.

See footnote at end of table.

*interpretations—Continued*

Soil features affecting—Continued						Limitations to use as filter fields for septic tanks
Farm ponds—Con.	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings <sup>1</sup>	
Embankment						
Fair shear strength; subject to piping.	Not applicable..	High available water capacity; moderate intake rate; steeper slopes not suitable for irrigation.	Soil favorable; no limitations; steep slopes necessitate careful selection of outlets.	High available water capacity; moderately erodible soils on steep slopes.	Fair to poor bearing capacity and shear strength.	Moderate: moderate permeability. Severe: slopes of more than 8 percent.
Extremely stony material; limited volume.	Not applicable..	Not applicable..	Not applicable..	Not applicable..	Shallow to sandstone; poor to fair bearing capacity and shear strength at a depth above 10 to 20 inches; difficult to excavate.	Severe: shallow to bedrock.
Fair shear strength; drainage needed.	Slow runoff; moderately slow permeability.	Not applicable..	Not applicable..	Not applicable..	Fair to poor shear strength and bearing capacity; seasonal high water table.	Severe: water table at a depth of 1½ to 3½ feet.
Low permeability; medium compressibility; good to fair resistance to piping.	Needs drainage; moderately slow permeability.	Not applicable..	Not applicable..	Not applicable..	Fair to poor shear strength and bearing capacity; water table.	Severe: water table at a depth of 2 to 4 feet.
High shear strength; can be used in outer zone.	Not applicable..	Low available water capacity; moderate intake rate; shallow to gravel; gravelly.	Not applicable..	Not applicable..	Shallow to gravel; good bearing capacity and shear strength at a depth below 20 inches.	Slight.
Moderate to good strength and stability; gravel is good outside zone.	Not applicable..	Moderate available water capacity; moderate intake rate.	Not applicable..	Not applicable..	Fair to poor bearing capacity and shear strength at a depth of 20 to 40 inches; good in underlying gravel.	Slight or no limitations.
Fair to good strength and stability; subject to piping.	Not applicable..	High available water capacity; moderate intake rate.	Not applicable..	Not applicable..	Fair to poor bearing capacity and shear strength.	Moderate: moderate permeability. Severe: slopes of more than 8 percent.



TABLE 7.—Engineering

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Paniogue: PnA---	Good to a depth of 19 inches; fair at a depth of 19 to 31 inches; poor at a depth below 31 inches.	Fair for sand; fair for gravel after screening; SW-SM or SP-SM material at a depth below 30 to 50 inches.	Fair: A-4 and A-2 material.	Moderately deep; low-plasticity silts over well-drained gravelly sand; moderate susceptibility to frost heaving.	About 20 to 40 inches of moderately permeable soil over sand and gravel.
Pavohroo: PBF, PBG.	Good to a depth of 17 inches; poor at a depth below 17 inches, gravelly and clayey.	Not suitable: excessive fines.	Fair to poor at depth of 17 to 44 inches; moderately plastic; A-4 or A-6 material.	Slopes of 0 to 60 percent; deep; low-plasticity silts over limestone; moderate susceptibility to frost heaving.	More than 40 inches of moderately to moderately slowly permeable soil over limestone; seams and joints in places; subject to dissolving.
*Polatis: PoA, PoB, PoC, PrA, PrB, PrC, PCD. For Tenno part of PCD, see Tenno series.	Good to a depth of 7 inches; fair at a depth of 7 to 20 inches, bedrock at a depth of 20 to 40 inches.	Not suitable: excessive fines.	Fair: low shrink-swell potential; A-4 material.	Moderately deep; moderately plastic silts and clays over basalt; high susceptibility to frost heaving.	Less than 40 inches of moderately permeable soil over basalt; seams and joints in places.
*Portino: PsA, PsB, PsC, PtA, PtB, PtC, PtD, PuA, PuB, PFD. For Knull part of PuA and PuB, see Knull series. For Thornock part of PFD, see Thornock series.	Good to a depth of 10 inches; fair at a depth of 10 to 20 inches, bedrock at a depth of 20 to 40 inches.	Not suitable: excessive fines.	Fair: low shrink-swell potential; A-4 material.	Moderately deep; moderately plastic silts and clays over basalt; high susceptibility to frost heaving.	Less than 40 inches of moderately permeable soil over basalt; seams and joints in places.
Portneuf: PvA, PvB, PvC, PvD.	Fair: firm when moist at a depth below 14 inches.	Not suitable: excessive fines.	Fair: low shrink-swell potential; A-4 material.	Deep; low plasticity; moderate susceptibility to frost heaving.	More than 40 inches of moderately permeable soil over basalt; seams and joints in places.
Presto: Pw-----	Poor: loamy sand--	Poor for sand; not suitable for gravel; SM material to a depth of 28 inches; ML or CL material at a depth below 28 inches.	Good to fair: A-2 material to a depth of 28 inches; low shrink-swell potential; A-4 material at a depth below 28 inches.	Low-plasticity silty sands; low susceptibility to frost heaving to a depth of 28 inches.	About 28 inches of moderately rapidly permeable soil over silty lake sediments.
*Rexburg: ReD, ReE, RGF, RGG. For Wahtigup part of RGF and RGG, see Wahtigup series.	Good-----	Not suitable: excessive fines.	Fair: low shrink-swell potential; A-4 material.	Deep; low-plasticity silts; moderate to high susceptibility to frost heaving.	More than 40 inches of moderately permeable soil over basalt; seams and joints in places.

See footnote at end of table.

## interpretations—Continued

Soil features affecting—Continued						Limitations to use as filter fields for septic tanks
Farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings <sup>1</sup>	
Fair to poor strength and stability; subject to piping.	Not applicable--	Moderate available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength at a depth above 20 to 40 inches; sand and gravel at a depth below 20 to 40 inches.	Moderate: moderate permeability.
Fair to good strength and stability; subject to piping.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength.	Moderate: moderate permeability; 0 to 8 percent slopes. Severe: slopes of more than 8 percent.
Fair to good strength and stability; subject to piping.	Not applicable--	Moderate available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength; basalt at a depth below 20 to 40 inches.	Severe: moderately deep to bedrock.
Fair to good strength and stability; subject to piping.	Not applicable--	Moderate available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength; basalt at a depth below 20 to 40 inches.	Severe: moderately deep to bedrock.
Fair to good strength and stability; subject to piping.	Not applicable--	High available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength.	Moderate: moderate permeability. Severe: slopes of more than 8 percent.
Soil material permeable; good for filter transition zones.	Not applicable--	Moderate available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair bearing capacity and shear strength at a depth above 30 inches; fair to poor bearing capacity and shear strength at a depth below 30 inches.	Moderate: moderate permeability.
Fair to good strength and stability; subject to piping.	Not applicable--	Not applicable--	Soil favorable; no limitations; steeper slopes necessitate careful selection of outlets.	High available water capacity; moderately erodible soils on steeper slopes.	Fair to poor bearing capacity and shear strength.	Moderate: moderate permeability.



TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
<b>*Ricrest:</b> RHF, RHG, RIG, RLF, RLG. For Wahtigup part of RLF and RLG, see Wahtigup series.	Not suitable: stony.	Not suitable: sand; excessive fines; GM material at a depth below 23 inches.	Fair to poor: stony; moderate to low shrink-swell potential; moderate plasticity; A-4, A-6, and A-2 materials.	Deep; moderate- to low-plasticity silts and clays; moderate susceptibility to frost heaving.	More than 40 inches of moderately permeable, stony soil over limestone; seams and joints in places; subject to dissolving.
<b>Riverwash:</b> Rv----	Not suitable: sand and gravel.	Good: gravel and sand.	Good: A-1 material; water table varies with river level.	Water table varies with river level; low susceptibility to frost heaving.	Rapidly to very rapidly permeable sand and gravel.
<b>*Robin:</b> RNF, RNG, RoB, RoD, RoE, RPF, RPG, RSF, RSG. For Gilispie part of RPF and RPG, see Gilispie series. For Swanner part of RSF and RSG, see Swanner series.	Good-----	Not suitable: excessive fines.	Fair: low to moderate plasticity; A-4 or A-6 material.	Deep; low- to moderate-plasticity silts; moderate susceptibility to frost heaving.	More than 60 inches of moderately permeable soil.
<b>Sasser:</b> SaA, SaB, SaC.	Good-----	Fair: gravel and sand at a depth below 20 to 40 inches.	Fair: A-4 material to a depth of 20 to 40 inches; A-1 material at a depth below 20 to 40 inches.	Moderately deep; low-plasticity silty sands over sand and gravel; low susceptibility to frost heaving.	20 to 40 inches of moderately rapidly permeable soil over gravel.
<b>*Sessions:</b> SeD, SeE, SMF, SNF, SNF2. For Nielsen part of SNF and SNF2, see Nielsen series.	Good to a depth of 10 inches; poor at a depth below 10 inches.	Not suitable: excessive fines.	Poor: highly plastic; A-7 material at a depth below 10 inches; high shrink-swell potential.	Deep; highly plastic clays; slopes of 0 to 30 percent; high susceptibility to frost heaving.	More than 40 inches of moderately to slowly permeable soil.

See footnote at end of table.

## interpretations—Continued

Soil features affecting—Continued						Limitations to use as filter fields for septic tanks
Farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings <sup>1</sup>	
Fair strength and stability.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength at a depth above 40 inches; limestone at a depth below 40 inches.	Severe: slopes of more than 20 percent.
Rapidly to very rapidly permeable; good for outer fill zones and drainage blankets.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Good bearing capacity and shear strength; subject to high water table, which varies with river level.	Slight, if no pollution hazard exists.
Fair to good strength and stability; subject to piping.	Not applicable--	Not applicable--	Steeper slopes necessitate careful selection of outlets; no soil limitations.	High available water capacity; moderately erodible soils on steeper slopes.	Fair to poor bearing capacity and shear strength.	Moderate: moderate permeability. Severe: slopes of more than 8 percent.
Moderately rapidly permeable; good for filter transition zones.	Not applicable--	Moderate available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to good bearing capacity and shear strength at a depth above 20 to 40 inches; gravel at a depth below 20 to 40 inches.	Slight: 0 to 4 percent slopes. Moderate: 4 to 8 percent slopes.
Poor shear strength and stability; subject to cracking.	Not applicable--	Not applicable--	No soil limitations; steeper slopes necessitate careful selection of outlets.	High available water capacity; moderately erodible soils on steep slopes; difficult to establish vegetation in some areas of silty clay.	Poor bearing capacity and shear strength; subject to cracking.	Severe: slow permeability.



TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
*Sheege: SOF, SOG, SPF, SRF, SRG. For Robin part of SRF and SRG, see Robin series. For Pavohroo part of SPF, see Pavohroo series.	Not suitable: shallow and extremely stony.	Not suitable: shallow to bedrock.	Poor: shallow and extremely stony.	Shallow and extremely stony; slopes of 0 to 60 percent.	Less than 20 inches of moderately permeable soil over limestone; seams and joints in places; subject to dissolving; slopes limiting.
Spaa: SS-----	Not suitable; stony and extremely rocky.	Not suitable: excessive fines; shallow to bedrock.	Poor: extremely rocky; shallow.	Shallow; low plasticity; low shrink-swell potential; poor binding material.	About 10 to 20 inches of tufa over cemented travertine deposits.
Stan. StA, StB----	Good to a depth of 50 inches; very gravelly at a depth below 50 inches.	Not suitable for sand; SM or ML material to a depth of 40 to 50 inches; good for gravel.	Fair: A-4 material; good at a depth below 50 inches.	Deep; low-plasticity silty sands over gravel; low susceptibility to frost heaving.	More than 40 inches of moderately rapidly permeable soil over very gravelly sandy loam.
Swanner: SWF, SWG.	Not suitable: extremely stony.	Not suitable: excessive fines; shallow to bedrock.	Poor: shallow and extremely stony.	Shallow; extremely stony over rhyolite; slopes of 0 to 60 percent.	Less than 20 inches of moderately permeable soil over rhyolite.
Tenno: TdB, TdC, TED.	Not suitable: extremely stony.	Not suitable: excessive fines; shallow to bedrock.	Poor: shallow and stony.	Shallow; stony over basalt.	Less than 20 inches of moderately permeable soil over basalt.
*Tetonia: TNF, TNG, TOF, TOG. For Gilispie part of TOF and TOG, see Gilispie series.	Good to a depth of 44 inches; fair at a depth below 44 inches.	Not suitable: excessive fines.	Fair: low shrink-swell potential; A-4 material.	Deep; low-plasticity silts; slopes of 0 to 60 percent; moderate susceptibility to frost heaving.	More than 60 inches of moderately permeable soil; slopes may be limiting.
Thornock: ThB, ThC, TTD.	Not suitable: stony.	Not suitable: excessive fines; shallow to bedrock.	Poor: shallow; stony.	Shallow; extremely stony over basalt.	Less than 20 inches of moderately permeable soil over basalt.

See footnote at end of table.

## interpretations—Continued

Soil features affecting—Continued						Limitations to use as filter fields for septic tanks
Farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings <sup>1</sup>	
Extremely stony soil; limited volume.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Shallow to limestone; fair to poor bearing capacity and shear strength at a depth above 20 inches; difficult to excavate.	Severe: shallow to bedrock.
Suitable for outer zone only.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Shallow and extremely rocky; fair bearing capacity and shear strength.	Severe: shallow to bedrock.
Moderately permeable; subject to piping.	Not applicable--	Moderate available water capacity; moderately rapid intake rate.	Not applicable--	Not applicable--	Fair to good bearing capacity and shear strength at a depth above 40 inches; gravelly sandy loam at a depth below 40 inches.	Slight.
Shallow; moderately permeable; limited volume.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Shallow to rhyolite; fair to poor bearing capacity and shear strength at a depth above 10 to 20 inches; difficult to excavate.	Severe: shallow to bedrock.
Stony soil material; limited volume.	Not applicable--	Low available water capacity; moderate intake rate; soils stony and shallow.	Stony and shallow soils; difficult to excavate.	Shallow and stony soils; difficult to establish sod; difficult to excavate.	Shallow to basalt; fair to good bearing capacity and shear strength at a depth above 10 to 20 inches; difficult to excavate.	Severe: shallow to bedrock.
Fair to good strength and stability; subject to piping.	Not applicable--	Not applicable--	No soil limitations; steeper slopes necessitate careful selection of outlets.	High available water capacity; moderately erodible soils on steeper slopes.	Fair to poor bearing capacity and shear strength.	Moderate: moderate permeability. Severe: slopes of more than 8 percent.
Extremely stony material; limited volume.	Not applicable--	Low available water capacity; moderate intake rate; extremely stony and shallow.	Not applicable--	Not applicable--	Shallow to basalt; fair to poor bearing capacity and shear strength at a depth above 10 to 20 inches; difficult to excavate.	Severe: shallow to bedrock.



TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds
					Reservoir area
Turnerville: TUF--	Good to a depth of 27 inches; fair at a depth below 27 inches.	Not suitable: excessive fines.	Poor: moderately plastic at a depth below 23 inches.	Deep; moderately plastic silts and clays; slopes of 0 to 30 percent; high susceptibility to frost heaving.	More than 60 inches of moderately permeable soil.
Wahtigup: WHF, WHG.	Not suitable: stony.	Not suitable: excessive fines.	Fair: moderate shrink-swell potential; A-4 material; some stones and gravel; A-1 material at a depth below 45 inches.	Slopes of 20 to 60 percent; deep; low-plasticity silty gravel over gravel; moderate susceptibility to frost heaving.	More than 40 inches of moderately permeable soil over gravel and rocks.
Wapello: WaA, WaB.	Good: fine sandy loam to a depth of 29 inches.	Poor: excessive fines.	Fair: low shrink-swell potential; A-4 material.	Deep; low-plasticity silty sands; low susceptibility to frost heaving.	More than 60 inches of moderately permeable soil.
Wardboro: Wb----	Poor: very gravelly coarse sand at a depth below 10 to 20 inches.	Good: sand and gravel at a depth below 10 to 20 inches.	Good: A-2 or A-4 material to a depth of 11 inches; A-1 material at a depth below 11 inches.	Shallow: low-plasticity silty sands over gravel and sand; low susceptibility to frost heaving.	Moderately rapidly permeable to very rapidly permeable soil.
Waycup: WcD----	Poor: extremely stony and rocky.	Not suitable: excessive fines.	Fair: stones and rocks; low shrink-swell potential; A-4 material.	Deep; stony silts and loams; moderately plastic; moderate susceptibility to frost heaving.	More than 40 inches of moderately permeable stony loam.
Weeding: We-----	Poor: loamy sand--	Poor: loamy sand to a depth of 45 inches; good sand at a depth below 40 inches; 5 to 15 percent fines; water table; not suitable for gravel.	Good: A-2 material; shallow to water table.	Deep; low-plasticity silty sands; seasonal high water table at a depth of 2 to 4 feet; low susceptibility to frost heaving.	More than 40 inches of rapidly permeable soil; water table at a depth of less than 4 feet.
Wolverine: WOF--	Poor: sand-----	Fair: sand may be poorly graded; 5 to 15 percent fines; not suitable for gravel.	Good: A-2 material; needs soil binder.	Deep sands; loose sand hinders hauling operations.	More than 60 inches of very rapidly permeable soil.

<sup>1</sup> Engineers and others should not apply specific values to estimates of bearing capacity.

*interpretations—Continued*

Soil features effecting—Continued						Limitations to use as filter fields for septic tanks
Farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings <sup>1</sup>	
Low shear strength and compaction.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Fair to poor bearing capacity and shear strength.	Severe: moderately slow permeability.
Poor to fair: stony soil material; limited volume; high shear strength at a depth below 45 inches; stony.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Good bearing capacity and shear strength; gravel and rock at a depth below 40 inches or more.	Moderate: moderate permeability. Severe: slopes of 8 percent.
Moderately permeable; subject to piping.	Not applicable--	Moderate available water capacity; moderate intake rate.	Not applicable--	Not applicable--	Fair to good bearing capacity and shear strength.	Slight at a depth above 29 inches. Moderate at a depth below 29 inches; permeability.
Moderately rapid to very rapid permeability; can be used in outer zone; high shear strength.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Shallow to gravel and sand; good bearing capacity and shear strength at a depth below 10 to 20 inches.	Slight.
Fair to good stability; subject to piping.	Not applicable--	Not applicable--	Not applicable--	Not applicable--	Extremely stony; fair to poor bearing capacity and shear strength.	Moderate: moderate permeability; deep to bedrock. Severe: slopes of more than 8 percent.
Moderately to rapidly permeable; subject to piping.	Needs some drainage; slow runoff; moderately rapid permeability.	Moderate available water capacity; medium to high intake rate.	Not applicable--	Not applicable--	Fair to good bearing capacity and shear strength; seasonal high water table.	Severe: water table at a depth of 2 to 4 feet.
Moderately to very rapidly permeable.	Not applicable--	Moderately low available water capacity; high intake rate; undulating slopes.	Not applicable--	Not applicable--	Good bearing capacity and shear strength.	Slight.



Corrosivity, as used in table 6, indicates the potential danger to uncoated metal or concrete structures through chemical action that dissolves or weakens the structural material. Structural materials may corrode if buried in soil, and a given material corrodes in some kinds of soil more rapidly than in others. Extensive installations that intersect soil boundaries or soil horizons are more likely to be damaged by corrosion than are installations entirely in one kind of soil or soil horizon.

### *Engineering interpretations*

Table 7 contains selected information useful to engineers and others who plan to use soil material in the construction of highways, farm facilities, buildings, and sewage disposal systems. Detrimental or undesirable features are emphasized, but very important desirable features also may be shown. The ratings and other interpretations in this table are based on the estimated engineering properties of the soils in table 6, on available test data, including those in table 5, and on field experience. Although the information applies only to soil depths indicated in table 6, it is reasonably reliable to depths of about 6 feet for most soils, and to depths of several feet more for others.

Topsoil is a term used to designate a fertile soil or soil material ordinarily rich in organic matter, used as a top-dressing for lawns, gardens, roadbanks, and the like. The ratings indicate suitability for such uses.

The ratings for sand and gravel are based on the probability that delineated areas of soil contain deposits of sand and gravel. The ratings do not indicate quality or size of deposits.

The ratings for road fill material used to build embankments indicate performance of soil material moved from borrow areas for these purposes.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soil features, favorable as well as unfavorable, are principal ones that affect location of highways.

Farm pond reservoir areas are affected mainly by loss of water by seepage, and the soil features are those that influence such seepage.

Farm pond embankments serve as dams. The soil features of both subsoil and substratum are important in the use of soils for the construction of embankments.

Foundations for low buildings are affected chiefly by features of the undisturbed soil that influence its capacity to support low buildings that have normal foundation loads. Specific values of bearing capacity have not been assigned.

Permeability, location of water table, and susceptibility to flooding affect the functioning of septic tanks and filter fields. The degree of limitation and the principal reasons for assigning moderate or severe limitations are given.

## **Formation and Classification of the Soils**

This section discusses the factors of soil formation and their effect on the soils of the Bingham Area. In addition, it discusses the classification of the soils according to their morphology and genesis. Table 8 in this section gives the

classification of the soils according to the classification system in current use.

### **Factors of Soil Formation**

Soils are the result of five major soil-forming factors. These factors are (1) the kinds or types of parent material from which the soil has been formed, (2) the organisms, both plant and animal, that have lived in and on the soil, (3) the climate under which the soil has existed since accumulation of the parent material, (4) the relief or lay of the land, which influences the climate of local areas and influences temperature and moisture content of the soils and their susceptibility to erosion, and (5) the length of time that the soil-forming factors have been active.

The factors of soil formation are so closely interrelated that few generalizations can be made regarding the effect of any one factor because the effect of each is modified by the other four. Many of the processes of soil development are unknown.

#### *Parent material*

The soils of the Bingham Area formed in parent material of several kinds. In the western part of the Survey Area, silt loams and wind-laid silts overlie basalt bedrock. The principal soil series are Portneuf, Polatis, Pancheri, Thornock, and Tenno. Small areas of eolian sand are along the eastern fringes of this area, the main body being west of Firth. The sandy materials have been blown from alluvial terraces along the Snake River. Soil series in these places are Bondranch, Matheson, and Malm.

Most of the river deposits consist of deep beds of water-worn gravel of mixed origin, overlain by loamy or sandy alluvium. Soils of the Bannock, Bock, Hayeston, Heieston, and Packham series are the main soils whose parent material is mostly of Snake River origin. Soils of the Blackfoot, Wapello, Firth, and Stan series have been influenced by deposits or reworking from the Blackfoot River and Sand Creek. Soils of the Paesl series formed wholly in outwash from Sand Creek.

The Presto Bench and the mountain foot slopes adjacent to it and extending up the Blackfoot River consist of a mantle of loess overlying mostly basalt and rhyolite. Soils of the Newdale, Rexburg, and Tetonia series are the principal soils that are too deep to be influenced by the underlying rock. Soils of the Araveton, Swanner, and Mike series are influenced by residual material from the underlying rock.

The Blackfoot Mountains are covered by a thin mantle of loess mixed with residual material, mostly from limestone. Soil series of this area are Sheege, Pavohroo, Ricrest, Hymas, and Wahtigup.

Soils of the Sessions, Nielsen, and Dranyon series, on the high mountains and on the mountain valleys, formed in material that was derived mainly from sandstone but has some loessal material in the upper part.

The Willow Creek-Long Valley-Grays Lake area consists mostly of deep loessal soils overlying basalt, sandstone, limestone, and associated rocks. In most places these soils are too deep to be influenced by the underlying rock. Soils of the Lanark and Robin series are common in this area. Soils of the Gilispie series are shallow to



basalt and show considerable influence from the underlying rock.

Some poorly drained or somewhat poorly drained soils are in the lower positions in the high mountain valleys and are associated with Lanark and Robin soils. These are principally those of the Outlet and Enochville series.

The terraces in the Aberdeen-Springfield area have material deposited by an ancient lake impounded behind a rock barrier that is now the site of the American Falls of the Snake River. Soils that formed on these old lake terraces include those of the Declo, Fingal, and Paniogue series, and some soils of the LaJara and Fulmer series.

TABLE 8.—*Classification of soil series of the Bingham Area by higher categories*

Series	Family	Subgroup	Order
Alpon	Fine-loamy, mixed	Cryic Paleborolls	Mollisols.
Ammon	Coarse-silty, mixed, frigid	Calcithidic Haploxerolls	Mollisols.
Araveton	Fine-loamy, mixed, frigid	Calcic Haploxerolls	Mollisols.
Bannock	Coarse-loamy over sandy or sandy-skeletal, mixed, frigid	Aridic Calcixerolls	Mollisols.
Blackfoot	Fine-loamy, mixed, frigid	Fluvaquentic Haploxerolls	Mollisols.
Bock	Coarse-loamy, mixed, frigid	Calcithidic Haploxerolls	Mollisols.
Bondbranch	Loamy, mixed, frigid	Lithic Xerollic Camborthids	Aridisols.
Declo	Coarse-loamy, mixed, mesic	Xerollic Calcithids	Aridisols.
Dranyon	Fine-loamy, mixed	Argic Pachic Cryoborolls	Mollisols.
Enochville	Fine-silty, mixed	Cumulic Cryaquolls	Mollisols.
Fingal	Fine, montmorillonitic, mesic	Aquic Haploxerolls	Mollisols.
Firth	Coarse-loamy, mixed	Aquic Haploborolls	Mollisols.
Fulmer	Fine-loamy, mixed (calcareous), frigid	Typic Haplaquolls	Mollisols.
Gilispie	Loamy, mixed	Argic Lithic Cryoborolls	Mollisols.
Hayeston	Coarse-loamy, mixed (calcareous), frigid	Xeric Torriorthents	Entisols.
Heiseton	Coarse-loamy, mixed (calcareous), frigid	Aquic Xerofluvents	Entisols.
Hymas	Loamy-skeletal, carbonatic, frigid	Lithic Haploxerolls	Mollisols.
Kimama	Fine-silty, mixed, mesic	Aridic Calcic Argixerolls	Mollisols.
Knull	Fine-silty, mixed, mesic	Xerollic Natrargids	Aridisols.
LaJara <sup>1</sup>	Coarse-loamy, mixed (calcareous), frigid	Typic Haplaquolls	Mollisols.
Lanark	Fine-silty, mixed	Argic Pachic Cryoborolls	Mollisols.
Malm	Coarse-loamy, mixed, frigid	Xerollic Calcithids	Aridisols.
Matheson	Coarse-loamy, mixed, frigid	Xerollic Calcithids	Aridisols.
Mike	Loamy, mixed, frigid	Lithic Calcixerolls	Mollisols.
Newdale	Coarse-silty, mixed, frigid	Calcithidic Haploxerolls	Mollisols.
Nielsen	Loamy-skeletal, mixed	Argic Lithic Cryoborolls	Mollisols.
Outlet	Fine-loamy, mixed	Aquic Cryoborolls	Mollisols.
Outlet, noncalcareous variant	Fine-loamy over sandy or sandy-skeletal, mixed	Pachic Cryoborolls	Mollisols.
Packham	Loamy-skeletal, mixed, frigid	Xerollic Camborthids	Aridisols.
Paesl	Fine-loamy over sandy or sandy-skeletal, mixed, frigid	Calcithidic Haploxerolls	Mollisols.
Pancheri	Coarse-silty, mixed, frigid	Xerollic Calcithids	Aridisols.
Paniogue <sup>1</sup>	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic	Xerollic Calcithids	Aridisols.
Pavohroo	Fine-loamy, mixed	Pachic Cryoborolls	Mollisols.
Polatis	Coarse-silty, mixed, frigid	Xerollic Calcithids	Aridisols.
Portino	Coarse-silty, mixed, mesic	Xerollic Calcithids	Aridisols.
Portneuf	Coarse-silty, mixed, mesic	Xerollic Calcithids	Aridisols.
Presto	Sandy over loamy, mixed, frigid	Xerollic Calcithids	Aridisols.
Rexburg	Coarse-silty, mixed, frigid	Calcic Haploxerolls	Mollisols.
Ricrest	Fine-loamy, mixed, frigid	Calcic Pachic Haploxerolls	Mollisols.
Robin	Fine-silty, mixed	Cryic Pachic Paleborolls	Mollisols.
Sasser	Coarse-loamy over sandy or sandy-skeletal, mixed, frigid	Aridic Calcixerolls	Mollisols.
Sessions	Fine, montmorillonitic	Argic Cryoborolls	Mollisols.
Sheege	Loamy-skeletal, carbonatic	Cryic Lithic Rendolls	Mollisols.
Spaa	Loamy, mixed, frigid	Lithic Haploxerolls	Mollisols.
Stan	Coarse-loamy, mixed, frigid	Aridic Calcixerolls	Mollisols.
Swanner	Loamy-skeletal, mixed, frigid	Lithic Haploxerolls	Mollisols.
Tenno	Loamy, mixed, frigid	Lithic Xerollic Camborthids	Aridisols.
Tetonia	Coarse-silty, mixed	Pachic Cryoborolls	Mollisols.
Thornock	Loamy, mixed, mesic	Lithic Xerollic Calcithids	Aridisols.
Turnerville	Fine-silty, mixed	Typic Cryoborolls	Alfisols.
Wahtigup	Fine-loamy, mixed, frigid	Calcithidic Haploxerolls	Mollisols.
Wapello	Coarse-loamy, mixed, frigid	Calcithidic Haploxerolls	Mollisols.
Wardboro	Sandy-skeletal, mixed, frigid	Xeric Torriorthents	Entisols.
Waycup	Loamy-skeletal, mixed, mesic	Xerollic Calcithids	Aridisols.
Weeding	Sandy, mixed	Aquic Haploborolls	Mollisols.
Wolverine	Mixed, frigid	Xeric Torripsamments	Entisols.

<sup>1</sup> These soils are taxadjuncts. The reasons for excluding them from the series with which they are here identified are as follows:

LaJara soils contain slightly less clay than is defined as the range for the series.

Paniogue soils are slightly more calcareous in the surface layer than is defined as the range for the series.



### *Plants and animals*

Vegetation cover, or in some places the lack of it, has appreciably influenced soil formation within the Survey Area. The low rainfall and consequent sparse vegetation of the drier area has produced soils that have a thin A1 horizon and low organic-matter content. Some of the river terraces and bottoms receive runoff from the uplands and therefore have more organic matter. The same effect of higher precipitation is apparent on mountains and foot slopes. Generally, the vegetation increases with elevation on soils of about equal depth, because of the increase in rainfall and snow. The thickness of the A1 horizon and the organic-matter content increase in proportion to the increased vegetation, except under the denser forests.

Where the climate is cool and wet enough to support fir and other conifers, this type of vegetation contributes to a definite difference in soil characteristics. Decaying plant residue from conifers produces organic acids, which, when leached through the soil, remove much organic matter and iron. This produces the gray, bleached horizon just below the surface in the Turnerville soils. The leaching of basic elements below the root zone results in an acid soil.

Rodents and other burrowing animals cause mixing of underlying material with the surface horizon. This is most apparent in the low mounds or hummocks common in the drier area. Insects and earthworms open channels and pores through the soil profile, thus mixing the horizons and aiding in aeration and water movement through the soil. Compact nodules of soil formed in cicada burrows are a prominent feature of the lower horizons of many of the Portneuf, Portino, and associated soils.

### *Climate*

Climate is the most important factor in soil formation if given enough time to act on the soil material. Indirectly, it affects the kind and amount of vegetation and micro-organism activity, which in turn affects soil formation. Directly, climate affects weathering of mineral materials, redeposition of soil materials by wind and water, and the amount of water movement through the soil. Climate not only varies on a broad scale geographically, but also differs greatly in a short distance because of slope, exposure, and elevation.

Prevailing winds are from the southwest. Northerly winds are common in the colder months. This influences soil formation by affecting rainfall patterns, drifting of snow, deposition and redistribution of soil materials, and evaporation of soil moisture.

The semiarid soils in the western part of the Survey Area formed in calcareous loess under low rainfall (about 8 to 11 inches a year) with hot, dry summers and cold winters. Weathering of minerals under these conditions takes place slowly, and minerals are only slightly leached out of the root zone. Lime has been leached to a depth of 6 to 12 inches, leaving the surface soil free of lime, or nearly so. Little redistribution of clays has taken place.

Two temperature zones are recognized in this Survey Area with a dividing line running west of the village of Springfield. The warmer zone, where the average soil temperature is more than 47° F., is confined to the southwestern part of the Area. In this warmer area the soils are mainly those of the Portneuf, Portino, Declo, and

Thornock series. The colder zone, where the average soil temperature is less than 47°, lies north of the division line. In the colder area the soils are mainly those of the Pancheri, Polatis, and Tenno series. Although lime accumulation is distinct in these soils, hardpans are rare and, if present, are weakly cemented and discontinuous. The river and lake terraces have a climate similar to that of the uplands, but the effect of climate is dominated by relief and other influences.

Presto Bench and the mountain foot slopes along the Blackfoot River have more rainfall (11 to 13 inches a year) than the semiarid western part of the Area. A distinct horizon of lime accumulation has formed at a depth of about 15 inches, but weathering and translocation of clay has been insufficient to form a horizon of clay accumulation. The major soils of this area are those of the Newdale series. They differ from soils of the Portneuf and Pancheri series mainly in having a darker colored A1 horizon and more organic matter.

On the higher benches and lower mountain areas, the annual precipitation is 13 to 16 inches. The increased moisture has produced more abundant vegetation, which has caused an increase in the organic-matter content of the soil. The A1 horizon is darker colored than that of soils with less moisture, and carbonates have leached to a depth of about 25 inches or more. Translocation of clay is evident in the subsoil. These soils are principally those of the Rexburg and Tetonia series.

The mountains and mountain valleys have an annual precipitation of 16 to 20 inches. The higher elevations of the mountains are colder than the mountain valleys. In general, this temperature difference produces differences in soil formation, but soil formation is complicated by exposure and other factors. The higher rainfall leaches the calcium carbonate deeper, and the colder climate allows greater production of organic material. The upper horizons of the soil tend to be more acid. The A1 horizon is thicker and darker colored and contains more organic matter. In these areas the precipitation and subsequent leaching are great enough to accumulate considerable amounts of clay in the subsoil. Lime in many places is leached to depths greater than 60 inches. Soils in mountain valleys, such as those of the Robin and Lanark series, reflect this climatic environment. Some of the soils in the mountains, such as those of the Hymas, Ricrest, Pavohroo, and Sheege series, are too shallow or youthful to be altered much by climate.

### *Relief*

Relief influences soil development and formation greatly. Rainfall that is not absorbed tends to run off or collect in depressions. On steep north slopes, the sun's rays are less effective in heating the soil. Thus, vegetation is more dense, and the soils are deeper and darker colored and have more organic matter. Evaporation is higher on south slopes, and the soil is warmer. Depressions or concave areas tend to be more poorly drained, and salts often accumulate.

In the loessal uplands of the western part of the Survey Area, soils formed in potholes, or areas of trapped drainage. These potholes are generally only a few acres in size and are covered by water for varying lengths of time, depending on the size of the area draining into them.



Soil development in these places depends more on leaching by water than on climate or other soil-forming factors. Lime is leached to a greater depth, and a horizon of clay accumulation has formed below the surface horizon. Soils of the Kimama series are representative.

The soils on river and lake terraces have been subjected to overflow from the river during their formation. Some have also received runoff from adjacent uplands. Some of the soils on the lower terraces and bottom lands are still subject to a high water table because of irrigation seepage from the higher areas. The poorer drainage in the lower lying soils has given rise to soils of the LaJara, Fulmer, and Fingal series, whose formation has been more influenced by wetness than by other soil-forming factors. Soils of the Outlet and Enochville series formed under similar persistent wet conditions in the mountain valleys.

The dominant soils on the Presto Bench and the Blackfoot Mountain foot slopes are those of the Newdale series. The cooler climate on north slopes and uplands at higher elevations has produced soils of the Teton series. These are soils that have a thicker, deeper, darker colored surface horizon and lime accumulations at depths below about 25 inches.

Possibly the steep mountainous areas received nearly as much loessal material as the valleys. Erosion has removed much of this material nearly as rapidly as it was laid down. For this reason, many of the soils of the mountains are strongly influenced by the underlying bedrock. North slopes and protected pockets have deeper soils and possibly receive and retain more moisture. In these places soil-forming processes have taken place over long periods of time, and the microclimate has been a major factor. Soils of the Turnerville series are representative.

In the mountain valleys, the soils at higher elevations are leached of calcium carbonate. Clay has accumulated, and bleached silt coatings are on the ped surfaces, suggesting that leaching has taken place. Soils of the Robin series are representative.

At slightly lower elevations in the valleys, rainfall has been less, the soils are somewhat warmer, and the snow cover melts away earlier in spring. In these places the soil has a thinner A1 horizon, lime accumulation within the upper 60 inches, and less clay accumulation than the Robin soils. Soils of the Lanark series formed under these conditions.

### **Time**

Soil-forming processes are usually slow, and appreciable time is required to change the parent material. The length of time necessary for significant changes to take place depends on the combination of soil-forming factors involved. Soils develop faster in a humid area than in a dry area. Mountain soils are usually young and immaturely developed because of the constant removal of material by erosion. Flood plains and some alluvial fans have young soils because of repeated deposition. Heat promotes chemical activity in the soil; cold retards it. These and other factors affect the time required to alter the parent material.

Soils on the loessal uplands of the Snake River Plains have formed slowly because of the low rainfall and cool climate. Insufficient time had passed for parent material to be altered greatly. Leaching from natural precipita-

tion has caused a lime accumulation near the surface. The thin A1 horizon, typical of an arid soil, has a comparatively high level of mineral fertility, since precipitation has been insufficient to leach these elements from the soil in the length of time the soils have been in place.

Water has eroded some of the loess from the uplands and redeposited it on the higher river terraces in the form of alluvial fans. These recent soils show little or no development and are uniformly calcareous throughout the profile. Soils of the Ammon series are an example.

Newdale and Teton series soils on the uplands in the same area have been undisturbed long enough for some soil formation to take place. This is shown by the downward movement of lime and the formation of weak to moderate soil structure.

Mountainous soils, such as those of the Sheege, Pavoh-roo, Hymas, and Ricrest series, are young. Constant geologic erosion has removed soil material from the surface about as fast as soil-forming processes have acted upon it. The less steep, deeper soils of the lower mountain slopes in protected areas show some soil development. Rexburg soils show evidence of downward movement of lime and weak to moderate soil structure.

More development has occurred in the soils in the mountain valleys during the time involved than in soils of similar parent material on the Snake River Plains, mainly because of differences in temperature and rainfall. An example is the Robin soils, which formed in loess where annual precipitation amounts to 17 to 19 inches. In these places lime has been leached to a depth below 60 inches, and clay has been translocated into the subsoil to form a textural B horizon. The Portneuf soils, which formed in apparently similar loessal material but where annual precipitation amounts to 8 to 11 inches, show only slight translocation of clay, or none at all, and the lime has been leached from only the upper few inches.

Most of the soils in the Survey Area are geologically young. Only a few, such as those of the Sessions and Knull series, have been acted upon by soil-forming processes long enough to have developed strong profile characteristics.

## **Classification of the Soils**

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (2) and later revised (6). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965 and supplemented in March 1967 and September 1968 (8). This system is under continual study, and readers interested in the development of the system should refer to available literature (5).

Table 8 shows the classification of each of the soil series represented in the Bingham Area according to the current system. This system defines classes in terms of observable or measurable properties of soils. The properties chosen are primarily those that permit the grouping of soils that are similar in genesis. The classification is designed to encompass all soils. It has six categories. Beginning with the most inclusive, they are the order, suborder, great group, subgroup, family, and series. These are briefly defined in the following paragraphs.



**ORDER.**—Ten orders are recognized in the current system. These are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic grouping of soils. Two exceptions, Entisols and Histosols, occur in many different climates. Four of the orders are represented in the Bingham Area. These are the Entisols, Aridisols, Mollisols, and Alfisols.

Entisols are young mineral soils that do not have genetic horizons or have only the beginning of such horizons.

Aridisols are mainly soils of dry places. They have a light-colored surface horizon and one or more additional diagnostic horizons.

Mollisols are friable and have a thick, dark-colored surface horizon. In addition, they have one or more additional diagnostic horizons.

Alfisols are soils that are generally moist, have clay accumulations in the subsoil, and generally have base saturation of more than 35 percent.

**SUBORDER.**—Each order is subdivided into suborders, mainly on the basis of soil characteristics that produce classes having the greatest genetic similarity and that are important to plant growth. These characteristics chiefly reflect the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. The suborders have a narrower climatic range than the orders.

**GREAT GROUP.**—Each suborder is divided into great groups, on the basis of uniformity in the kinds and sequence of major horizons and similarity of the significant features of corresponding horizons. The horizons considered are those in which clay, iron, or humus have accumulated and those that have pans that interfere with the growth of roots or the movement of water. The features selected are the self-mulching properties of clays, soil temperature, chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like.

**SUBGROUP.**—Each great group is divided into subgroups, one that represents the central (typic) concept of the group, and others, called intergrades, that have one or more properties of another great group, suborder, or order.

**FAMILY.**—Families are established within each subgroup, primarily on the basis of properties important to the growth of plants or properties significant in engineering. Texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence are among the properties considered.

**SERIES.**—The series consists of a group of soils that formed in a particular kind of parent material and have horizons similar in all important characteristics, except for texture of the surface layer, and are similar in arrangement in the profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

## General Nature of the Area

The Bingham Area is in the eastern part of the Snake River Plains and extends into the Blackfoot Mountains and Grays Lake area to the east. The Area is somewhat

rectangular in shape and is approximately 80 miles from east to west and 12 to 40 miles from north to south. Elevations are about 4,000 feet in the irrigated sections but more than 10,000 feet in some of the mountainous areas.

## Topography and Drainage

Variations in the general surface of the plains area are slight. The Snake River and its branches have not cut deep channels in this area, but flow on the plateau surface. Low basaltic mounds, a few well-formed craters, and the shallow terraces of the Snake River provide the major relief.

The Bingham Area is roughly dissected by the Snake River and one of its main branches, the Blackfoot River. These two rivers have formed smooth, nearly flat alluvial terraces at successive elevations and of various ages. East and west of the alluvial terraces a mantle of loess covers the irregular basalt flows, giving rise to the hilly or rolling uplands. On Gibson Terrace, along the eastern edges of part of the alluvial terraces, wind has deposited sandy material in the form of narrow longitudinal dunes and hummocks.

The eastern part of the Bingham Area is made up of the Blackfoot Mountains and loess-covered rolling uplands. Meadow Creek, Willow Creek, Brush Creek, and Wolverine Creek are the main streams in this part.

## Climate<sup>a</sup>

The climate of the Bingham Area is characteristic of the Snake River Plains, where much of the Survey Area is located. Summers are hot and dry, and winters are cold with considerable snow at times.

The average annual precipitation is 7 inches in the extreme northern part of the Area and 8 inches in the extreme west; it is 13.5 inches east of Fort Hall at an elevation of 5,700 feet and nearly 16 inches at Blackfoot Dam at an elevation of 6,200 feet. The higher elevations in the eastern part of the Area receive an average of about 25 inches a year.

As is typical of semiarid regions, the precipitation varies considerably from year to year. Thirty years of record at Aberdeen Experiment Station show a range in annual precipitation of less than 5 inches to more than 13 inches, less than 6 to more than 16 inches at Blackfoot, and about 11 to more than 22 inches at Blackfoot Dam.

Intense rainfall is infrequent; rainfall amounting to as much as 2 inches in 1 day is rare. The highest one-hour intensity recorded for Pocatello was 1.24 inches in August 1920, when 0.96 inch of rain fell in 30 minutes.

The average snowfall ranges from about 25 inches in the extreme north and west to 90 inches or more at the higher elevations in the east. The approximate time of maximum water content of the snowpack is April 1. The snow course at Blackfoot Dam averages 27 inches of snow on the ground and a water content of 8.4 inches at that time. Beyond the limits of the Bingham Area, but within the Blackfoot River Basin, other snow courses at higher

<sup>a</sup>By D. J. STEVLINGSON, climatologist for Idaho, National Weather Service, U.S. Department of Commerce, Boise.

elevations show greater values. Slug Creek Divide, elevation 7,225 feet, at the southern limits of the Blackfoot River drainage, has a 46-inch average snow cover and a 15.7-inch water content on April 1.

Temperature records show average annual extremes of 96° F. and -19° for Idaho Falls and of 98° and -12° for Pocatello. Once in 10 years, on the average, Idaho Falls will have extremes of 99° and -32°, and Pocatello will have 102° and -24°. The average weekly temperatures show a fairly smooth transition from a low point in mid-January to a peak in mid-July, but marked deviations from the average may be expected in any year. Deviations from the long-term average are least in July and August.

Temperature and precipitation data for the Bingham Area are given in table 9.

The average growing season is the period between the last freezing temperature recorded in spring and the first in fall. It is about 110 days in the principal farming areas. Blackfoot has an average growing season of about 130 days. In the higher eastern part, the average is less than 60 days and there is some danger of freezing temperatures at any time of the year. Table 10 gives probable dates of last freezing temperatures in spring and first in fall.

A meteorological drought index, devised by the Environmental Science Services Administration, has been

TABLE 9.—*Temperature and precipitation data*

[Based on data from Aberdeen and Blackfoot]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—		Days with snow cover	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Number	Inches
January.....	31	11	45	-11	0.9	0.3	1.6	18	5
February.....	37	16	51	-6	.8	.3	1.4	13	5
March.....	47	24	62	9	.7	.3	1.3	6	4
April.....	60	31	76	21	.9	.3	1.7	( <sup>1</sup> )	3
May.....	70	38	85	29	1.1	.2	2.0	0	0
June.....	78	45	91	36	1.0	.2	2.0	0	0
July.....	89	51	98	43	.4	.1	.9	0	0
August.....	86	49	96	39	.5	.1	1.1	0	0
September.....	77	40	90	30	.6	.1	1.3	0	0
October.....	64	32	81	21	.8	.1	1.6	( <sup>1</sup> )	3
November.....	46	23	63	7	.8	.2	1.5	3	3
December.....	35	16	49	-3	.9	.4	1.5	16	3
Annual.....	60	31	<sup>2</sup> 98	<sup>3</sup> -15	9.4	6.5	12.6	56	4

<sup>1</sup> Less than half a day.

<sup>2</sup> Average annual highest temperature.

<sup>3</sup> Average annual lowest temperature.

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

[Based on data from Aberdeen Experiment Station, Blackfoot, and Fort Hall]

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than.....	April 23	May 1	May 18	June 1	June 16
2 years in 10 later than.....	April 15	April 24	May 11	May 26	June 10
5 years in 10 later than.....	March 29	April 10	April 28	May 12	May 28
Fall:					
1 year in 10 earlier than.....	October 16	October 2	September 20	September 8	August 26
2 years in 10 earlier than.....	October 23	October 8	September 26	September 14	September 1
5 years in 10 earlier than.....	November 6	October 21	October 9	September 27	September 14



used in analyzing past records. During more than 35 years of record, the most severe drought condition in the Upper Snake River Plains occurred during the period from July 1933 to December 1935. Of these 30 months, there were 16 with extreme drought, 7 with severe drought, and 7 with moderate or mild drought conditions. In July 1934 the index reached a low of -8.83 on a scale where any value of -4.0 or lower is considered extreme. An even longer period of drought extended from August 1958 to July 1961, but of these 36 months, only 2 months were rated extreme; 9 were rated severe, 8 moderate, and 17 mild.

Winds in the Upper Snake River Plains are predominantly from the southwest quadrant, although in the colder months a sizable percentage of hourly observations shows northerly winds at Idaho Falls Airport. The highest recorded windspeed, sustained for a period of 1 minute, is 57 miles per hour at Idaho Falls and 72 miles per hour at Pocatello.

The average relative humidity, based on observations every 6 hours, ranges from 89 percent at 5 a.m. in December to 25 percent at 5 p.m. in July at Idaho Falls Airport. It ranges from 84 percent at 5 a.m. in December to 21 percent at 5 p.m. in July at the Pocatello Airport.

Evaporation from a 48-inch pan has been measured daily during the warmer months for more than 20 years at the Aberdeen Experiment Station. The long-term average monthly totals, in inches, are: April—4.92, May—7.07, June—7.94, July—9.25, August—8.37, September—5.60, and October—3.41.

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## Glossary

**Alkali soil.** Generally, a highly alkaline soil. Specifically, an alkali soil has 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 the growth of most crop plants is low from this cause.

**Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

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

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

**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.

**Colluvium.** Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

**Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found 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 and brittle; little affected by moistening.

**Drainage class** (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, 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 different classes of natural soil drainage are recognized.

*Excessively drained* soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

*Somewhat excessively drained* soils are also very permeable and are free from mottling throughout their profile.

*Well-drained* soils are nearly free from mottling and are commonly of intermediate texture.

*Moderately well drained* soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

*Somewhat poorly drained* soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

*Poorly drained* soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

*Very poorly drained* soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

**Flood plain.** Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

**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.

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

**Ped.** An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

**Permeability.** The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.*

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid---	Below 4.5	Mildly alkaline-----	7.4 to 7.8
Very strongly acid--	4.5 to 5.0	Moderately alkaline--	7.9 to 8.4
Strongly acid-----	5.1 to 5.5	Strongly alkaline----	8.5 to 9.0
Medium acid-----	5.6 to 6.0	Very strongly alka-	
Slightly acid-----	6.1 to 6.5	line -----	9.1 and
Neutral -----	6.6 to 7.3		higher

**Residual material.** Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material in which a soil has formed.

**Saline soil.** A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

**Saline-alkali soil.** A soil that contains a harmful concentration of salts and exchangeable sodium; or contains harmful salts and has a highly alkaline reaction; or contains harmful salts and exchangeable sodium and is strongly alkaline in reaction. The salts, exchangeable sodium, and alkaline reaction occur in the soil in such location that growth of most crop plants is less than normal.

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

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

**Slope.** The number of feet of fall per 100 feet of horizontal distance.

Expressed in this survey as—

Nearly level-----	0 to 2 percent
Very gently sloping-----	2 to 4 percent
Gently sloping-----	4 to 8 percent
Moderately sloping-----	8 to 12 percent
Strongly sloping-----	12 to 20 percent
Moderately steep-----	20 to 30 percent
Steep-----	30 to 60 percent
Very steep-----	60 percent or more

**Solum.** The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes 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 characteristic of the soil are largely confined to the solum.

**Structure, soil.** The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

**Stubble mulch.** Stubble or other crop residues left on the soil, or partly worked into the soil, to provide protection from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Water table.** The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.





## GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to an interpretive group, read the introduction to the section it is in for general information about its management. For information on use of soils for woodland, see section beginning on page 80. Other information is given in tables as follows:

Acreage and extent, table 1, p. 11.  
Estimated yields, table 2, p. 71.

Use of soils for windbreak plantings, table 4, p. 83.  
Engineering uses of the soils, tables 5, 6, and 7,  
pp. 88 through 115.

Map symbol		Capability unit										Windbreak group
High inten- sity	Low and medium inten- sity	Mapping unit	Page	Irrigated		Dryland		Range site		Page	Number	
				Symbol	Page	Symbol	Page	Name				
---	ALF	Alpon silt loam, hilly 1/-	12	-----	--	VIe-1	69	-----	--	--	--	
---	ALG	Alpon silt loam, steep 1/-	12	-----	--	VIIe-0	70	-----	--	--	--	
AmA	---	Ammon silt loam, 0 to 2 percent slopes	12	IIc-2	65	-----	--	-----	--	--	1	
AmB	---	Ammon silt loam, 2 to 4 percent slopes	13	IIe-1	64	-----	--	-----	--	--	1	
---	AVF	Araveton extremely stony loam, hilly	13	-----	--	VIIIs-2	70	Stony, 12 to 16 inches precipitation	77	--	--	
---	AVG	Araveton extremely stony loam, steep	14	-----	--	VIIIs-2	70	Steep Stony Slopes, 12 to 16 inches precipitation	77	--	--	
---	ArD	Araveton loam, 4 to 12 percent slopes	14	-----	--	VIe-1	69	Loamy, 12 to 16 inches precipitation	77	--	--	
BaA	---	Bannock loam, 0 to 2 percent slopes	14	IIs-1	65	-----	--	-----	--	--	1	
BaB	---	Bannock loam, 2 to 4 percent slopes	15	IIe-3	64	-----	--	-----	--	--	1	
BaC	---	Bannock loam, 4 to 8 percent slopes	15	IIIe-12	66	-----	--	-----	--	--	2	
Bc	---	Blackfoot loam	15	IIw-2	65	-----	--	-----	--	--	3	
Bd	---	Blackfoot loam, drained	16	IIc-2	65	-----	--	-----	--	--	3	
Bf	---	Blackfoot loam, saline	16	IIw-2	65	-----	--	-----	--	--	4	
Bk	---	Blackfoot silty clay loam	16	IIw-2	65	-----	--	-----	--	--	3	
BoA	---	Bock loam, 0 to 2 percent slopes	16	IIc-2	65	-----	--	-----	--	--	1	
BoB	---	Bock loam, 2 to 4 percent slopes	17	IIe-1	64	-----	--	-----	--	--	1	
---	BRB	Bondbranch sandy loam, undulating	17	-----	--	VIIe-1	70	Shallow Loamy, 8 to 12 inches precipitation	74	--	--	
DcA	---	Declo fine sandy loam, 0 to 2 percent slopes	18	IIe-4	64	-----	--	-----	--	--	1	
DcB	---	Declo fine sandy loam, 2 to 4 percent slopes	18	IIe-3	64	-----	--	-----	--	--	1	
DcC	---	Declo fine sandy loam, 4 to 8 percent slopes	18	IIIe-13	66	-----	--	-----	--	--	2	
DeA	---	Declo loam, 0 to 2 percent slopes	17	IIc-2	65	-----	--	-----	--	--	1	
DeB	---	Declo loam, 2 to 4 percent slopes	18	IIe-1	64	-----	--	-----	--	--	1	
DeC	---	Declo loam, 4 to 8 percent slopes	18	IIIe-1	65	-----	--	-----	--	--	2	
DeD	---	Declo loam, 8 to 12 percent slopes	18	IVe-1	67	-----	--	-----	--	--	2	
DeE2	---	Declo loam, 12 to 20 percent slopes, eroded	18	IVe-1	67	-----	--	-----	--	--	--	
---	DRF	Dranyon silt loam, hilly 2/-	19	-----	--	VIe-1	69	-----	--	--	--	
---	DRG	Dranyon silt loam, steep 2/-	19	-----	--	VIIe-0	70	-----	--	--	--	
---	DSF	Dranyon-Gilispie complex, hilly 3/-	19	-----	--	VIIIs-2	70	-----	--	--	--	
		Dranyon part	--	-----	--	VIIIs-2	70	-----	--	--	--	
		Gilispie part	--	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--	--	
---	En	Enochville silt loam	20	-----	--	IVw-9	69	Semiwet Meadow	79	--	--	
FgA	---	Fingal loam, 0 to 2 percent slopes	20	IIs-9	65	-----	--	-----	--	--	4	
FgB	---	Fingal loam, 2 to 4 percent slopes	21	IIe-1	64	-----	--	-----	--	--	4	
FlA	---	Fingal loam, saline, 0 to 2 percent slopes	21	IIIs-8	66	-----	--	-----	--	--	4	
FlB	---	Fingal loam, saline, 2 to 4 percent slopes	21	IIIs-8	66	-----	--	-----	--	--	4	
FmA	---	Fingal loam, strongly saline, 0 to 2 percent slopes	21	IVs-8	67	-----	--	Saline-alkali Meadow, 8 to 12 inches precipitation	76	--	--	
FnA	---	Fingal clay loam, 0 to 2 percent slopes	22	IIs-9	65	-----	--	-----	--	--	4	
Fr	---	Firtn sandy loam	22	IIw-2	65	-----	--	-----	--	--	3	
Fs	---	Firth sandy loam, drained	22	IIe-4	64	-----	--	-----	--	--	1	
Fu	---	Fulmer loam	22	Vw-2	67	-----	--	Wet Meadow	79	--	--	
Fv	---	Fulmer loam, drained	23	IIw-2	65	-----	--	-----	--	--	3	
---	GLF	Gilispie extremely stony loam, hilly	23	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--	--	
---	GMF	Gilispie extremely rocky loam, hilly	24	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--	--	
Gp	---	Gravel pit	24	-----	--	VIIIs-1	70	-----	--	--	--	
HaA	---	Hayeston sandy loam, 0 to 2 percent slopes	24	IIIs-3	66	-----	--	-----	--	--	1	
HaB	---	Hayeston sandy loam, 2 to 4 percent slopes	24	IIIe-13	66	-----	--	-----	--	--	1	



## GUIDE TO MAPPING UNITS--Continued

Map symbol				Capability unit					Windbreak	
High inten- sity	Low and medium inten- sity			Irrigated		Dryland		Range site	group	
		Mapping unit	Page	Symbol	Page	Symbol	Page	Name	Page	Number
HeA	---	Hayeston loam, 0 to 2 percent slopes-----	24	IIIs-1	65	-----	--	-----	--	1
HsA	---	Heiseton sandy loam, 0 to 2 percent slopes-----	25	IIe-4	64	-----	--	-----	--	3
HsB	---	Heiseton sandy loam, 2 to 4 percent slopes-----	25	IIe-3	64	-----	--	-----	--	3
HtA	---	Heiseton loam, 0 to 2 percent slopes-----	25	IIc-2	65	-----	--	-----	--	3
---	HYF	Hymas extremely stony loam, hilly-----	26	-----	--	VIIIs-2	70	Shallow Stony, 12 to 16 inches precipitation	77	--
---	HYG	Hymas extremely stony loam, steep-----	26	-----	--	VIIIs-2	70	Steep Stony Slopes, 12 to 16 inches precipitation	77	--
Km	---	Kimama silt loam-----	26	IIc-2	65	VIc-1	69	Loamy, 8 to 12 inches precipitation	74	1
La	---	LaJara sandy loam-----	28	Vw-2	67	-----	--	Wet Meadow	79	--
Ld	---	LaJara sandy loam, drained-----	28	IIw-2	65	-----	--	-----	--	3
---	LkB	Lanark silt loam, 0 to 4 percent slopes-----	29	-----	--	IIIc-4	68	Loamy, 16 to 22 inches precipitation	78	--
---	LkD	Lanark silt loam, 4 to 12 percent slopes-----	28	-----	--	IIIe-4	68	Loamy, 16 to 22 inches precipitation	78	--
---	LkE	Lanark silt loam, 12 to 20 percent slopes-----	29	-----	--	IIIe-4	68	Loamy, 16 to 22 inches precipitation	78	--
---	LNF	Lanark silt loam, rolling-----	29	-----	--	VIe-1	69	Loamy, 16 to 22 inches precipitation	78	--
---	LRF	Lanark-Robin silt loams, rolling-----	29	-----	--	VIe-1	69	Loamy, 16 to 22 inches precipitation	78	--
---	LS	Lava flows-----	29	-----	--	VIIIs-1	70	-----	--	--
---	LT	Lava rock land-----	30	-----	--	VIIIs-2	70	Very Shallow, 8 to 12 inches precipitation	75	--
---	LV	Limestone rock land-----	30	-----	--	VIIIs-1	70	-----	--	--
MaA	---	Malm fine sandy loam, 0 to 2 percent slopes-----	30	IIIs-3	66	VIIs-3	69	Loamy, 8 to 12 inches precipitation	74	1
MaB	---	Malm fine sandy loam, 2 to 4 percent slopes-----	30	IIIe-13	66	VIIs-3	69	Loamy, 8 to 12 inches precipitation	74	1
Mh	---	Marsh-----	30	VIIIw-1	68	-----	--	-----	--	--
MnA	---	Matheson fine sandy loam, 0 to 2 percent slopes-----	31	IIe-4	64	VIIs-3	69	Loamy, 8 to 12 inches precipitation	74	1
MnB	---	Matheson fine sandy loam, 2 to 4 percent slopes-----	31	IIe-3	64	VIIs-3	69	Loamy, 8 to 12 inches precipitation	74	1
MnC	---	Matheson fine sandy loam, 4 to 8 percent slopes-----	31	IIIe-13	66	VIIs-3	69	Loamy, 8 to 12 inches precipitation	74	2
---	MBC	Matheson-Bondbranch complex, undulating-----	31	-----	--	VIIe-1	70	Loamy, 8 to 12 inches precipitation	74	--
---	MoF	Mike extremely stony silt loam, 0 to 30 percent slopes-----	32	-----	--	VIIIs-2	70	Shallow Stony, 8 to 12 inches precipitation	75	--
---	NdB	Newdale silt loam, 0 to 4 percent slopes-----	33	-----	--	IIIc-45	69	Loamy, 8 to 12 inches precipitation	74	--
---	NdD	Newdale silt loam, 4 to 12 percent slopes-----	32	-----	--	IIIe-45	68	Loamy, 8 to 12 inches precipitation	74	--
---	NdE	Newdale silt loam, 12 to 20 percent slopes-----	33	-----	--	IIIe-45	68	Loamy, 8 to 12 inches precipitation	74	--
---	NEF	Newdale silt loam, hilly-----	33	-----	--	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	--
---	NEG	Newdale silt loam, steep-----	33	-----	--	VIIe-0	70	Steep Slopes, 8 to 12 inches precipitation	76	--
---	NLF	Nielsen extremely stony loam, hilly-----	33	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--
---	NLG	Nielsen extremely stony loam, steep-----	34	-----	--	VIIIs-2	70	Steep Stony Slopes, 16 to 22 inches precipitation	79	--
---	Ot	Outlet silty clay loam-----	34	-----	--	IVw-9	69	Semiwet Meadow	79	--
---	Ou	Outlet loam, noncalcareous variant-----	35	-----	--	IVw-9	69	Semiwet Meadow	79	--
PaA	---	Packham gravelly loam, 0 to 2 percent slopes-----	35	IVs-1	67	-----	--	-----	--	5
PaB	---	Packham gravelly loam, 2 to 4 percent slopes-----	36	IVs-1	67	-----	--	-----	--	5
Pd	---	Paesl fine sandy loam-----	37	IIIs-3	66	-----	--	-----	--	1
Pe	---	Paesl silt loam-----	36	IIIs-1	65	-----	--	-----	--	1
PhA	---	Pancheri silt loam, 0 to 2 percent slopes-----	38	IIc-2	65	VIc-1	69	Loamy, 8 to 12 inches precipitation	74	1
PhB	---	Pancheri silt loam, 2 to 4 percent slopes-----	37	IIe-1	64	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	1
PhC	---	Pancheri silt loam, 4 to 8 percent slopes-----	38	IIIe-1	65	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	2
PhD	---	Pancheri silt loam, 8 to 12 percent slopes-----	38	IVe-1	67	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	2
PnA	---	Panogue loam, 0 to 2 percent slopes-----	39	IIIs-1	65	-----	--	-----	--	1
---	PBF	Pavohroo loam, hilly 4/-----	40	-----	--	VIe-1	69	-----	--	--
---	PBG	Pavohroo loam, steep 4/-----	39	-----	--	VIIe-0	70	-----	--	--
PoA	---	Polatis silt loam, 0 to 2 percent slopes-----	41	IIIs-1	65	VIIs-3	69	Loamy, 8 to 12 inches precipitation	74	1
PoB	---	Polatis silt loam, 2 to 4 percent slopes-----	40	IIe-11	64	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	1
PoC	---	Polatis silt loam, 4 to 8 percent slopes-----	41	IIIe-12	66	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	2
PrA	---	Polatis stony silt loam, 0 to 2 percent slopes-----	41	IIIs-1	65	VIIs-3	69	Loamy, 8 to 12 inches precipitation	74	1
PrB	---	Polatis stony silt loam, 2 to 4 percent slopes-----	41	IIe-11	64	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	1
PrC	---	Polatis stony silt loam, 4 to 8 percent slopes-----	41	IIIe-12	66	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	2

## GUIDE TO MAPPING UNITS--Continued

Map symbol				Capability unit						Windbreak
High inten- sity	Low and medium inten- sity	Mapping unit	Page	Irrigated		Dryland		Range site		group
				Symbol	Page	Symbol	Page	Name	Page	Number
---	PCD	Polatis-Tenno complex, undulating-----	41							
		Polatis part-----	--	-----	--	VIIIs-2	70	Loamy, 8 to 12 inches precipitation	74	--
		Tenno part-----	--	-----	--	VIIIs-2	70	Shallow Stony, 8 to 12 inches precipitation	75	--
PsA	---	Portino silt loam, 0 to 2 percent slopes-----	42	IIIs-1	65	VIIs-3	69	Loamy, 8 to 12 inches precipitation	74	1
PsB	---	Portino silt loam, 2 to 4 percent slopes-----	42	IIe-11	64	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	1
PsC	---	Portino silt loam, 4 to 8 percent slopes-----	42	IIIe-12	66	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	2
PtA	---	Portino stony silt loam, 0 to 2 percent slopes-----	42	IIIs-1	65	VIIs-3	69	Loamy, 8 to 12 inches precipitation	74	1
PtB	---	Portino stony silt loam, 2 to 4 percent slopes-----	43	IIe-11	64	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	1
PtC	---	Portino stony silt loam, 4 to 8 percent slopes-----	43	IIIe-12	66	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	2
PtD	---	Portino stony silt loam, 8 to 12 percent slopes-----	43	IVe-2	67	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	2
PuA	---	Portino-Knull silt loams, 0 to 2 percent slopes-----	43	IIIs-1	65	VIIs-3	69	Loamy, 8 to 12 inches precipitation	74	--
PuB	---	Portino-Knull silt loams, 2 to 4 percent slopes-----	43	IIe-11	64	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	--
---	PFD	Portino-Thornock complex, undulating-----	43							
		Portino part-----	--	-----	--	VIIIs-2	70	Loamy, 8 to 12 inches precipitation	74	--
		Thornock part-----	--	-----	--	VIIIs-2	70	Shallow Stony, 8 to 12 inches precipitation	75	--
PvA	---	Portneuf silt loam, 0 to 2 percent slopes-----	44	IIc-2	65	VIc-1	69	Loamy, 8 to 12 inches precipitation	74	1
PvB	---	Portneuf silt loam, 2 to 4 percent slopes-----	44	IIe-1	64	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	1
PvC	---	Portneuf silt loam, 4 to 8 percent slopes-----	44	IIIe-1	65	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	2
PvD	---	Portneuf silt loam, 8 to 12 percent slopes-----	45	IVe-1	67	VIe-1	69	Loamy, 8 to 12 inches precipitation	74	2
Pw	---	Presto loamy sand-----	45	IVe-5	67	VIIe-1	70	Sandy, 8 to 12 inches precipitation	76	5
---	ReD	Rexburg silt loam, 4 to 12 percent slopes-----	46	-----	--	IIIe-4	68	Loamy, 12 to 16 inches precipitation	77	--
---	ReE	Rexburg silt loam, 12 to 20 percent slopes-----	46	-----	--	IIIe-4	68	Loamy, 12 to 16 inches precipitation	77	--
---	RGF	Rexburg-Wahtigup association, hilly-----	46							
		Rexburg part-----	--	-----	--	IIIe-4	68	Loamy, 12 to 16 inches precipitation	77	--
		Wahtigup part-----	--	-----	--	VIe-1	69	Loamy, 12 to 16 inches precipitation	77	--
---	RGG	Rexburg-Wahtigup association, steep-----	47							
		Rexburg part-----	--	-----	--	VIIe-0	70	Steep Slopes, 12 to 16 inches precipitation	78	--
		Wahtigup part-----	--	-----	--	VIIe-0	70	Steep Slopes, 8 to 12 inches precipitation	76	--
---	RHF	Ricrest stony loam, hilly-----	48	-----	--	VIe-1	69	Steep Slopes, 16 to 22 inches precipitation	78	--
---	RHG	Ricrest stony loam, steep-----	47	-----	--	VIIe-0	70	Steep Slopes, 16 to 22 inches precipitation	78	--
---	RIG	Ricrest extremely stony loam, very steep-----	48	-----	--	VIIIs-2	70	-----	--	--
---	RLF	Ricrest-Wahtigup stony loams, hilly-----	48							
		Ricrest part-----	--	-----	--	VIe-1	69	Steep Slopes, 16 to 22 inches precipitation	78	--
		Wahtigup part-----	--	-----	--	VIe-1	69	Loamy, 12 to 16 inches precipitation	77	--
---	RLG	Ricrest-Wahtigup stony loams, steep-----	48							
		Ricrest part-----	--	-----	--	VIIe-0	70	Steep Slopes, 16 to 22 inches precipitation	78	--
		Wahtigup part-----	--	-----	--	VIIe-0	70	Steep Slopes, 8 to 12 inches precipitation	76	--
Rv	---	Riverwash-----	48	VIIIw-1	68	-----	--	-----	--	--
---	RNF	Robin silt loam, rolling-----	49	-----	--	VIe-1	69	Loamy, 16 to 22 inches precipitation	78	--
---	RNG	Robin silt loam, steep-----	49	-----	--	VIIe-0	70	Steep Slopes, 16 to 22 inches precipitation	78	--
---	RoB	Robin silt loam, 0 to 4 percent slopes-----	48	-----	--	IIIc-9	69	Loamy, 16 to 22 inches precipitation	78	--
---	RoD	Robin silt loam, 4 to 12 percent slopes-----	49	-----	--	IIIe-9	68	Loamy, 16 to 22 inches precipitation	78	--
---	RoE	Robin silt loam, 12 to 20 percent slopes-----	49	-----	--	IIIe-9	68	Loamy, 16 to 22 inches precipitation	78	--
---	RPF	Robin-Gilispie complex, rolling-----	50							
		Robin part-----	--	-----	--	VIIIs-2	70	Loamy, 16 to 22 inches precipitation	78	--
		Gilispie part-----	--	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--
---	RPG	Robin-Gilispie complex, steep-----	50							
		Robin part-----	--	-----	--	VIIIs-2	70	Steep Slopes, 16 to 22 inches precipitation	78	--
		Gilispie part-----	--	-----	--	VIIIs-2	70	Steep Stony Slopes, 16 to 22 inches precipitation	79	--
---	RSF	Robin-Swanner association, hilly-----	50							
		Robin part-----	--	-----	--	VIe-1	69	Loamy, 16 to 22 inches precipitation	78	--
		Swanner part-----	--	-----	--	VIIIs-2	70	Shallow Stony, 12 to 16 inches precipitation	77	--
---	RSG	Robin-Swanner association, steep-----	50							
		Robin part-----	--	-----	--	VIIe-0	70	Steep Slopes, 16 to 22 inches precipitation	78	--
		Swanner part-----	--	-----	--	VIIIs-2	70	Steep Stony Slopes, 12 to 16 inches precipitation	77	--



## GUIDE TO MAPPING UNITS--Continued

Map symbol											
High inten- sity	Low and medium inten- sity	Mapping unit	Page	Capability unit				Range site	Windbreak group		
				Irrigated		Dryland					
				Symbol	Page	Symbol	Page	Name	Page	Number	
SaA	---	Sasser fine sandy loam, 0 to 2 percent slopes-----	50	IIIs-3	66	-----	--	-----	--	1	
SaB	---	Sasser fine sandy loam, 2 to 4 percent slopes-----	51	IIIE-13	66	-----	--	-----	--	1	
SaC	---	Sasser fine sandy loam, 4 to 8 percent slopes-----	51	IIIE-13	66	-----	--	-----	--	2	
---	SeD	Sessions silt loam, 4 to 12 percent slopes-----	51	-----	--	IIIE-9	68	Loamy, 16 to 22 inches precipitation	78	--	
---	SeE	Sessions silt loam, 12 to 20 percent slopes-----	52	-----	--	IIIE-9	68	Loamy, 16 to 22 inches precipitation	78	--	
---	SMF	Sessions silt loam, rolling-----	52	-----	--	VIe-1	69	Loamy, 16 to 22 inches precipitation	78	--	
---	SNF	Sessions-Nielsen complex, hilly-----	53								
		Sessions part-----	--	-----	--	VIIIs-2	70	Loamy, 16 to 22 inches precipitation	78	--	
		Nielsen part-----	--	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--	
---	SNF2	Sessions-Nielsen complex, hilly, eroded-----	53								
		Sessions part-----	--	-----	--	VIIIs-2	70	Loamy, 16 to 22 inches precipitation	78	--	
		Nielsen part-----	--	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--	
---	SOF	Sheege extremely stony loam, hilly-----	53	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--	
---	SOG	Sheege extremely stony loam, steep-----	53	-----	--	VIIIs-2	70	Steep Stony Slopes, 16 to 22 inches precipitation	79	--	
---	SPF	Sheege-Pavohroo association, hilly-----	53								
		Sheege part-----	--	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--	
		Pavohroo part 4/-----	--	-----	--	VIe-1	69	-----	--	--	
---	SRF	Sheege-Robin association, hilly-----	54								
		Sheege part-----	--	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--	
		Robin part-----	--	-----	--	VIe-1	69	Loamy, 16 to 22 inches precipitation	78	--	
---	SRG	Sheege-Robin association, steep-----	54								
		Sheege part-----	--	-----	--	VIIIs-2	70	Steep Stony Slopes, 16 to 22 inches precipitation	79	--	
		Robin part-----	--	-----	--	VIIe-0	70	Steep Slopes, 16 to 22 inches precipitation	78	--	
---	SS	Spaa extremely rocky loam-----	54	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--	
StA	---	Stan fine sandy loam, 0 to 2 percent slopes-----	55	IIe-4	64	-----	--	-----	--	1	
StB	---	Stan fine sandy loam, 2 to 4 percent slopes-----	55	IIe-3	64	-----	--	-----	--	1	
---	SU	Stony rock land-----	55	-----	--	VIIIs-1	70	-----	--	1	
---	SWF	Swanner extremely stony loam, hilly-----	55	-----	--	VIIIs-2	70	Shallow Stony, 12 to 16 inches precipitation	77	--	
---	SWG	Swanner extremely stony loam, steep-----	56	-----	--	VIIIs-2	70	Steep Stony Slopes, 12 to 16 inches precipitation	77	--	
TdB	---	Tenno stony loam, 0 to 4 percent slopes-----	56	IVs-1	67	VIIIs-2	70	Shallow Loamy, 8 to 12 inches precipitation	74	--	
TdC	---	Tenno stony loam, 4 to 8 percent slopes-----	56	IVe-2	67	VIIIs-2	70	Shallow Loamy, 8 to 12 inches precipitation	74	--	
---	TED	Tenno extremely stony loam, undulating-----	57	-----	--	VIIIs-2	70	Shallow Stony, 8 to 12 inches precipitation	75	--	
---	TM	Terrace escarpments-----	57	-----	--	VIIIE-1	70	-----	--	--	
---	TNF	Tetonia silt loam, rolling-----	57	-----	--	VIe-1	69	Loamy, 12 to 16 inches precipitation	77	--	
---	TNG	Tetonia silt loam, steep-----	57	-----	--	VIIe-0	70	Steep Slopes, 12 to 16 inches precipitation	78	--	
---	TOF	Tetonia-Gilispie association, hilly-----	57								
		Tetonia part-----	--	-----	--	VIe-1	69	Loamy, 12 to 16 inches precipitation	77	--	
		Gilispie part-----	--	-----	--	VIIIs-2	70	Shallow Stony, 16 to 22 inches precipitation	79	--	
---	TOG	Tetonia-Gilispie association, steep-----	58								
		Tetonia part-----	--	-----	--	VIIe-0	70	Steep Slopes, 12 to 16 inches precipitation	78	--	
		Gilispie part-----	--	-----	--	VIIIs-2	70	Steep Stony Slopes, 16 to 22 inches precipitation	79	--	
ThB	---	Thornock stony loam, 0 to 4 percent slopes-----	58	IVs-1	67	VIIIs-2	70	Shallow Loamy, 8 to 12 inches precipitation	74	--	
ThC	---	Thornock stony loam, 4 to 8 percent slopes-----	58	IVe-2	67	VIIIs-2	70	Shallow Loamy, 8 to 12 inches precipitation	74	--	

GUIDE TO MAPPING UNITS--Continued

Map symbol										Windbreak group
High inten-sity	Low and medium inten-sity	Mapping unit	Page	Capability unit				Range site	Page	Number
				Irrigated		Dryland				
---	TTD	Thornock extremely stony loam, undulating-----	58	-----	--	VIIIs-2	70	Shallow Stony, 8 to 12 inches precipitation	75	--
---	TUF	Turnerville silt loam, hilly <u>5</u> /-----	59	-----	--	VIe-1	69	-----	--	--
---	WHF	Wahtigup stony loam, hilly-----	59	-----	--	VIe-1	69	Loamy, 12 to 16 inches precipitation	77	--
---	WHG	Wahtigup stony loam, steep-----	60	-----	--	VIIe-0	70	Steep Slopes, 8 to 12 inches precipitation	76	--
WaA	---	Wapello fine sandy loam, 0 to 2 percent slopes-----	60	IIe-4	64	-----	--	-----	--	1
WaB	---	Wapello fine sandy loam, 2 to 4 percent slopes-----	61	IIe-3	64	-----	--	-----	--	1
Wb	---	Wardboro soils-----	61	IVs-1	67	VIIe-1	70	River Bottom, 8 to 12 inches precipitation	76	--
WcD	---	Waycup extremely stony loam, 0 to 12 percent slopes-----	61	-----	--	VIIIs-2	70	Stony, 8 to 12 inches precipitation	75	--
We	---	Weeding loamy sand-----	62	IVe-5	67	-----	--	-----	--	4
---	WOF	Wolverine sand, rolling-----	62	-----	--	VIIe-1	70	Sands, 8 to 12 inches precipitation	75	--

1/ This soil is in woodland suitability group 3.  
2/ This soil is in woodland suitability group 2.  
3/ Dranyon part of this unit is in woodland suitability group 2.

4/ This soil is in woodland suitability group 4.  
5/ This soil is in woodland suitability group 1.





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