

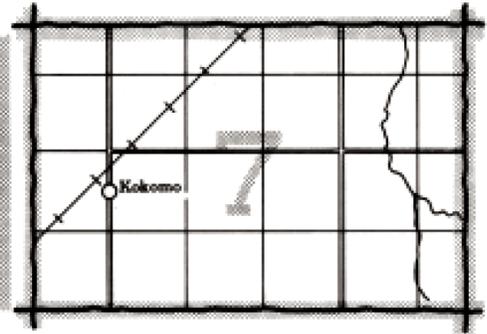
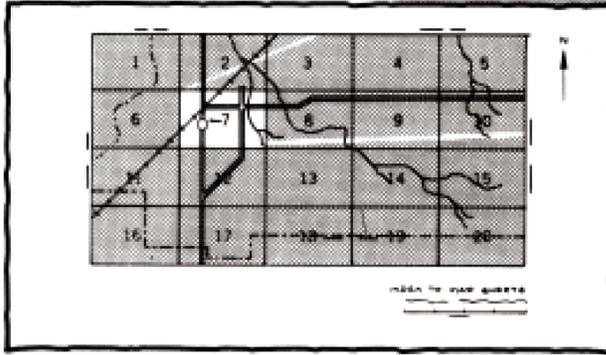
**SOIL SURVEY OF  
SUMMIT COUNTY AREA,  
COLORADO**



**United States Department of Agriculture  
Soil Conservation Service  
in cooperation with  
Colorado Agricultural Experiment Station**

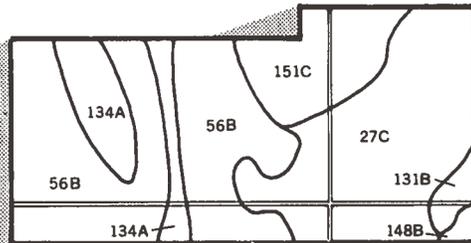
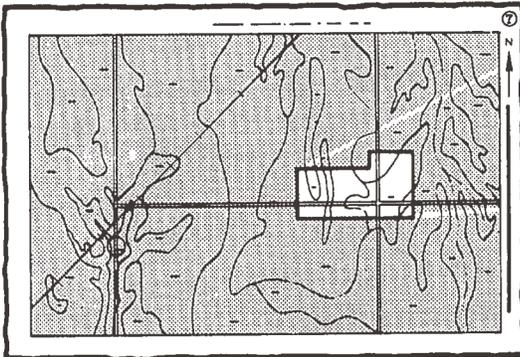
# HOW TO USE

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

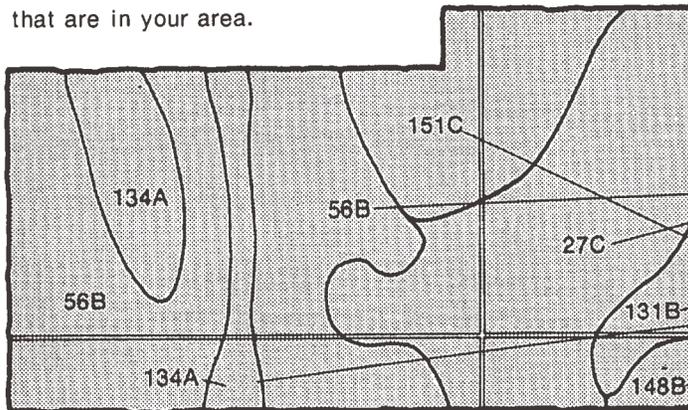


2. Note the number of the map sheet and turn to that sheet.

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



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

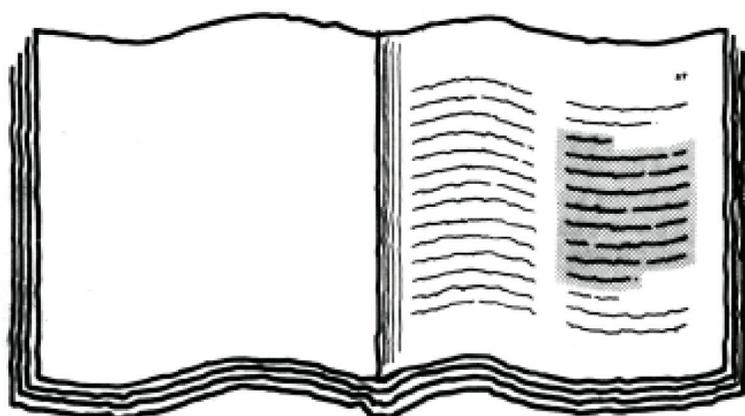


## Symbols

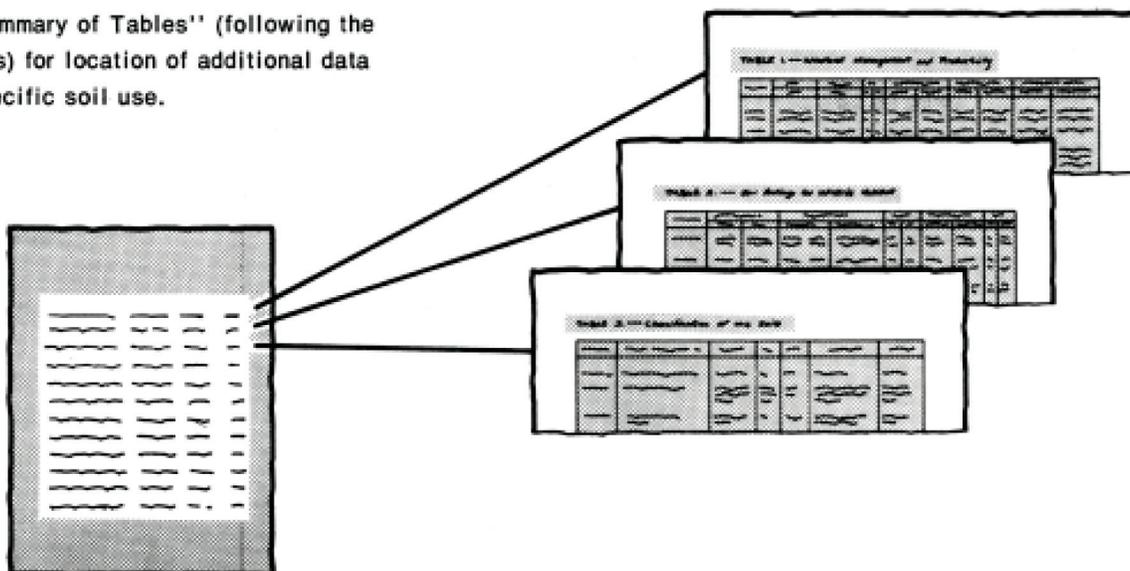
- 27C
- 56B
- 131B
- 134A
- 148B
- 151C

# THIS SOIL SURVEY

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

A detailed illustration of a table with multiple columns and rows, representing the 'Index to Soil Map Units'. The table contains various entries, likely listing map unit names and their corresponding page numbers. The text is too small to read, but the structure is that of a standard index table.

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



Consult "Contents" for parts of the publication that will meet your specific needs.

7. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

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

Major fieldwork for this soil survey was completed in the period 1971-1973. Soil names and descriptions were approved in September 1974. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1973. This survey was made cooperatively by the Soil Conservation Service and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the Summit County Commissioners and the Middle Park Soil Conservation District.

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

**Cover: Typical area of Youga and Anvik soils, in the foreground, and Frisco and Peeler soils, in the background. Eagle Nest Peak is in the far background.**

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## Foreword

This soil survey contains much information useful in land-planning programs in the Summit County Area. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

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

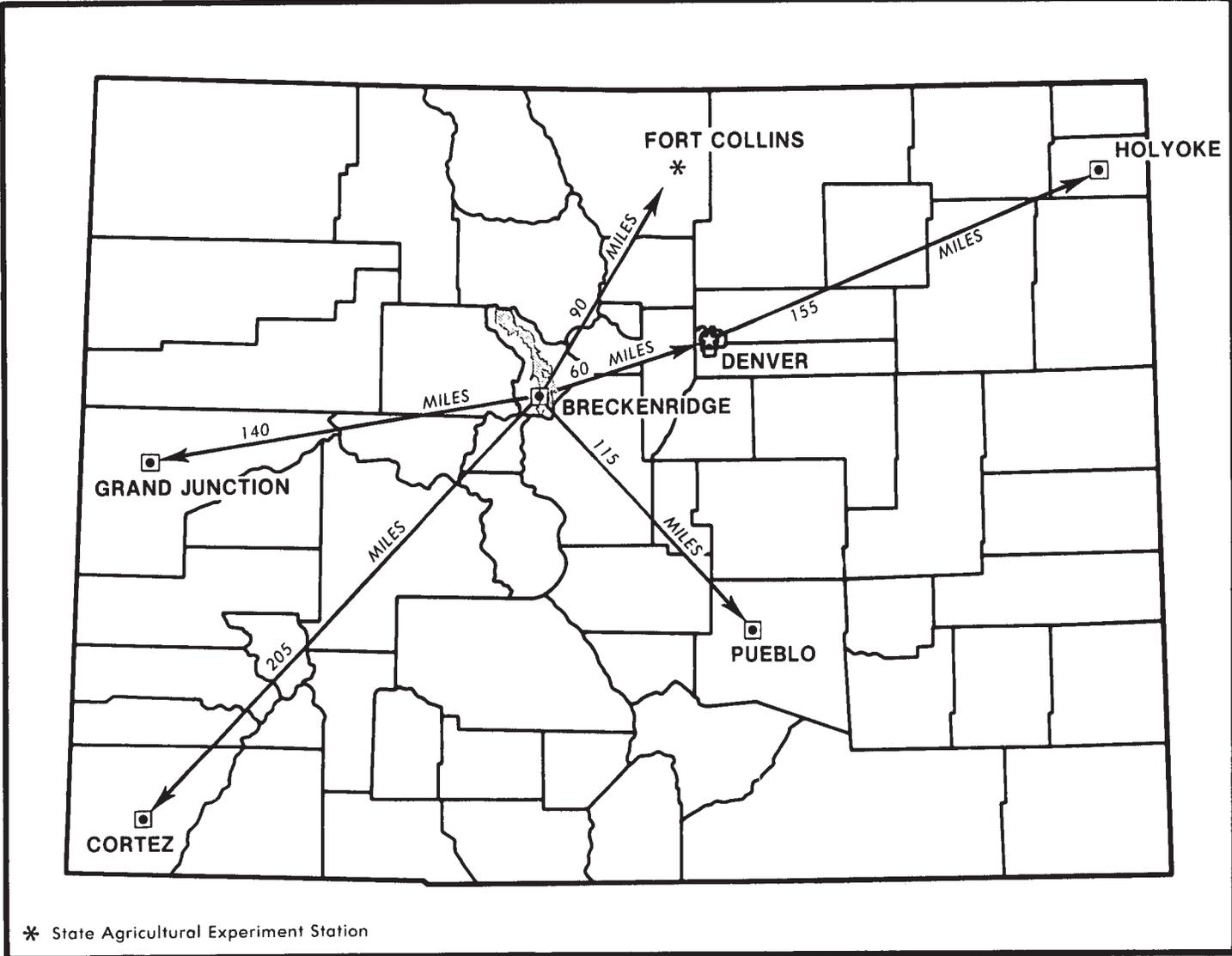
Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to use as septic tank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

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

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



Robert G. Halstead  
State Conservationist  
Soil Conservation Service



Location of Summit County Area in Colorado.

# SOIL SURVEY OF SUMMIT COUNTY AREA, COLORADO

By Ray L. Miles and Louis A. Fletcher, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,  
in cooperation with Colorado Agricultural Experiment Station

The SUMMIT COUNTY AREA consists of the central part of Summit County, which is in the north-central part of Colorado. Most of the National Forest lands in the survey area are excluded. The survey area covers 102,976 acres, or about 161 square miles, whereas all of Summit County covers 394,240 acres, or 616 square miles.

The Area is in the central Rocky Mountain geographic region. Breckenridge, the county seat, is at an elevation of 9,640 feet. Elevation ranges from about 7,600 feet in the northern corner of the survey area to about 11,500 feet in the southern part. The Area consists of steep mountain uplands and glacial drift. It is drained mainly by the Blue River, which crosses it from south to north. Ten Mile Creek crosses the area from west to east and joins the Blue River at Dillon Reservoir.

## General nature of the area

This section gives general information about the Summit County Area. It discusses settlement, agriculture, natural resources, and climate.

## Settlement

Colorado became part of the United States in 1819 as a result of separate treaties with Spain and with the Ute Indians. Claims to the area were strengthened by the explorations of John C. Fremont in 1844 and 1845, and Colorado officially became a territory in 1861 (4).

The discovery of gold near Breckenridge in 1859 started the booms of 1860, 1878, and 1898 in the area. A fourth boom that is going on now is centered around recreation.

When Colorado became a state in 1876, Summit County was one of the original 17 counties. Summit County was so named because of the mountainous character of its territory. Its eastern boundary followed "the summit of the snowy range" from a point south of Breckenridge to the Wyoming line and west to the Utah line (3). The county did not officially become a part of the United States until August 1936. Because of an oversight, no one had ever made a legal claim to this strip of "no man's land."

By June of 1860 there were about 8,000 people in the county, and the population in 1970 was 2,665. Breckenridge, the county seat, has a population of 548. Frisco, the second largest town, has a population of 471. Other towns in the survey area are Dillon, Blue River, Montezuma, and Silverthorne. There are several ghost towns, and the names are about all that remain—Argentine, Lincoln City, Tiger, Parkville, and Dyersville. Dillon is a relocated town; old Dillon is under the Dillon Reservoir, which was completed in 1963.

## Agriculture

Ranchers in the Summit County Area have had to adapt to the long cold winters during which their irrigated grass meadows are covered with several feet of snow. They either move their livestock to warmer climates or cut and stack the grass hay from their meadows for feed during these winter months.

The Middle Park Soil Conservation District, which was formed in 1957, assists ranchers in management of their grazing systems and irrigation water. Since 1972, the District Board has reviewed subdivision plans for the County Commissioners and helped to make land use decisions. The District assists land owners with seeding, brush management, and fertilizer recommendations.

The capability of most of the soils in the Summit County Area for agricultural production is limited by a cold climate and short growing season. In the past, truck farming of lettuce and potatoes was important in the Area. Today, however, small truck farmers can not economically compete with the advanced technology of agriculture in other parts of the United States.

Agriculture is steadily declining as land is converted to recreation sites and homesites. At present, recreation is of major importance to the economy of the Area.

## Natural resources

Water is one of the most important natural resources in the Area. It is used to generate power at Green Mountain

Reservoir, to supply domestic water needs at Dillon Reservoir, and to irrigate hay meadows. Both reservoirs are used for fishing and boating.

Soil is also an important natural resource. Livestock and wildlife graze the range plants that are produced by the soil. The soil is also used as homesites and sites for recreation.

Very small amounts of gold and silver are still mined in the Breckenridge area. Mining, however, has sharply declined since the 1890's.

Because of the increase in recreation homesite subdivisions, many small ranches have gone out of production. In the northern part of the Area, however, there are still a few ranches. They use water from the Blue River and other streams to irrigate grass hay. Their livestock graze the natural rangeland during the summer months.

Many privately owned areas have an abundance of trees that have potential commercial uses. Timber is a natural resource that can be sold for sawlogs, poles, or Christmas trees, and it can also be used for firewood.

## Climate

In the Summit County Area, summers are warm or hot in most valleys and are much cooler in the mountains. Winters are cold in the mountains. Valleys are colder than the lower slopes of adjacent mountains because of cold air drainage. Precipitation occurs in the mountains throughout the year, and a deep snowpack accumulates during winter. Snowmelt usually supplies much more water than can be used for agriculture in the county. In valleys, precipitation in summer falls as showers; some thunderstorms occur. In winter the ground is covered with snow much of the time. Chinook winds, which blow downslope and are warm and dry, often melt and evaporate the snow.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Green Mountain Dam and Dillon, Colorado, for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season. Green Mountain Dam represents the lower parts of the valleys in the county, and Dillon represents the upper parts.

In lower valleys in winter the average temperature is 19.5 degrees F., and the average daily minimum is 6.5 degrees. The lowest temperature on record, -44 degrees, occurred at Green Mountain Dam on February 1, 1951. In summer the average temperature is 60.4 degrees, and the average daily maximum is 78 degrees. The highest temperature, 98 degrees, was recorded on August 11, 1964.

In the upper parts of valleys in winter the average temperature is 17.6 degrees F., and the average daily minimum is 1.5 degrees. The lowest temperature on record, -45 degrees, occurred at Dillon on February 1, 1951. In summer the average temperature is 53.6 degrees, and the average daily maximum is 72.4 degrees. The highest temperature, 86 degrees, was recorded on June 23, 1954.

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

Of the total annual precipitation, 8.8 inches, or 57 percent, usually falls during the period April through September, which includes the growing season for most crops. In 2 years in 10, the April to September rainfall is less than 6.9 inches. The heaviest 1-day rainfall during the period of record was 1.5 inches at Green Mountain Dam on September 27, 1959. Thunderstorms number about 41 each year, 29 of which occur in summer.

Average seasonal snowfall is 88 inches in the lower valleys and 147 inches in the upper valleys. The greatest snow depth at any one time during the period of record was 36 inches. In the average year, 62 days have at least 1 inch of snow on the ground, but the number of days varies greatly from year to year.

The average relative humidity in mid-afternoon is about 41 percent. Humidity is higher at night, and the average at dawn is about 69 percent. The amount of possible sunshine is 71 percent. The prevailing direction of the wind is from the south. Average windspeed is highest, 10.4 miles per hour, in April.

## How this survey was made

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

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, 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 soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

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

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

## General soil map for broad land use planning

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

The general soil map provides a broad perspective of the soils and landscape in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

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

## Map unit descriptions

### 1. Frisco-Peeler-Muggins

*Strongly acid to mildly alkaline, deep, medium textured and fine textured soils on mountainsides*

This map unit makes up about 37 percent of the survey area. It occurs along the eastern and western parts of the soil survey area. Annual precipitation averages 18 to 30 inches; about two-thirds occurs in the spring and summer. Elevation ranges from 8,000 to 11,000 feet.

About 40 percent of this map unit consists of Frisco soils, 25 percent is Peeler soils, and 10 percent is Muggins soils. The remaining 25 percent consists of Anvik and Grenadier soils and areas of Histic Cryaquolls and Rock outcrop.

Frisco soils are deep, well drained, and moderately permeable. They have a very pale brown sandy loam surface layer and a light yellowish brown very stony sandy clay loam subsoil. The subsoil and substratum contain 35 percent or more, by volume, rock fragments larger than 3 inches in diameter.

Peeler soils are deep, well drained, and moderately permeable. They have a very pale brown sandy loam surface layer and a light yellowish brown and pale brown cobbly sandy clay loam subsoil. The subsoil and substratum contain less than 35 percent, by volume, rock fragments larger than 3 inches in diameter.

Both the Frisco and Peeler soils are moderately sloping to very steep. They are mostly on mountainsides and ridges. Slope is 6 to 65 percent. Parent material is glacial drift.

Muggins soils are deep, well drained, and slowly permeable. They have a pinkish gray sandy loam surface layer and a light reddish brown sandy clay subsoil. The subsoil and substratum contain less than 25 percent rock fragments, by volume. Muggins soils are nearly level to steep. They are on mountainsides, ridges, and fans. Slope is 0 to 35 percent. Parent material is glacial drift.

This map unit is used for timber production, recreation, and wildlife. The dominant vegetation is lodgepole pine, Engelmann spruce, blue spruce, subalpine fir, and Douglas-fir. Quaking aspen has replaced conifers in some areas due to fire or other disturbances. Grass species include Thurber fescue, nodding brome, Idaho fescue, and wheatgrasses. Forbs, which are sparse, include showy cinquefoil, yarrow, geranium, and aspen peavine.

### 2. Quander-Youga-Anvik

*Slightly acid to mildly alkaline, deep, medium textured soils on mountainsides, ridges, and fans*

This map unit makes up about 20 percent of the survey area. It occurs in the north-central part of the survey area on the west side of Green Mountain Reservoir and in the area between Acorn Creek and Brush Creek. Annual precipitation is 14 to 18 inches; about two-thirds occurs in the spring and summer. Elevation ranges from 7,500 to 9,500 feet.

About 30 percent of this map unit consists of Quander soils, 30 percent is Youga soils, and 25 percent is Anvik soils. The remaining 15 percent consists of Handran soils and Rock outcrop.

Quander soils are deep, well drained, and moderately permeable. They have a dark grayish brown cobbly loam surface layer and a brown very cobbly sandy clay loam subsoil. The subsoil and substratum contain 35 percent or more, by volume, rock fragments larger than 3 inches in diameter. Quander soils are nearly level to very steep. They are on mountainsides, ridges, and fans. Slope is 0 to 55 percent. Parent material is glacial drift.

Youga soils are deep, well drained, and moderately slowly permeable. They have a dark grayish brown loam surface layer and a yellowish brown and strong brown clay loam subsoil. The subsoil contains less than 25 percent rock fragments, by volume. Youga soils are nearly level to steep. They are on mountainsides and fans and in swales. Slope is 0 to 50 percent. Parent material is glacial drift.

Anvik soils are deep, well drained, and moderately permeable. They have a brown loam surface layer, a pinkish gray loam subsurface layer, and a light yellowish brown cobbly clay loam subsoil and substratum. The subsoil and substratum contain less than 25 percent, by volume, rock fragments. Anvik soils are moderately sloping to steep. They are on mountainsides, ridges, and fans. Slope is 6 to 35 percent. Parent material is mixed colluvium and alluvium derived from a variety of rock.

This map unit is used for range and wildlife. The dominant vegetation is sagebrush, rabbitbrush, bitterbrush, snowberry, serviceberry, wheatgrasses, bluegrasses, and buckwheat.

### 3. Cimarron-Yovimpa-Bucklon

*Neutral to moderately alkaline, shallow and deep, fine textured and medium textured soils on mountainsides and ridges*

This map unit makes up about 15 percent of the survey area. It occurs in the north-central part of the survey area on the east side of Green Mountain Reservoir and east of the Quander-Youga-Anvik unit. Annual precipitation is 14 to 18 inches; about two-thirds occurs in the spring and summer. Elevation ranges from 7,500 to 9,500 feet.

About 35 percent of this map unit consists of Cimarron soils, 30 percent is Yovimpa soils, and 25 percent is Bucklon soils. The remaining 10 percent consists of Leavitt and Quander soils and Rock outcrop.

Cimarron soils are 40 to 60 inches deep over shale or slate bedrock. They are well drained and slowly permeable. They have a grayish brown loam surface layer and a light olive brown clay subsoil. They are moderately sloping to steep and are on mountainsides. Slopes are 6 to 35 percent. Cimarron soils formed in material weathered from slate and shale.

Yovimpa soils are shallow, 10 to 20 inches deep over shale and slate bedrock. They are moderately well

drained and slowly permeable. They have a grayish brown clay loam surface layer and a light yellowish brown clay subsoil. They are moderately sloping to steep and are on mountainsides and ridges. Slope is 6 to 45 percent. Yovimpa soils formed in material weathered from shale and slate.

Bucklon soils are shallow—10 to 20 inches deep over slate and shale. They are well drained and moderately slowly permeable. They have a grayish brown loam surface layer and olive brown slaty light clay loam underlying material. These soils are moderately steep to steep. They are on mountainsides and ridges. Slope is 15 to 35 percent. Bucklon soils formed in material weathered from slate and shale.

This map unit is used for range and wildlife. The dominant vegetation is sagebrush, rabbitbrush, bitterbrush, serviceberry, wheatgrasses, bluegrasses, and buckwheat.

### 4. Grenadier-Leadville-Rock outcrop

*Strongly acid and very strongly acid, deep, medium textured soils on mountainsides and ridges*

This map unit makes up about 20 percent of the survey area. It occurs in the southern and eastern part of the survey area, mainly east and south of Breckenridge. Annual precipitation is 20 to 40 inches; about two-thirds occurs in the spring and summer. Elevation ranges from 8,500 to 13,000 feet.

About 60 percent of this map unit consists of Grenadier soils, 15 percent is Leadville soils, and 15 percent is Rock outcrop. The remaining 10 percent consists of the Frisco and Peeler soils and Histic Cryaquolls.

Grenadier soils are deep, well drained, and moderately permeable. They have a dark brown gravelly loam surface layer, a strong brown gravelly sandy clay loam subsoil and a brown very cobbly loam substratum. The subsoil and substratum contain more than 35 percent rock fragments, by volume.

Leadville soils are deep, well drained, and moderately permeable. They have a light reddish brown gravelly loam surface layer and a reddish brown very cobbly clay loam subsoil.

Both the Grenadier and Leadville soils are moderately steep to very steep. They are on mountainsides and ridges. The Grenadier soils formed in glacial drift. The Leadville soils formed in material weathered from sandstone.

This map unit is used for woodland, recreation, and wildlife. The dominant vegetation is Engelmann spruce, subalpine fir, lodgepole pine, and quaking aspen. There is a very sparse understory of grasses and forbs.

### 5. Cryaquolls-Handran

*Slightly acid to mildly alkaline, deep, coarse textured to fine textured soils on flood plains, fans, benches, and terraces*

This map unit makes up about 8 percent of the survey area. It occurs along the major streams and rivers in the

survey area. Annual precipitation is 14 to 25 inches; about two-thirds occurs in the spring and summer. Elevation is 7,500 to 10,000 feet.

About 45 percent of the map unit consists of Cumulic Cryaquolls and Histic Cryaquolls, and 45 percent is Handran soils. The remaining 10 percent consists of related soils that have coarser textures.

Cryaquolls are deep, poorly drained, rapidly permeable to slowly permeable soils. They have a dark colored loam or sandy loam surface layer and sandy loam to clay subsurface layers. They are underlain by sand, gravel, and cobbles at a depth of 1 to 4 feet. The water table is 1 to 2 feet from the surface. Cryaquolls are mainly nearly level. They are on flood plains, alluvial fans, valley benches, and terraces. Slopes are 0 to 5 percent. Cryaquolls formed in alluvium derived from a variety of rocks.

Handran soils are deep, well drained, and rapidly permeable. They have a brown gravelly loam surface layer, a brown gravelly sandy loam subsurface layer, and brown very cobbly loam underlying material. Rock fragments make up 35 to 85 percent of the soil and increase with depth. The Handran soils are nearly level to strongly sloping. They are on valley benches and fans. Slope is 0 to 15 percent.

Both the Cryaquolls and the Handran soils formed in alluvial deposits derived from a variety of rocks.

This map unit is used mainly for range and wildlife. Some areas are used for irrigated hayland. The dominant vegetation is wheatgrasses, bluegrasses, tufted hairgrasses, and sedges.

## Soil maps for detailed planning

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

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

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

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the

soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Frisco series, for example, was named for the town of Frisco in Summit County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Anvik loam, 6 to 15 percent slopes, is one of several phases within the Anvik series.

Some map units are made up of two or more dominant kinds of soil and are called soil complexes. A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Frisco-Peeler complex, 6 to 25 percent slopes, is an example.

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

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

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

## Soil descriptions

**1D—Anvik loam, 6 to 15 percent slopes.** This is a deep, well drained, moderately sloping to strongly sloping soil on mountainous uplands. It formed in colluvium and glacial drift derived from a variety of rocks. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is 35 to 75 days.

Small areas of Youga and Muggins soils and Youga thick surface soils are included in mapping. Also included are similar soils that have a 5- to 8-inch thick dark-colored surface layer.

Typically, the surface layer is brown loam about 10 inches thick. The subsurface layer is bleached, pinkish gray loam about 5 inches thick. The subsoil is light yellowish brown cobbly clay loam about 33 inches thick. The substratum is light yellowish brown cobbly light clay loam to a depth of 60 inches or more.

Permeability is moderate and the available water capacity is high. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage has a woodland overstory and an understory of grasses and forbs. Grazing by livestock is the major use, but this soil is also used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude the use of this soil for crops.

Management of this Anvik soil for range should include a deferred grazing system and limited thinning of the more densely wooded areas. Grasses recommended for seeding are slender wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of quaking aspen, lodgepole pine, Douglas-fir, and the understory consists of Thurber fescue, bluegrass, brome, and wheatgrass. The total annual production averages about 3,000 pounds of air-dry forage per acre.

This soil is not used for timber production; there is only a scattering of coniferous trees. Areas have limited use for quaking aspen but can be used as calving sites by ranchers with cattle. Thinned-out trees are used for firewood.

Excessive slope is the most limiting soil property to be considered in the design of access roads and recreation homesite subdivisions. Snow removal becomes an increasingly greater problem as more homes are built. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff, caused by snowmelt, increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Wildlife on this wooded soil includes mule deer, elk, blue grouse, snowshoe hare, mourning dove, and chipmunks. The natural migration of deer and elk herds has been disturbed in many areas now used for recreation homesite subdivisions. Capability subclass VIe.

**1F—Anvik loam, 15 to 35 percent slopes.** This is a deep, well drained, moderately steep and steep soil on mountainous uplands. It formed in colluvium and glacial drift derived from a variety of rocks. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is 35 to 75 days.

Small areas of Youga, Peeler, and Quander soils and the Youga thick surface soils are included in mapping.

Also included are similar soils that have a dark-colored surface layer 5 to 8 inches thick.

Typically, the surface layer is brown loam about 10 inches thick. The subsurface layer is bleached, pinkish gray loam about 5 inches thick. The subsoil is light yellowish brown cobbly clay loam about 33 inches thick. The substratum is light yellowish brown cobbly light clay loam to a depth of 60 inches or more.

Permeability is moderate and the available water capacity is high. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage has a woodland overstory and an understory of grasses and forbs. Grazing by livestock is the major use of this soil, but it is also used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude using the soil as cropland.

Management of this Anvik soil for range should include a deferred grazing system and limited thinning of the more densely wooded areas. Grasses recommended for seeding are slender wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of quaking aspen, lodgepole pine, and Douglas-fir, and the understory is Thurber fescue, bluegrasses, bromes, and wheatgrasses. The total annual production averages about 2,500 pounds of air-dry forage per acre.

These areas are not used for timber production because they have only a scattering of coniferous trees. They have limited use for quaking aspen but may be used as calving sites by ranchers with cattle. Thinned out trees are used for firewood.

Excessive slope is the most limiting soil property to be considered in the design of access roads and recreation homesite subdivisions. Snow removal becomes an increasingly greater problem as more homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding minimizes the erosion hazard but is difficult. Homes should be designed to utilize existing slope, and foundation cuts should be kept to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt water. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Wildlife on this wooded soil includes mule deer, elk, blue grouse, snowshoe hare, mourning dove, and chipmunks. The natural migration of deer and elk herds has been disturbed in many areas now used by recreation homesite subdivisions. Capability subclass VIIe.

**2F—Bucklon loam, 15 to 35 percent slopes.** This is a shallow, well drained, moderately steep and steep soil on mountain side slopes and ridges. It formed in material weathered from slate and shale bedrock. The average annual precipitation is about 15 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is 35 to 75 days.

Small areas of Yovimpa and Cimarron soils are included in mapping. Shale outcrops and similar soils that contain more than 35 percent channery fragments in the profile are also included.

Typically, the surface layer is grayish brown loam about 10 inches thick. The underlying material is olive brown slaty light clay loam. It overlies shale bedrock at a depth of about 18 inches.

Permeability is moderately slow, and the available water capacity is low. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage is rangeland, but some areas are used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude use of the soil for crops.

Management of this soil for range includes using a deferred grazing system and brush control. Grasses recommended for seeding include western wheatgrass, Indian ricegrass, and bluebunch wheatgrass. The dominant native vegetation consists of western wheatgrass, needle-and-thread, Indian paintbrush, and big sagebrush. The total annual production averages about 1,000 pounds of air-dry forage per acre.

Excessive slope and shallow depth to bedrock are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Shallow depth to bedrock makes it difficult to excavate for access roads and foundations for buildings. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slope, and the foundation cuts should be kept to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost and shrink-swell action.

Rangeland wildlife on this soil includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIe.

**3D—Cimarron loam, 6 to 15 percent slopes.** This is a deep, well drained, moderately sloping to strongly sloping soil on mountainous uplands. It formed in local alluvium derived from shale and in shale residuum. The average annual precipitation is about 16 inches, the average annual air temperature is about 32 degrees F, and the frost-free season is about 35 to 75 days.

Small areas of Bucklon, Yovimpa, and Youga soils are included in mapping. Also included are small areas of a soil that has a bleached light-colored layer at the surface or below the dark-colored surface layer. A few small areas of soils that have bedrock at a depth of less than 40 inches and soils that have weak subsoil development are also included. Small areas of soils that have 1 to 2 inches

of peat on the surface and are mottled in the subsoil as a result of continuous irrigation are included.

Typically, the surface layer is grayish brown loam about 14 inches thick. The subsoil is light olive brown clay about 25 inches thick. The substratum is light brownish gray clay, and it overlies shale bedrock at a depth of about 45 inches.

Permeability is slow, and the available water capacity is high. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage is rangeland, but some areas are used for irrigated hayland and also recreation and wildlife habitat. A cold climate and a short growing season limit production of introduced grasses and preclude the use of this soil as cropland.

Management of this soil for range includes the use of a deferred grazing system and limited brush control. Where this soil is irrigated, ditches and fields need to be carefully designed to control irrigation water. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, mountain brome, Arizona fescue, big bluegrass, and bluebunch wheatgrass. The dominant native vegetation consists of western wheatgrass, slender wheatgrass, Junegrass, big sagebrush, snowberry, and numerous forbs. The total annual production averages about 1,600 pounds of air-dry forage per acre.

Excessive slope and high shrink-swell potential are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Snow removal becomes an increasingly greater problem as more homes are built. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Foundations should also be designed to withstand the shrinking and swelling of the clayey subsoil. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost and shrink-swell action.

Rangeland wildlife on this soil includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIe.

**3F—Cimarron loam, 15 to 35 percent slopes.** This is a deep, well drained, moderately steep to steep soil on mountainous uplands. It formed in local shale alluvium and shale residuum. The average annual precipitation is about 16 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is about 35 to 75 days.

Small areas of Bucklon, Yovimpa, and Youga soils are included in mapping. Also included are small areas of a soil that has a bleached light-colored layer either at the

surface or below the dark-colored surface layer. A few small areas of soils that have bedrock at a depth of less than 40 inches or that have weak subsoil development are also included. Small areas where 1- to 2-inch peat layers are on the surface and the subsoil is mottled as a result of continuous irrigation are included.

Typically, the surface layer is grayish brown loam about 14 inches thick. The subsoil is light olive brown clay about 25 inches thick. The substratum is light brownish gray clay, and it overlies shale bedrock at a depth of about 45 inches.

Permeability is slow, and the available water capacity is high. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage is rangeland, but some areas are used as irrigated hayland and for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude the use of this soil as cropland.

Management of this soil for range includes the use of a deferred grazing system and limited brush control. Where this soil is irrigated, ditches and fields need to be carefully designed to control irrigation water. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, mountain brome, Arizona fescue, big bluegrass, and bluebunch wheatgrass. The dominant native vegetation consists of western wheatgrass, slender wheatgrass, Junegrass, big sage, snowberry, and numerous forbs. The total annual production averages about 1,500 pounds of air-dry forage per acre.

Excessive slope and high shrink-swell potential are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Snow removal becomes an increasingly greater problem as more homes are built. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Foundations should also be designed to withstand the shrinking and swelling of the clayey subsoil and substratum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost and shrink-swell action.

Rangeland wildlife on this soil includes deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIe.

**4—Cumulic Cryaquolls, nearly level.** Cumulic Cryaquolls are on flood plains. They are poorly drained soils that are subject to annual flooding. Slope is 0 to 5 percent. Cumulic Cryaquolls have a black surface layer 20 or more inches thick and are underlain by sand and gravel at a depth of 2 to 4 feet. Texture above those

depths ranges from sandy loam to clay and is commonly stratified. The water table is within 12 to 24 inches of the surface sometime during the growing season. The available water capacity is low to high, and permeability is rapid to slow. Surface runoff is slow. The hazard of erosion by wind and water is slight.

Included in mapping are small areas of soils like Cumulic Cryaquolls that have no dark colored surface layer or a thinner one. Also included are areas of Histic Cryaquolls.

Most of the acreage is irrigated hayland, but some of it is used by wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of Cumulic Cryaquolls requires proper use of irrigation water, subsurface drainage, and fertilization to maintain grass hay production. Grasses recommended for seeding are slender wheatgrass, mountain brome, reed canarygrass, and big bluegrass. The dominant native vegetation consists of tufted hairgrass, slender wheatgrass, Nebraska sedge, reedgrass, willows, shrubby cinquefoil, and numerous forbs. The total annual production averages about 2,500 pounds of air-dry forage per acre.

These soils are used mainly for irrigated grass-hay production. Before the construction of Dillon and Green Mountain Reservoirs, irrigation was accomplished by the natural flooding from spring snowmelt. Now that the dams control the flooding, irrigation ditches must carry the water to the hayland. Irrigation systems should be designed to avoid over-irrigation and ponding and to return excess water to the river. Ponding of irrigation water results in decreased hay production.

Spring fertilization is recommended because fall application can result in fertilizer being lost during spring snowmelt. Nitrogen and phosphate are recommended for most irrigated hayland.

Seasonal flooding and depth to water table are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. The flooding hazard makes these soils unsuitable for such uses. They should be reserved for greenbelts, golf courses, and other restricted uses. Onsite investigations are needed before any construction is planned because there is a wide variation of soil properties. Flood protection measures should be designed to control at least the storms of 1 in 100 year severity. Adequate soil drainage is needed for most land uses.

Rangeland and wetland wildlife include deer, sage grouse, white-tailed jackrabbit, mourning dove, ducks, mink, and beaver. Capability subclass VIw.

**5E—Frisco-Peeler complex, 6 to 25 percent slopes.** These are deep, well drained, moderately sloping to moderately steep soils on fans, mountainsides, and ridges in the south-central part of the survey area. They formed in glacial drift derived from a variety of rocks. Elevation is 8,500 to 11,000 feet. The average annual precipitation is about 21 inches, the average annual air temperature is

about 34 degrees F, and the frost-free season is 30 to 40 days. The Frisco soil makes up about 55 percent of this complex, and the Peeler soil makes up about 35 percent. Included in mapping and making up 10 percent of the acreage are small areas of Grenadier, Muggins, and Anvik soils; Cumulic Cryaquolls; and Rock outcrop.

Typically, the surface of the Frisco soil is covered by a duff layer of needles and twigs about 3 inches thick. Below that is a leached layer of very pale brown sandy loam about 16 inches thick. The subsoil is light yellowish brown very stony sandy clay loam about 51 inches thick. The substratum is light yellowish brown very stony sandy clay loam to a depth of 80 inches or more.

The Frisco soil has moderate permeability and medium available water capacity. The effective rooting depth is 60 inches. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Typically, the surface of the Peeler soil is covered by a duff layer of needles and twigs about 3 inches thick. Below that is a leached layer of very pale brown sandy loam about 15 inches thick. Next is a layer of very pale brown and yellowish brown cobbly sandy clay loam about 7 inches thick. The subsoil is light yellowish brown and pale brown cobbly sandy clay loam about 33 inches thick. The substratum is light yellowish brown cobbly light sandy clay loam to a depth of 60 inches or more.

The Peeler soil has moderate permeability and high available water capacity. The effective rooting depth is 60 inches. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage of this complex is woodland that is used for recreation, wildlife, and timber production. A cold climate and a short growing season limit the production of introduced grasses and wood crops.

The dominant native vegetation consists of lodgepole pine, subalpine fir, Engelmann spruce, and a sparse understory of grasses, shrubs, and forbs.

The Frisco and Peeler soils are suited to the production of lodgepole pine; 10,200 board feet of merchantable timber can be produced from a fully-stocked, even-aged stand of 80-year-old trees. Thinning operations produce poles for fences, corrals, and power lines. There are no restrictions on normal timber harvest, but care should be taken to prevent the erosion of skid trails and access roads.

Excessive slope and large stones are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Snow removal becomes an increasingly greater problem as more homes are built. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for

excessive snowmelt. Excavations and cuts and fills are difficult because of large stones throughout the profile. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Woodland wildlife includes mule deer, elk, blue grouse, snowshoe hare, white-tailed ptarmigan, yellow-bellied marmot, and chipmunks. The natural migration of deer and elk herds has been disturbed in many areas now used for recreation homesite subdivisions. Capability subclass VIe.

**5F—Frisco-Peeler complex, 25 to 65 percent slopes.** These are deep, well drained, steep to very steep soils on mountainsides and ridges in the south-central part of the survey area. They formed in glacial drift derived from a variety of rocks. Elevation is 8,500 to 11,000 feet. The average annual precipitation is about 21 inches, the average annual air temperature is about 34 degrees F, and the frost-free season is about 30 to 60 days. The Frisco soil makes up about 60 percent of this complex, and the Peeler soil makes up about 30 percent. Included in mapping and making up about 10 percent of the acreage are small areas of Grenadier, Muggins, and Leadville soils; Cumulic Cryaquolls; and Rock outcrop.

Typically the surface of the Frisco soil is covered by a duff layer of needles and twigs about 3 inches thick. Below that is a leached layer of very pale brown sandy loam about 16 inches thick. The subsoil is light yellowish brown very stony sandy clay loam about 51 inches thick. The substratum is light yellowish brown very stony sandy clay loam to a depth of 80 inches or more.

The Frisco soil has moderate permeability and medium available water capacity. The effective rooting depth is 60 inches. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Typically, the surface of the Peeler soil is covered by a duff layer of needles and twigs about 3 inches thick. Below that is a leached layer of very pale brown sandy loam about 15 inches thick. Next is a layer of very pale brown and yellowish brown cobbly sandy clay loam about 7 inches thick. The subsoil is light yellowish brown and pale brown cobbly sandy clay loam about 33 inches thick. The substratum is light yellowish brown cobbly light sandy clay loam to a depth of 60 inches or more.

The Peeler soil has moderate permeability and high available water capacity. The effective rooting depth is 60 inches. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage of this complex is woodland that is used for recreation, wildlife, and timber production. A cold climate and a short growing season limit the production of introduced grasses and weed crops.

The dominant native vegetation consists of lodgepole pine, subalpine fir, Engelmann spruce, and a sparse understory of grasses, shrubs, and forbs.

The Frisco and Peeler soils are suited to the production of lodgepole pine; 10,200 board feet of merchantable timber can be produced from a fully-stocked, even-aged stand of 80-year-old trees. Thinning operations produce

poles for fences, corrals, and power lines. Excessive slope limits the types of equipment used during timber harvest and makes reforestation difficult. Extreme care should be taken to prevent erosion of skid trails and access roads.

Excessive slope and large stones are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Snow removal becomes an increasingly greater problem as more homes are built. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. Excavations and cuts and fills are hard to make in Frisco soils because of large stones throughout the profile. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Woodland wildlife includes mule deer, elk, grouse, snowshoe hare, white-tailed ptarmigan, yellow-bellied marmot, and chipmunks. The natural migration of deer and elk herds has been disturbed in many areas now used for recreation homesite subdivisions. Capability subclass VIIe.

**6—Gravel pits.** Gravel pits are open excavations from which sand and gravel have been removed. Sand and gravel are valuable mainly as the coarse aggregates used in construction. Capability class VIII.

**7C—Grenadier gravelly loam, 0 to 6 percent slopes.** This is a deep, well drained, nearly level to gently sloping soil on mountainsides. It formed in glacial drift derived from a variety of rocks. The average annual precipitation is about 25 inches, the average annual air temperature is about 32 degrees F, and the frost-free season is about 30 to 50 days. Elevation is 9,000 to 13,000 feet.

Small areas of Frisco, Peeler, and Leadville soils are included in mapping. Small areas of Cumulic Cryaquolls and Histic Cryaquolls also are included.

Typically, the Grenadier soil has a duff layer of needles and twigs about 3 inches thick. The mineral surface layer is dark brown gravelly loam about 3 inches thick. The subsoil is strong brown gravelly sandy clay loam about 13 inches thick. The substratum is brown very cobbly sandy loam to a depth of 60 inches or more.

Permeability is moderate and the available water capacity is medium. Surface runoff is medium. The hazard of wind and water erosion is slight.

Most of the acreage is woodland that is used for recreation, wildlife, and timber production. A cold climate and a short growing season limit the production of introduced grasses and wood crops.

The dominant native vegetation consists of Engelmann spruce, subalpine fir, lodgepole pine, and a sparse understory of grasses, shrubs, and forbs.

This soil is suited to the production of lodgepole pine. A fully-stocked, even-aged stand of 80-year-old trees can produce 4,400 board feet of merchantable timber per acre. There are no restrictions on normal timber harvest, but reforestation is slow due to the cold climate.

Small stones throughout the profile are to be considered in the design of access roads and recreation homesite subdivisions. The stones interfere with excavations and cuts and fills for foundations and access roads. Seeding of vegetation is difficult due to soil acidity. Roads should be designed to provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Woodland wildlife includes mule deer, elk, blue grouse, snowshoe hare, white-tailed ptarmigan, yellow-bellied marmot, and chipmunks. Capability subclass VIIs.

**7D—Grenadier gravelly loam, 6 to 15 percent slopes.** This is a deep, well drained, moderately sloping to strongly sloping soil on glacial fans. It formed in glacial drift derived from a variety of rocks. The average annual precipitation is about 25 inches, the average annual air temperature is about 32 degrees F, and the frost-free season is about 30 to 50 days. Elevation is 9,000 to 13,000 feet.

Small areas of Frisco, Peeler, and Leadville soils are included in mapping. Small areas of Cumulic Cryaquolls and Histic Cryaquolls also are included.

Typically, the surface is covered with a duff layer of needles and twigs about 3 inches thick. The mineral surface layer is dark brown gravelly loam about 3 inches thick. The subsurface layer is pink gravelly loam about 3 inches thick. The subsoil is strong brown gravelly sandy clay loam about 13 inches thick. The substratum is brown very cobbly sandy loam to a depth of 60 inches or more.

Permeability is moderate, and the available water capacity is medium. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage is woodland that is used for recreation, wildlife, and timber production. A cold climate and a short growing season limit the production of introduced grasses and wood crops.

The dominant native vegetation consists of Engelmann spruce, subalpine fir, lodgepole pine, and a sparse understory of grasses, shrubs, and forbs.

This soil is suited to the production of lodgepole pine. It can produce 4,400 board feet of merchantable timber per acre from a fully-stocked, even-aged stand of 80-year-old trees. There are no restrictions on normal timber harvest, but care should be taken to prevent erosion of skid trails and access roads.

Excessive slope and small stones are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Snow removal becomes an increasingly greater problem as more homes are built. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on

cut and fill slopes. Seeding minimizes the erosion hazard, but establishing vegetation is difficult. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum and provide drainage outlets for excessive snowmelt. Small stones throughout the profile interfere with excavations and cuts and fills. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Woodland wildlife includes mule deer, elk, blue grouse, snowshoe hare, white-tailed ptarmigan, yellow-bellied marmot, and chipmunks. The natural migration of deer and elk herds has been disturbed in many areas now used for recreation homesite subdivisions. Capability subclass VIIIs.

**7F—Grenadier gravelly loam, 15 to 55 percent slopes.** This is a deep, well drained, moderately steep to steep soil on mountain side slopes and ridges. It formed in glacial drift derived from a variety of rocks. The average annual precipitation is about 25 inches, the average annual air temperature is about 32 degrees F, and the frost-free season is 30 to 50 days. Elevation is 9,000 to 13,000 feet.

Small areas of Frisco, Peeler, and Leadville soils are included in mapping. Small areas of Cumulic Cryaquolls and Histic Cryaquolls also are included. Areas of a similar soil that has no subsurface layer and is above timberline are also included.

Typically, the surface is covered with a duff layer of needles and twigs about 3 inches thick. The mineral surface layer is dark brown gravelly loam about 3 inches thick. The subsurface layer is pink gravelly loam about 3 inches thick. The subsoil is strong brown gravelly sandy clay loam about 13 inches thick. The substratum is brown very cobbly sandy loam to a depth of 60 inches or more.

Permeability is moderate, and the available water capacity is medium. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage is woodland that is used for recreation, wildlife, and timber production. A cold climate and a short growing season limit the production of introduced grasses and wood crops.

The dominant native vegetation consists of Engelmann spruce, subalpine fir, lodgepole pine, and a sparse understory of grasses, shrubs, and forbs.

This soil is suited to the production of lodgepole pine. It can produce 4,400 board feet of merchantable timber per acre from a fully-stocked, even-aged stand of 80-year-old trees. Excessive slope limits the types of equipment used during timber harvest and makes reforestation difficult. Extreme care should be taken to prevent erosion of skid trails and access roads.

Excessive slope and small stones are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Snow removal becomes an increasingly greater problem as more homes are built. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on

cut and fill slopes. Seeding minimizes the erosion hazard, but establishing vegetation is difficult. Homes should be designed to utilize existing slope, keep foundation cuts to a minimum, and provide drainage outlets for excessive snowmelt. Small stones throughout the profile interfere with excavation and making cuts and fills. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Woodland wildlife includes mule deer, elk, blue grouse, snowshoe hare, white-tailed ptarmigan, yellow-bellied marmot, and chipmunks. The natural migration of deer and elk herds has been disturbed in many areas now used for recreation homesite subdivisions. Capability subclass VIIIs.

**8B—Handran gravelly loam, 0 to 3 percent slopes.** This is a deep, well drained, nearly level soil on terraces. It formed in alluvial deposits derived from a variety of rocks. The average annual precipitation is about 15 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Small areas of Quander soil and Cumulic Cryaquolls are included in mapping.

Typically, the surface layer is brown gravelly loam about 6 inches thick. The next layer is brown gravelly sandy loam about 9 inches thick. The underlying material is brown very cobbly sandy loam to a depth of 60 inches or more.

Permeability is rapid, and the available water capacity is medium. Surface runoff is slow. The hazard of wind and water erosion is slight.

Most of the acreage is rangeland, but some areas are used for irrigated grass hay, recreation, and wildlife. A cold climate and a short growing season limit production and preclude use of this soil as cropland.

Management of the Handran soils for range requires a deferred grazing system and limited brush control. Where they are irrigated, these soils need proper water management to prevent over-irrigation. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, mountain brome, Arizona fescue, big bluegrass, and bluebunch wheatgrass. The dominant native vegetation consists of western wheatgrass, fescue, serviceberry, antelope bitterbrush, and big sagebrush. The total annual production averages about 1,500 pounds of air-dry forage per acre.

Excessive amounts of small and large stones and rapid permeability are the most limiting soil properties to be considered in the design of access roads, septic systems, and recreation homesite subdivisions (fig. 1). Stones in the soil profile interfere with excavations and cuts and fills. Leach fields should be designed carefully to eliminate the hazard of ground water pollution. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, coyote, mourning dove, ground squirrel, and yellow-bellied marmot. Capability subclass VIIIs.

**8D—Handran gravelly loam, 3 to 15 percent slopes.** This is a deep, well drained, gently sloping to strongly sloping soil on alluvial fans. It formed in alluvial deposits derived from a variety of rocks. The average annual precipitation is about 15 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Small areas of Quander soil are included in mapping.

Typically, the surface layer is brown gravelly loam about 6 inches thick. The next layer is brown gravelly sandy loam about 9 inches thick. The underlying material is brown very cobbly sandy loam to a depth of 60 inches or more.

Permeability is rapid and the available water capacity is medium. Surface runoff is slow. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage is rangeland that is also used for recreation and wildlife. A cold climate and a short growing season limit the production and preclude use of this soil as cropland.

Management of this soil for range requires a deferred grazing system and limited brush control. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, mountain brome, Arizona fescue, big bluegrass, and bluebunch wheatgrass. The dominant native vegetation consists of wheatgrass, fescue, serviceberry, antelope bitterbrush, and big sagebrush. The total annual production averages about 1,300 pounds of air-dry forage per acre.

Excessive slope, small and large stones, and rapid permeability are the most limiting soil properties to be considered in the design of access roads, septic systems, and recreation homesite subdivisions. Slope stabilization is difficult even where homes are constructed on nearly level pads. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Stones in the soil profile interfere with excavations and cuts and fills. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum. Careful design of leach fields can eliminate the hazard of ground water pollution. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, coyote, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIIc.

**9F—Handran bouldery loam, 15 to 55 percent slopes.** This is a deep, well drained, moderately steep to steep soil on mountain side slopes and ridges. It formed in glacial drift derived from a variety of rocks. The average annual precipitation is about 15 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 8,500 to 10,000 feet.

Small areas of Quander soils are included in mapping.

Typically, the surface layer is very dark grayish brown bouldery loam about 8 inches thick. The next layer is dark

grayish brown very bouldery loam about 4 inches thick. The underlying material is pale brown very bouldery sandy loam to a depth of 60 inches or more.

Permeability is rapid, and the available water capacity is medium. Surface runoff is slow. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage is rangeland that is also used for recreation and wildlife. A cold climate and a short growing season limit production and preclude use of this soil as cropland.

Management of this soil for range requires a deferred grazing system and limited brush control. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, bluebunch wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of wheatgrass, fescue, serviceberry, antelope bitterbrush, and big sagebrush. The total annual production averages about 1,300 pounds of air-dry forage per acre.

Excessive slope, large and small stones, and rapid permeability are the most limiting soil properties to be considered in the design of access roads, septic systems, and recreation homesite subdivisions. Slope stabilization is difficult even where homes are constructed on nearly level pads. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Stones in the soil profile interfere with excavation and cuts and fills. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Careful design of leach fields can eliminate the hazard of ground water pollution. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIIc.

**10—Histic Cryaquolls, nearly level.** These are poorly drained soils on flood plains and alluvial fans. Elevation is more than 9,000 feet. Slope is 0 to 5 percent. Areas are subject to annual flooding, and the water table is at or near the surface most of the year.

Histic Cryaquolls have a peat layer 5 to 14 inches thick on the surface and a black surface layer 20 inches or more thick, that ranges from sandy loam to clay and is commonly stratified. Sand and gravel are at a depth of 1 to 4 feet. The available water capacity is medium to high. Permeability is rapid to slow. Surface runoff is slow. The erosion hazard is slight.

Included in mapping are small areas of soils that are similar to this soil but have no peat layer on the surface or that have neither a dark colored surface layer nor a peat layer. Areas of Cumulic Cryaquolls are also included.

Management of Histic Cryaquolls should include shrub control, subsurface drainage, and control of the beaver population. Grasses recommended for seeding are slender wheatgrass, mountain brome, reed canarygrass, and big bluegrass. The dominant native vegetation consists of willows, shrubby cinquefoil, tufted hairgrass, sedges, rushes,

and numerous forbs. The annual production averages about 1,000 pounds of air-dry forage per acre.

Most of the acreage is used for wildlife habitat, and some areas are used for recreation. A cold climate, a short growing season, seasonal flooding, and a high water table preclude use of this soil for either agriculture or recreation homesite subdivisions. It is, however, suited to recreation uses, including fishing.

Onsite investigations are needed before any construction is planned because the soil properties vary widely. Flood protection measures should be designed to control at least 1 in 100 year storms. Adequate soil drainage is needed for most land uses.

Wetland wildlife includes mink, beaver, ducks, and trout. Capability subclass VIIw.

**11F—Leadville gravelly loam, 15 to 55 percent slopes.** This is a deep, well drained, moderately steep to steep soil on mountain side slopes and ridges. It formed in material weathered from sandstone. The average annual precipitation is about 23 inches, the average annual air temperature is about 32 degrees F, and the frost-free season is 30 to 50 days. Elevation is 10,500 to 12,000 feet.

Small areas of Grenadier, Frisco, and Peeler soils and Histic Cryaquolls are included in mapping.

Typically, the surface is covered with a duff layer of needles and twigs about 1 inch thick. Below that is a leached light reddish brown gravelly loam surface layer about 16 inches thick. Next is a layer of light reddish brown and brown gravelly loam about 10 inches thick. The subsoil is reddish brown very cobbly light clay loam. It overlies sandstone bedrock at a depth of about 42 inches.

Permeability is moderate, and the available water capacity is moderate. Surface runoff is rapid. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage is woodland that is used for recreation, wildlife, and timber production. A cold climate and a short growing season limit the production of introduced grasses and wood crops.

The dominant vegetation consists of Engelmann spruce, subalpine fir, lodgepole pine, and a sparse understory of grasses, shrubs, and forbs.

This soil is suited to the production of lodgepole pine. It can produce 6,700 board feet of merchantable timber per acre from a fully stocked, even aged stand of 80-year-old trees. Excessive slope limits the types of equipment used during timber harvest and makes reforestation difficult. Extreme care should be taken to prevent erosion of skid trails and access roads.

Excessive slope and large stones are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Snow removal becomes an increasingly greater problem as more homes are built. Surface runoff resulting from snowmelt increases the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Roads should be

designed to keep cuts and fills to a minimum and provide drainage outlets for excessive snowmelt. Large stones throughout the profile interfere with excavation and cuts and fills. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Woodland wildlife includes mule deer, elk, blue grouse, snowshoe hare, white-tailed ptarmigan, and yellow-bellied marmot. Capability subclass VIIe.

**12C—Leavitt loam, 0 to 6 percent slopes.** This is a deep, well drained, nearly level to gently sloping soil on alluvial fans. It formed in local alluvium derived from various sources. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Small areas of Youga and Cimarron soils are included in mapping.

Typically, the surface layer is grayish brown and about 8 inches thick. It is loam in the upper part and light clay loam in the lower part. The subsoil is brown clay loam about 21 inches thick. The substratum is light olive brown clay loam to a depth of 60 inches or more.

Permeability is moderate, and the available water capacity is high. Surface runoff is medium. The hazard of wind and water erosion is slight.

Most of the acreage is rangeland that is also used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and precludes use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, bluebunch wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of wheatgrass, Junegrass, big sagebrush, snowberry, and numerous forbs. The total annual production averages about 1,600 pounds of air-dry forage per acre.

Low strength and moderate shrink-swell are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIe.

**12D—Leavitt loam, 6 to 15 percent slopes.** This is a deep, well drained, moderately sloping to strongly sloping soil on alluvial fans and mountainsides. It formed in local alluvium derived from various sources. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Small areas of Youga and Cimarron soils are included in mapping.

Typically, the surface layer is grayish brown and about 8 inches thick. It is loam in the upper part and light clay loam in the lower part. The subsoil is brown clay loam about 21 inches thick. The substratum is light olive brown clay loam to a depth of 60 inches or more.

Permeability is moderate, and the available water capacity is high. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage is rangeland that is also used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, bluebunch wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of wheatgrass, Junegrass, big sagebrush, snowberry, and numerous forbs. The total annual production averages about 1,600 pounds of air-dry forage per acre.

Excessive slope is the most limiting soil property to be considered in the design of access roads and recreation homesite subdivisions. Slope stabilization is difficult even where houses are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Houses should be designed to utilize the existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and also provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIe.

**12F—Leavitt loam, 15 to 55 percent slopes.** This is a deep, well drained, moderately steep to steep soil on mountainsides and ridges. It formed in alluvium derived from various sources. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Small areas of Youga and Cimarron soils are included in mapping. About 3 miles northwest of Breckenridge are similar soils that have red sandstone bedrock at a depth of 20 to 40 inches.

Typically, the surface layer is grayish brown and about 8 inches thick. It is loam in the upper part and light clay loam in the lower part. The subsoil is brown clay loam about 21 inches thick. The substratum is light olive brown clay loam to a depth of 60 inches or more.

Permeability is moderate and the available water capacity is high. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage is rangeland that is also used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, bluebunch wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of wheatgrass, Junegrass, big sagebrush, snowberry, and numerous forbs. The total annual production averages about 1,600 pounds of air-dry forage per acre.

Excessive slope is the most limiting soil property to be considered in the design of access roads and recreation homesite subdivisions. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize the existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIIe.

**13—Mine dumps.** Mine dumps are areas of uneven accumulations, or piles, of waste rock (fig. 2). These areas have little or no segregation of rock fragments or of soil material or of both.

Areas are difficult to reclaim because each spoil pile reacts differently to treatment. Revegetation and erosion control are extremely difficult (fig. 3). Capability class VIII.

**14C—Muggins sandy loam, 0 to 6 percent slopes.** This is a deep, well drained, nearly level to gently sloping soil on alluvial fans. It formed in glacial drift derived from various sources. The average annual precipitation is about 18 inches, the average annual air temperature is about 34 degrees F, and the frost-free season is 30 to 50 days. Elevation is 7,600 to 10,000 feet.

Small areas of Frisco, Peeler, and Anvik soils are included in mapping. Also included are a few small pockets of locally transported weathered shale.

Typically, the surface is covered with a duff layer of needles and twigs about 3 inches thick. Below that is a leached layer of pinkish gray sandy loam about 12 inches thick. Next is a layer of light sandy clay loam about 6 inches thick. The subsoil is reddish brown sandy clay about 32 inches thick. The substratum is light reddish brown sandy clay loam to a depth of 60 inches or more.

Permeability is slow, and the available water capacity is high. Surface runoff is medium. The hazard of wind and water erosion is slight.

Most of the acreage is woodland that is used for recreation, wildlife, and timber production. A cold climate and a short growing season limit the production of introduced grasses and wood crops.

The dominant native vegetation consists of lodgepole pine, quaking aspen, scattered Engelmann spruce and subalpine fir, and a sparse understory of grasses, shrubs, and forbs.

This soil is suited to the production of lodgepole pine. It can produce 10,200 board feet of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Thinning operations produce poles for fences, corrals, and power lines. There are no restrictions on normal timber harvest.

Excessive shrinking and swelling upon wetting and drying is the most limiting soil property to be considered in the design of access roads and recreation homesite subdivisions. Snow removal becomes an increasingly greater problem as more homes are built. Foundations and roads, especially all-weather asphalt roads, are impractical unless provisions are made to offset shrink-swell and frost action.

Woodland wildlife includes mule deer, elk, blue grouse, snowshoe hare, yellow-bellied marmot, and chipmunks. The natural migration of deer and elk herds has been disturbed in many areas now used for recreation homesite subdivisions. Capability subclass VIe.

**14D—Muggins sandy loam, 6 to 15 percent slopes.** This is a deep, well drained, moderately sloping to strongly sloping soil on alluvial fans. It formed in glacial drift derived from various sources. The average annual precipitation is about 18 inches, the average annual air temperature is about 34 degrees F, and the frost-free season is 30 to 50 days. Elevation is 7,600 to 10,000 feet.

Small areas of Frisco, Peeler, and Anvik soils are included in mapping. Also included are a few small pockets of locally transported weathered shale.

Typically, the surface is covered with a duff layer of needles and twigs about 3 inches thick. Below that is a leached layer of pinkish gray sandy loam about 12 inches thick. Next is a layer of light sandy clay loam about 6 inches thick. The subsoil is reddish brown sandy clay about 32 inches thick. The substratum is light reddish brown sandy clay loam to a depth of 60 inches or more.

Permeability is slow, and the available water capacity is high. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage is woodland that is used for recreation, wildlife and timber production. A cold climate and a short growing season limit the production of introduced grasses and wood crops.

The dominant native vegetation consists of lodgepole pine, quaking aspen, scattered Engelmann spruce and subalpine fir, and a sparse understory of grasses, shrubs, and forbs.

This soil is suited to the production of lodgepole pine. It can produce 10,200 board feet of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees. Thinning operations produce poles for fences, corrals, and power lines. There are no restrictions on normal timber harvest, but care should be taken to prevent erosion of skid trails and access roads.

Slope and excessive shrinking and swelling upon wetting and drying are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Snow removal becomes an increasingly greater problem as more homes are built. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cuts and fills to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt roads and normal foundations are impractical unless provisions are made to offset shrink-swell and frost action.

Woodland wildlife includes mule deer, elk, blue grouse, snowshoe hare, yellow-bellied marmot, and chipmunks. The natural migration of deer and elk herds has been disturbed in many areas now used for recreation homesite subdivisions. Capability subclass VIe.

**14F—Muggins sandy loam, 15 to 35 percent slopes.** This is a deep, well drained, moderately steep and steep soil on mountainsides and ridges. It formed in glacial drift derived from various sources. The average annual precipitation is about 18 inches, the average annual air temperature is about 34 degrees F, and the frost-free season is 30 to 50 days. Elevation is 7,600 to 10,000 feet.

Small areas of Frisco, Peeler, and Anvik soils are included in mapping. A few small areas of Rock outcrop are also included.

Typically, the surface is covered with a duff layer of needles and twigs about 3 inches thick. Below that is a leached layer of pinkish gray sandy loam, about 12 inches thick. Next is a layer of pinkish gray light sandy clay loam about 6 inches thick. The subsoil is reddish brown sandy clay about 32 inches thick. The substratum is light reddish brown sandy clay loam to a depth of 60 inches or more.

Permeability is slow, and the available water capacity is high. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage is woodland that is used for recreation, wildlife, and timber production. A cold climate and a short growing season limit the production of introduced grasses and wood crops.

The dominant native vegetation consists of lodgepole pine, quaking aspen, scattered Engelmann spruce and subalpine fir, and a sparse understory of grasses, shrubs, and forbs.

This Muggins soil is suited to the production of lodgepole pine. It can produce 10,200 board feet of merchantable timber from a fully stocked, even-aged stand of 80-year-old trees.

Thinning operations produce poles for fences, corrals, and power lines. Slope limits the type of equipment that can be used during timber harvest and makes reforestation difficult. Extreme care should be taken to prevent erosion of skid trails and access roads.

Slope and excessive shrinking and swelling upon wetting and drying are the most limiting soil properties to be considered in the design of recreation and homesite developments. Snow removal becomes an increasingly greater problem as more homes are built. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cuts and fills to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt roads and normal foundations are impractical unless provisions are made to offset the shrink-swell and frost action.

Woodland wildlife includes mule deer, elk, blue grouse, snowshoe hare, yellow-bellied marmot and chipmunks. The natural migration of deer and elk herds has been disturbed in many areas now used for recreation homesite subdivisions. Capability subclass VIIe.

**15—Placer diggings.** These are areas of gravel, cobbles, and stones, left as spoil from dredging operations on the valley floor. They are along Blue River, French Creek, and Swan River. These areas support practically no vegetation. They are valuable as a source of coarse aggregate for use in construction. Capability class VIII.

**16C—Quander cobbly loam, 0 to 6 percent slopes.** This is a deep, well drained, nearly level to gently sloping soil on terraces. It formed in glacial drift derived from a variety of rocks. The average annual precipitation is about 18 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,500 feet.

Small areas of Handran, Leavitt, and Youga soils are included in mapping. Also, a small area west of Green Mountain Reservoir has sandstone bedrock at a depth of 20 to 40 inches.

Typically, the surface layer is dark grayish brown cobbly loam about 10 inches thick. The subsoil is brown very cobbly sandy clay loam about 49 inches thick. The substratum is yellowish brown very cobbly sandy clay loam to a depth of 60 inches or more.

Permeability is moderate, and the available water capacity is moderate. Surface runoff is slow. The hazard of wind and water erosion is slight.

Most of the acreage is rangeland that is also used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, bluebunch wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of Junegrass, wheatgrass, fescue, serviceberry, antelope bitterbrush, big sagebrush, and numerous forbs. The total annual production averages about 1,700 pounds of air-dry forage per acre.

Large and small stones in the profile are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Excavation is difficult because of stones in the profile. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIe.

**16D—Quander cobbly loam, 6 to 15 percent slopes.** This is a deep, well drained, moderately sloping to strongly sloping soil on fans and mountainsides. It formed in glacial drift derived from a variety of rocks. The average annual precipitation is about 18 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,500 feet.

Small areas of Handran, Leavitt, and Youga soils are included in mapping. A few small areas northeast of Silverthorne have shale bedrock at a depth of 30 to 45 inches, and a small area west of Green Mountain Reservoir has sandstone bedrock at 20 to 40 inches.

Typically, the surface layer is dark grayish brown cobbly loam about 10 inches thick. The subsoil is brown very cobbly sandy clay loam about 49 inches thick. The substratum is yellowish brown very cobbly sandy loam to a depth of 60 inches or more.

Permeability is moderate, and the available water capacity is moderate. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage is rangeland that is also used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, bluebunch wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of Junegrass, wheatgrass, fescue, serviceberry, antelope bitterbrush, big sagebrush, and numerous forbs. The total annual production averages about 1,700 pounds of air-dry forage per acre.

Slope and excessive small or large stones are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Slope stabilization is difficult even where homes are constructed on nearly level pads. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Stones in the soil profile interfere with excavation and cuts and fills. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIe.

**16E—Quander cobbly loam, 15 to 55 percent slopes.** This is a deep, well drained, moderately steep and steep soil on moraines, mountainsides, and ridges. It formed in glacial drift derived from a variety of rocks. The average annual precipitation is about 18 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,500 feet.

Small areas of Handran, Leavitt, and Youga soils are included in mapping. A few small areas northeast of Silverthorne have shale bedrock at a depth of 30 to 45 inches, and a small area west of Green Mountain Reservoir has sandstone bedrock at 20 to 40 inches.

Typically, the surface layer is dark grayish brown cobbly loam about 10 inches thick. The subsoil is brown very cobbly sandy clay loam about 49 inches thick. The substratum is yellowish brown very cobbly sandy clay loam to a depth of 60 inches or more.

Permeability is moderate, and the available water capacity is moderate. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage is rangeland that is also used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of the soil for range should include a deferred grazing system and brush control. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, bluebunch wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of Junegrass, wheatgrass, fescue, serviceberry, antelope bitterbrush, big sagebrush, and numerous forbs. The total annual production averages about 1,700 pounds of air-dry forage per acre.

Slope and excessive small or large stones are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Slope stabilization is difficult even where homes are constructed on nearly level pads. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Stones in the soil profile interfere with excavations and cuts and fills. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIIe.

**17F—Quander-Youga complex, 15 to 55 percent slopes.** These are deep, well drained, moderately steep to steep soils on mountainsides and ridges in the central and northern parts of the survey area and west of the Blue River. These soils formed in glacial drift derived from a variety of rocks. The average annual precipitation is about 18 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75

days. Elevation is 8,500 to 10,000 feet. The Quander soil makes up about 55 percent of this complex, and the Youga soils make up about 30 percent. Included in mapping are small areas of Handran and Anvik soils, which make up the other 15 percent.

Typically, the surface of the Quander soil is dark grayish brown cobbly loam about 10 inches thick. The subsoil is brown very cobbly sandy clay loam about 49 inches thick. The substratum is yellowish brown very cobbly sandy clay loam to a depth of 60 inches or more.

The Quander soil has moderate permeability and moderate available water capacity. The effective rooting depth is 60 inches. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Typically the surface of the Youga soil is dark grayish brown loam about 12 inches thick. The subsoil is yellowish brown clay loam about 53 inches thick. The substratum is light yellowish brown sandy clay loam to a depth of 60 inches or more.

The Youga soil has moderately slow permeability and high available water capacity. The effective rooting depth is 60 inches. Surface runoff is medium. The hazard of wind erosion is light, and the hazard of water erosion is moderate.

Most of the acreage is rangeland that is also used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude use of the soils as cropland.

Management of the Quander and Youga soils for range should include a deferred grazing system and brush control. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, bluebunch wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of Junegrass, wheatgrass, fescue, serviceberry, antelope bitterbrush, big sagebrush, and numerous forbs. The total annual production averages about 1,500 pounds of air-dry forage per acre.

Slope and excessive large or small stones are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. Large stones in the soil profile interfere with excavation and cuts and fills. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, yellow-bellied marmot and ground squirrels. Capability subclass VIIe.

**18—Rock outcrop-Cryoborolls complex.** Areas of this complex are on mountainsides, ridges, and escarpments (fig. 4). They are scattered throughout the survey area at elevations of 8,000 to 13,000 feet. The average annual precipitation is 15 to 30 inches, the average annual air temperature is 32 to 38 degrees F, and the frost-free season is 20 to 75 days. Slope is 30 to 70 percent. Rock outcrop makes up about 70 percent of this complex and Cryoborolls make up about 20 percent. Included in mapping are small areas of Cryoboralfs and Cryochrepts, which make up the other 10 percent.

Rock outcrop consists of exposed hard bedrock of mixed materials including granite, sandstone, and shale.

Cryoborolls are shallow and moderately deep, well drained loamy soils that are stony throughout. They are steep and very steep. They have a dark colored surface layer, and bedrock is at a depth of 10 to 40 inches. Reaction is slightly acid to moderately alkaline.

Cryoboralfs are shallow and moderately deep, well drained loamy soils that are stony throughout. They are steep and very steep. They have a light colored, bleached subsurface layer and a strongly developed subsoil. Bedrock is at a depth of 10 to 40 inches. Reaction is strongly acid to slightly acid.

Cryochrepts are shallow to moderately deep, well drained, loamy soils that are stony throughout. They are steep and very steep. They have a dark colored surface layer and a weakly developed subsoil. Bedrock is at a depth of 10 to 40 inches. Reaction is moderately acid to very strongly acid.

Permeability of these soils is rapid and the available water capacity is low. Surface runoff is rapid. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage is range for wildlife. Small areas can be used as range for livestock. These areas are so inaccessible that their use for agriculture or recreation homesite subdivisions is limited.

The dominant native vegetation at elevations of 8,000 to 9,000 feet consists of wheatgrasses, bluegrasses, sagebrush, snowberry, antelope bitterbrush, and numerous forbs. At elevations of 9,000 to 11,500 feet, native vegetation consists of lodgepole pine, Engelmann spruce, subalpine fir, and a sparse understory of grasses, shrubs, and forbs. At elevations above 11,500 feet, native vegetation is dominated by willows, sedges, and numerous forbs.

**19C—Youga loam, 0 to 6 percent slopes.** This is a deep, well drained, nearly level to gently sloping soil on mountainsides. It formed in glacial drift derived from various sources. The average annual precipitation is about 18 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Small areas of Quander, Leavitt, Cimarron, and Anvik soils are included in mapping. Also included are areas that have 1 to 2 inches of peat on the surface and mottling in the subsoil as a result of continuous irrigation.

Typically, the surface layer is dark grayish brown loam about 12 inches thick. The subsoil is yellowish brown and strong brown clay loam about 53 inches thick. The substratum is light yellowish brown sandy clay loam to a depth of 60 inches or more.

Permeability is moderately slow, and the available water capacity is high. Surface runoff is medium. The hazard of wind and water erosion is slight.

Most of the acreage is rangeland that is also used for recreation, wildlife, and irrigated grass hayland. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Where this soil is irrigated, ditches and fields should be designed carefully to properly control irrigation water. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, bluebunch wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of wheatgrass, Junegrass, big sagebrush, snowberry, and numerous forbs. The total annual production averages about 1,600 pounds of air-dry forage per acre.

There are no restrictive soil properties to be considered in the design of access roads and recreation homesite subdivisions. However, all-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIe.

**19D—Youga loam, 6 to 15 percent slopes.** This is a deep, well drained, moderately sloping to strongly sloping soil on mountainsides. It formed in glacial drift derived from a variety of sources. The average annual precipitation is about 18 inches, the average air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Small areas of Quander, Leavitt, Cimarron, and Anvik soils are included in mapping. Also included are areas that have 1 to 2 inches of peat on the surface and mottling in the subsoil as a result of continuous irrigation.

Typically, the surface layer is dark grayish brown loam about 12 inches thick. The subsoil is yellowish brown and strong brown clay loam about 53 inches thick. The substratum is light yellowish brown sandy clay loam to a depth of 70 inches or more.

Permeability is moderately slow, and the available water capacity is high. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage is rangeland that is also used for recreation and wildlife habitat and as irrigated grass hayland. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Where this

soil is irrigated, ditches and field layouts should be designed carefully to properly control irrigation water. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, bluebunch wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of wheatgrass, Junegrass, big sagebrush, snowberry, and numerous forbs. The total annual production averages about 1,600 pounds of air-dry forage per acre.

Slope is the most limiting soil property to be considered in the design of access roads and recreation homesite subdivisions. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize the existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrel, and yellow-bellied marmot. Capability subclass VIe.

**19F—Youga loam, 15 to 45 percent slopes.** This is a deep, well drained, moderately steep and steep soil on mountainsides and ridges. It formed in glacial drift derived from various sources. The average annual precipitation is about 18 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Small areas of Quander, Leavitt, Cimarron, and Anvik soils are included in mapping. Also included are areas that have 1 to 2 inches of peat on the surface and mottling in the subsoil as a result of continuous irrigation.

Typically, the surface layer is dark grayish brown loam about 12 inches thick. The subsoil is yellowish brown and strong brown clay loam about 53 inches thick. The substratum is light yellowish brown sandy clay loam to a depth of 70 inches or more.

Permeability is moderately slow, and the available water capacity is high. Surface runoff is rapid. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage is rangeland that is also used for recreation and as wildlife habitat and irrigated grass hayland. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Where this soil is irrigated, ditches and field layouts need to be designed carefully to properly control irrigation water. Grasses recommended for seeding include western wheatgrass, slender wheatgrass, bluebunch wheatgrass, mountain brome, Arizona fescue, and big bluegrass. The dominant native vegetation consists of wheatgrass, Junegrass,

big sagebrush, snowberry, and numerous forbs. The total annual production averages about 1,600 pounds of air-dry forage per acre.

Slope is the most limiting soil property to be considered in the design of access roads and recreation homesite subdivisions. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize the existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIIe.

**20D—Youga loam, thick surface, 6 to 15 percent slopes.** This is a deep, well drained, moderately sloping to strongly sloping soil on fans and mountainsides. It formed in glacial drift derived from various sources. The average annual precipitation is about 20 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 8,500 to 10,000 feet.

Small areas of Quander and Anvik soils are included in mapping. Also included are small areas that have 1 to 2 inches of peat on the surface and mottling in the subsoil as a result of continuous irrigation.

Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsurface layer is dark grayish brown gravelly loam about 20 inches thick. The subsoil is light brown gravelly sandy clay loam about 12 inches thick. The substratum is pink gravelly sandy clay loam to a depth of 60 inches or more.

Permeability is moderately slow, and the available water capacity is high. Surface runoff is medium. The hazard of wind erosion is slight, and the hazard of water erosion is moderate.

Most of the acreage is rangeland that is also used for recreation, wildlife, and irrigated grass hayland. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Where the soil is irrigated, ditches and field layouts should be designed carefully to properly control irrigation water. Grasses recommended for seeding include slender wheatgrass, mountain brome, Arizona fescue, and green needlegrass. The dominant native vegetation consists of Thurber fescue, bluegrasses, bromes, and wheatgrasses. The total annual production averages about 2,500 pounds of air-dry forage per acre.

Slope is the most limiting soil property to be considered in the design of access roads and recreation homesite sub-

divisions. Slope stabilization is difficult even where homes are built on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize the existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIe.

**20F—Youga loam, thick surface, 15 to 50 percent slopes.** This is a deep, well drained, moderately steep to steep soil on mountainsides and ridges. It formed in glacial drift derived from a variety of rocks. The average annual precipitation is about 20 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 8,500 to 10,000 feet.

Small areas of Quander and Anvik soils are included in mapping.

Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsurface layer is dark grayish brown gravelly sandy clay loam about 12 inches thick. The substratum is pink gravelly sandy clay loam to a depth of 60 inches or more.

Permeability is moderately slow, and the available water capacity is high. Surface runoff is rapid. The hazards of wind and water erosion are high.

Most of the acreage is rangeland that is also used for recreation and as wildlife habitat. A cold climate and short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Grasses recommended for seeding include slender wheatgrass, mountain brome, Arizona fescue, and green needlegrass. The dominant native vegetation consists of Thurber fescue, bluegrasses, bromes, and wheatgrasses. The total annual production averages about 2,500 pounds of air-dry forage per acre.

Slope is the most limiting soil property to be considered in the design of access roads and recreation homesite subdivisions. Slope stabilization is difficult even where homes are built on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize the existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed rabbit, mourning dove, ground squirrels, and yellow-bellied marmot. Capability subclass VIIe.

**21D—Yovimpa clay loam, 6 to 15 percent slopes.** This is a shallow, moderately well drained, moderately sloping to strongly sloping soil on mountainsides and ridges. It formed in material weathered from shale and slate bedrock. The average annual precipitation is about 14 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Small areas of Bucklon and Cimarron soils are included in mapping. Also included are small areas of soils that have bedrock at a depth of 20 to 40 inches or have no subsoil development.

Typically, the surface layer is grayish brown light clay loam about 2 inches thick. The subsoil is grayish brown and light yellowish brown clay about 16 inches thick. It overlies shale bedrock at a depth of about 18 inches.

Permeability is slow, and the available water capacity is low. Surface runoff is rapid. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage is rangeland that is also used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Grasses recommended for seeding include western wheatgrass and bluebunch wheatgrass. The dominant native vegetation consists of wheatgrasses, Indian ricegrass, squirreltail, winterfat, and big sagebrush. The total annual production averages about 500 pounds of air-dry forage per acre.

Slope and shallow depth to bedrock are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. A shallow depth to bedrock makes excavation for access roads and foundations for buildings difficult. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slope and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, ground squirrels, mourning dove, and yellow-bellied marmot. Capability subclass VIIe.

**21F—Yovimpa clay loam, 15 to 45 percent slopes.** This is a shallow, moderately well drained, moderately steep to steep soil on mountainsides and ridges. It formed in material weathered from shale and slate bedrock. The average annual precipitation is about 14 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Small areas of Bucklon and Cimarron soils are included in mapping. Also included are small areas of shale outcrop and soils that are similar to the Yovimpa soil but have bedrock at a depth of 20 to 40 inches. Other similar shallow soils have no subsoil development.

Typically, the surface layer is grayish brown light clay loam about 2 inches thick. The subsoil is grayish brown and light yellowish brown clay about 16 inches thick. It overlies shale bedrock at a depth of 18 inches.

Permeability is slow, and the available water capacity is low. Surface runoff is rapid. The hazard of wind erosion is slight, and the hazard of water erosion is high.

Most of the acreage is rangeland that is also used for recreation and wildlife. A cold climate and a short growing season limit the production of introduced grasses and preclude use of this soil as cropland.

Management of this soil for range should include a deferred grazing system and brush control. Grasses recommended for seeding include western wheatgrass and bluebunch wheatgrass. The dominant native vegetation consists of wheatgrasses, Indian ricegrass, squirreltail, winterfat, and big sagebrush. The total annual production averages 500 pounds of air-dry forage per acre.

Slope and shallow depth to bedrock are the most limiting soil properties to be considered in the design of access roads and recreation homesite subdivisions. A shallow depth to bedrock makes excavation of access roads and foundations for buildings difficult. Slope stabilization is difficult even where homes are constructed on nearly level pads. Surface runoff resulting from snowmelt increases the erosion hazard on cut and fill slopes. Seeding of vegetation minimizes the erosion hazard, but establishing a stand is difficult. Homes should be designed to utilize existing slopes and keep foundation cuts to a minimum. Roads should be designed to keep cut and fill slopes to a minimum and provide drainage outlets for excessive snowmelt. All-weather asphalt surfaces are impractical unless provisions are made to offset frost action.

Rangeland wildlife includes mule deer, sage grouse, white-tailed jackrabbit, ground squirrels, mourning dove, and yellow-bellied marmot. Capability subclass VIIe.

## Use and management of the soils

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

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and

other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

## Hay and pasture

This section provides information about the overall potential of the soils for hay and pasture and the major management concerns. In addition, the hay or pasture plants best adapted to the soil are listed, and the system of land capability classification used by the Soil Conservation Service is explained. Information about management is presented for each soil in the section "Soil maps for detailed planning." When making plans for management systems for individual fields or farms, check the detailed information given in the description of each soil.

About 8,500 acres in the survey area are used for irrigated grass hay and pasture. Cumulic Cryaquolls make up most of this acreage, but some areas of Cimarron, Handran, and Youga soils are also used as irrigated hay meadows. The acreage in hay and pasture has gradually decreased as more and more land is used for recreation homesite subdivisions.

Soil erosion is not a problem on the irrigated meadows. These meadows are never cultivated, and a solid stand of grasses protects the soil from erosion.

*Soil drainage* is a major management need on about two-thirds of the acreage used for hay and pasture. Many fields are irrigated continuously. This practice waterlogs the soil. If only the water needed by hay and pasture is applied, most wet areas can be eliminated.

*Soil fertility* is naturally high in most soils used as hay meadows and rangeland. Woodland soils have medium to low fertility, and soils above timberline have low to very low fertility.

Commercial fertilizer is recommended for maximum hay production. Generally 40 to 80 pounds of nitrogen and 15 to 30 pounds of phosphate per acre are recommended. Fertilizer is generally applied in spring for best results. Fall application may result in heavy losses of fertilizer due to leaching and surface runoff from snowmelt.

*Yields* from grass hay meadows range from 1.5 to 2.5 tons an acre annually. The cold climate and short growing season restrict the number of plant species that will grow and permit only one cutting of grass hay a year.

### Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit (?). These levels are defined in the following paragraphs. A survey area may not have soils of all classes. Because the climate of this survey area is too cold for common crops, there are no class I, II, III, or IV soils.

*Capability classes*, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

*Capability subclasses* are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

### Range

Most ranch operations in the Summit County Area are the cow-calf-yearling type. The average size of ranches is about 1,500 acres. Cattle are fed grass hay during the winter months.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 5 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Some of the soils that are in woodland are not listed. These soils naturally support stands of trees. The overstory is dense enough that the growth of grasses, shrubs, and forbs is sparse. These soils can be used for grazing if the tree cover is removed or the canopy is thinned. The following are explanations of column headings in table 5.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity

of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

*Potential production* refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

*Dry weight* refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

*Characteristic vegetation*—the grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

## Woodland management and productivity

The survey area can be divided into three major forest types. The southern part of the survey area, at an elevation of more than 10,000 feet, has Engelmann spruce and subalpine fir forest. The central part of the survey area, at an elevation of less than 10,000 feet, is dominantly lodgepole pine forest. At an elevation of less than 8,000 feet, there are mixed stands of quaking aspen, Douglas-fir, and lodgepole pine.

The spruce-fir area has the highest potential for the production of wood crops. The lodgepole pine areas have moderate potential for pole production, and the quaking aspen areas have little or no potential for commercial timber.

These types of forests cover nearly 50 percent of the survey area. The soils in most areas are severely limited by inaccessibility, steep slopes, and rock outcrops.

Most trees are in mature stands that need to be thinned. Where the crown competition factor does not restrict plant growth, mistletoe has taken over in these mature stands.

Table 6 contains information useful to woodland owners or forest managers in planning the use of soils for wood crops. Only soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; 5, low; and 6, very low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: *x*, *w*, *t*, *d*, *c*, *s*, *f*, and *r*.

In table 6 the soils are also rated for a number of factors to be considered in management. *Slight*, *moderate*, and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

*Seedling mortality* ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly

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

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *important trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

## Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay

minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

*Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.*

The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

### Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 7. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

*Shallow excavations* are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

*Dwellings* and *small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

*Local roads and streets* referred to in table 7 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

### Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 8 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, and *poor*, which mean about the same as *slight*, *moderate*, and *severe*.

*Septic tank absorption fields* are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a

system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

*Sewage lagoons* are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. Where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

*Sanitary landfill* is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 8 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

*Daily cover for landfill* should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more or-

ganic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

If it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

### Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction material. Each soil is evaluated to the depth observed, generally about 6 feet.

*Roadfill* is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 13 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low frost action potential, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

*Sand and gravel* are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

*Topsoil* is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can restrict plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils or very firm clayey soils; soils that have suitable layers less than 8 inches thick; soils that have large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

### Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

*Pond reservoir areas* hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

*Embankments, dikes, and levees* require soil material that is resistant to seepage, erosion, and piping and has

favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of the soil for use in embankments, dikes, and levees.

*Drainage* of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

*Irrigation* is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

*Terraces and diversions* are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

*Grassed waterways* are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

### Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

*Camp areas* require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

*Picnic areas* are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

*Playgrounds* require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

*Paths and trails* for walking, horseback riding, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have few or no stones or boulders on the surface.

## Wildlife habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable

for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of habitat are very severe and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

*Grain and seed crops* are seed-producing annuals used by wildlife. The soil and climate of the survey area are too cold for these crops—all soils are rated very poor.

*Grasses and legumes* are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, brome, clover, and alfalfa.

*Wild herbaceous plants* are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are muttongrass, lupine, mountain muhly, oatgrass, nodding brome, and wheatgrass.

*Hardwood trees* and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. There are no ratings for hardwood trees because they are not native to the survey area.

*Coniferous plants* are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

*Shrubs* are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are mountain-mahogany, bitterbrush, snowberry, and big sagebrush.

*Wetland plants* are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are saltgrass, cattail rushes, sedges, and reeds.

*Shallow water areas* are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

*Openland habitat* consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Since grain and seed crops are not grown in the survey area, openland wildlife is not common.

*Woodland habitat* consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include blue grouse, snowshoe hare, woodpeckers, squirrels, elk, red fox, porcupine, mule deer, and bear.

*Wetland habitat* consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

*Rangeland habitat* consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include coyote, mule deer, white-tailed jackrabbit, sage grouse, and meadowlark.

## Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties.

They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features.

## Engineering properties

Table 13 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 13 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

*Texture* is described in table 13 in the standard terms used by the U.S. Department of Agriculture (5). These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

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

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped

into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 13. Also in table 13 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

*Liquid limit* and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and in plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

## Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

*Permeability* is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

*Available water capacity* is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

*Soil reaction* is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

*Salinity* is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 14. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

*Shrink-swell potential* depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

*Risk of corrosion* pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidi-

ty, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

*Erosion factors* are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

*Wind erodibility groups* are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

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

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

## Soil and water features

Table 15 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

*Hydrologic soil groups* are used to estimate runoff from precipitation (6). Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

*Flooding* is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

*High water table* is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

*Depth to bedrock* is shown for all soils that are underlain by bedrock at a depth of 5 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

*Potential frost action* refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

## Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey (8) has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this

system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 16, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

**ORDER.** Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

**SUBORDER.** Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

**GREAT GROUP.** Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquents (*Hapl*, meaning simple horizons, plus *aquent*, the suborder of Entisols that have an aquic moisture regime).

**SUBGROUP.** Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haplaquents.

**FAMILY.** Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, nonacid, mesic, Typic Haplaquents.

**SERIES.** The series consists of soils that formed in a particular kind of material and have horizons that, except

for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

## Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (5). Unless otherwise noted, colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

### Anvik series

The Anvik series consists of deep, well drained soils that formed in colluvium and glacial drift derived from a variety of rocks. Anvik soils are on mountainous uplands and have slopes of 6 to 35 percent. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is 35 to 75 days. Elevation is 7,500 to 9,000 feet.

Anvik soils are similar to the Youga and Leavitt soils and are near the Youga, Leavitt, and Muggins soils. Youga and Leavitt soils have a dark-colored A1 horizon but lack the bleached A2 horizon of the Anvik soils. Muggins soils do not have a dark-colored A1 horizon and average more than 35 percent clay in the B horizon.

Typical pedon of Anvik loam, 15 to 35 percent slopes, about 17 miles south of Kremmling and about 1,000 feet north and 600 feet west of the southeast corner of sec. 28, T. 3 S., R. 78 W.:

- O1—1 inch to 0; undecomposed needles and twigs.  
 A11—0 to 6 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; soft, very friable; neutral (pH 6.5); clear smooth boundary.  
 A12—6 to 10 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure that parts to moderate medium granular; slightly hard, very friable; neutral (pH 6.6); clear smooth boundary.  
 A2—10 to 15 inches; pinkish gray (7.5YR 6/2) loam, dark brown (7.5YR 4/4) moist; moderate medium platy structure that parts to moderate medium granular; slightly hard, very friable; neutral (pH 6.6); clear wavy boundary.  
 B&A—15 to 20 inches; light yellowish brown (10YR 6/4) light clay loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; thin patchy clay films on faces of pedis; about 20 percent of horizon is composed of diffuse tongues of material like that in the A2 horizon; slightly acid (pH 6.4); clear wavy boundary.

B2t—20 to 40 inches; light yellowish brown (10YR 6/4) cobbly clay loam, yellowish brown (10YR 5/4) moist; strong medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; thin nearly continuous clay films on faces of pedis; 15 percent cobbles and stones; slightly acid (pH 6.2); gradual wavy boundary.

B3—40 to 48 inches; yellowish brown (10YR 6/4) cobbly light clay loam, yellowish brown (10YR 5/4) moist; moderate coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; thin, patchy clay films on faces of pedis; 25 percent cobbles and stones; slightly acid (pH 6.4); clear wavy boundary.

C—48 to 60 inches; light yellowish brown (10YR 6/4) cobbly light clay loam, yellowish brown (10YR 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; 35 percent cobbles and stones; neutral (pH 6.6).

Thickness of the solum ranges from 20 to 50 inches. Rock fragments make up 0 to 35 percent of the solum. Reaction ranges from slightly acid through mildly alkaline. The A1 horizon is brown or grayish brown. The texture is loam or sandy loam. The B2t horizon is light brown or light yellowish brown. It ranges from light clay loam to heavy clay loam. The C horizon is light yellowish brown or light brown.

### Bucklon series

The Bucklon series consists of shallow, well drained soils that formed in material weathered from slate and shale. Bucklon soils are on mountainous uplands and have slopes of 15 to 35 percent. The average annual precipitation is about 15 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is 35 to 75 days. Elevation is 7,500 to 9,500 feet.

Bucklon soils are near Yovimpa and Cimarron soils. Yovimpa soils average more than 35 percent clay in the B horizon. Cimarron soils have no bedrock above 40 inches and average more than 35 percent clay in the B horizon.

Typical pedon of Bucklon loam, 15 to 35 percent slopes, about 16 miles south of Kremmling about 1,400 feet west of the northeast corner of sec. 1, T. 5 S., R. 77 W.:

- A11—0 to 4 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; 10 percent slate; neutral (pH 6.8); clear smooth boundary.  
 A12—4 to 10 inches; grayish brown (2.5Y 5/2) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; 10 percent slate; neutral (pH 7.2); clear smooth boundary.  
 C—10 to 18 inches; olive brown (2.5Y 4/4) slaty light clay loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure that parts to moderate medium granular; slightly hard, friable, sticky and plastic; 20 percent slate; mildly alkaline (pH 7.6); clear smooth boundary.  
 Cr—18 to 24 inches; dark gray and olive shale.

The combined thickness of the A and C horizons ranges from 10 to 20 inches. Coarse fragments make up 0 to 20 percent of the A and C horizons. Reaction ranges from neutral through mildly alkaline. The A horizon is grayish brown to dark grayish brown. The texture is loam or clay loam. The C horizon is olive brown to brown.

### Cimarron series

The Cimarron series consists of deep, well drained soils that formed in local alluvium derived from shale and residuum of shale bedrock. Cimarron soils are on mountainous uplands and have slopes of 6 to 35 percent. The average annual precipitation is about 16 inches, the

average annual air temperature is about 37 degrees F, and the frost-free season is 35 to 75 days. Elevation is 7,500 to 9,000 feet.

Cimarron soils are similar to Yovimpa soils and are near Bucklon and Youga soils. Yovimpa and Bucklon soils have bedrock at a depth of 10 to 20 inches. Youga soils average less than 35 percent clay in the B horizon.

Typical pedon of Cimarron loam, 15 to 35 percent slopes, about 15 miles south of Kremmling and about 1,200 feet north and 1,200 feet east of the southwest corner of sec. 11, T. 3 S., R. 78 W.:

- A11—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; loose, very friable, slightly sticky and slightly plastic; neutral (pH 6.6); clear smooth boundary.
- A12—6 to 14 inches; grayish brown (10YR 5/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral (pH 6.6); clear smooth boundary.
- B1—14 to 22 inches; light yellowish brown (10YR 6/4) heavy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; soil develops cracks 5 to 10 mm wide; thin and patchy clay films on faces of peds; neutral (pH 6.8); clear smooth boundary.
- B2t—22 to 39 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; strong medium subangular blocky structure; very hard, firm, very sticky and very plastic; soil develops cracks 5 to 15 mm wide; thin continuous clay films on ped faces; neutral (pH 7.2); clear smooth boundary.
- C1—39 to 45 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, very sticky and very plastic; 30 percent shale fragments; mildly alkaline (pH 7.6); abrupt smooth boundary.
- C2r—45 to 50 inches; partially weathered shale.

Thickness of the solum ranges from 30 to 64 inches. Coarse fragments make up 0 to 35 percent of the solum. Reaction ranges from neutral through mildly alkaline. The A1 horizon is brown or grayish brown. The texture is loam or light clay loam. The B2t horizon is yellowish brown or light olive brown. It ranges from heavy clay loam to clay. The C horizon is light brownish gray or light yellowish brown.

### Frisco series

The Frisco series consists of deep, well drained soils that formed in glacial drift derived from a variety of rocks. Frisco soils are on mountainsides, till plains, or alluvial fans and have slopes of 6 to 65 percent. The average annual precipitation is about 20 inches, the average annual air temperature is about 34 degrees F, and the frost-free season is 30 to 60 days. Elevation is 8,500 to 11,000 feet.

Frisco soils are similar to Leadville soils and are near Peeler, Muggins, and Grenadier soils. Leadville and Muggins soils have hue of 5YR or redder. Peeler soils contain less than 35 percent rock fragments throughout the profile. Grenadier soils lack a B2t horizon and typically are very strongly acid in reaction throughout.

Typical pedon of Frisco sandy loam in area of Frisco-Peeler complex, 25 to 65 percent slopes, about 5 miles northeast of Breckenridge in the NE1/4 of sec. 29, T. 6 S., R. 77 W.:

- O1—3 to 2 inches; undecomposed organic material, principally needles, bark, and twigs.

O2—2 inches to 0; partially decomposed organic materials like those of the horizon above.

A2—0 to 16 inches; very pale brown (10YR 7/3) sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure that parts to weak fine granular; slightly hard, very friable; 10 percent gravel; slightly acid (pH 6.5); gradual smooth boundary.

B21t—16 to 48 inches; light yellowish brown (10YR 6/4) very stony sandy clay loam, yellowish brown (10YR 5/6) moist; less than 5 percent very pale brown (10YR 7/3) bleached sand grains on peds; moderate medium subangular blocky structure; slightly hard, very friable; thin patchy clay films on faces of peds and inside root channels; 60 percent stone; slightly acid (pH 6.5); gradual wavy boundary.

B22t—48 to 60 inches; light yellowish brown (10YR 6/4) very stony sandy clay loam, yellowish brown (10YR 5/6) moist; strong and moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; thin nearly continuous clay films on faces of peds and as fillings inside of root channels and pores; 60 percent stone; slightly acid (pH 6.4); gradual smooth boundary.

B3—60 to 67 inches; light yellowish brown (10YR 6/4) very stony sandy clay loam, yellowish brown (10YR 5/6) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; peds are very hard, firm; thin patchy clay films on faces of peds; 60 percent stone; slightly acid (pH 6.4); gradual smooth boundary.

C—67 to 80 inches; light yellowish brown (10YR 6/4) very stony sandy clay loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable; 60 percent stone; slightly acid (pH 6.4).

Thickness of the solum ranges from 30 to 100 inches. Rock fragments make up 35 to 80 percent of the solum and are dominantly 10 to 24 inches in diameter. Reaction ranges from strongly acid through neutral. The A2 horizon is yellowish brown to white. The B2t horizon is pale olive to light brown. It is sandy clay loam, loam, or clay loam. The C horizon is pale olive to light brown.

### Grenadier series

The Grenadier series consists of deep, well drained soils that formed in glacial drift derived from a variety of rocks. Grenadier soils are on mountainsides, ridges, and glacial fans and have slopes of 0 to 55 percent. The average annual precipitation is about 25 inches, the average annual air temperature is about 32 degrees F, and the frost-free season is 30 to 50 days. Elevation is 9,000 to 13,000 feet.

Grenadier soils are near Frisco, Peeler, Muggins, and Leadville soils. All of these nearby soils have a B2t horizon.

Typical pedon of Grenadier gravelly loam, 15 to 55 percent slopes, about 6 miles east of Breckenridge and about 1,100 feet east, 100 feet north of the southwest corner of sec. 34, T. 6 S., R. 77 W.:

O1—3 inches to 0; partially decomposed organic matter consisting of needles, twigs and bark.

A1—0 to 3 inches; dark brown (7.5YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure that parts to moderate fine granular; soft, very friable; 20 percent gravel; very strongly acid (pH 4.8); irregular wavy boundary.

A2—3 to 6 inches; pink (7.5YR 7/4) gravelly loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; soft, very friable; 20 percent gravel; very strongly acid (pH 4.8); irregular wavy boundary.

B2—6 to 19 inches; strong brown (7.5YR 5/6) gravelly sandy clay loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 25 percent gravel and 10 percent cobbles; very strongly acid (pH 5.0); gradual smooth boundary.

C—19 to 60 inches; brown (7.5YR 5/4) very cobbly sandy loam, strong brown (7.5YR 5/6) moist; massive; soft, very friable; 40 percent cobbles and 20 percent gravel; very strongly acid (pH 5.0).

Thickness of the solum ranges from 9 to 27 inches. Rock fragments make up 15 to 35 percent of the solum and 35 to 85 percent of the C horizon. They are dominantly less than 10 inches in diameter. Reaction ranges from strongly acid to very strongly acid in the solum. The A1 horizon is grayish brown to dark brown gravelly loam or gravelly sandy loam. The B2t horizon is light yellowish brown to strong brown gravelly sandy clay loam or gravelly loam. The C horizon is light yellowish brown to brown.

### Handran series

The Handran series consists of deep, well drained soils that formed in alluvial deposits and glacial drift derived from a variety of rocks. Handran soils are on terraces and mountainsides and have slopes of 0 to 55 percent. The average annual precipitation is about 15 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 35 to 75 days. Elevation is 7,500 to 9,000 feet.

Handran soils are similar to Quander soils and are near Quander soils and Cumulic Cryaquolls. Quander soils have a B2t horizon and cobbly sandy clay loam texture.

Typical pedon of Handran gravelly loam, 0 to 3 percent slopes, about 22 miles south of Kremmling and about 800 feet east of the southwest corner of sec. 28, T. 3 S., R. 78 W.:

A1—0 to 6 inches; brown (7.5YR 5/2) gravelly loam, very dark brown (7.5YR 2/2) moist; strong fine granular structure; soft, very friable; 25 percent gravel, 10 percent cobbles, 5 percent stones; neutral (pH 6.6); gradual smooth boundary.

AC—6 to 15 inches; brown (7.5YR 5/3) gravelly sandy loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure that parts to moderate very fine subangular blocky; slightly hard, very friable; 30 percent gravel, 5 percent cobbles, 5 percent stones; neutral (pH 6.6); gradual smooth boundary.

C—15 to 60 inches; brown (10YR 5/3) very cobbly sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; 40 percent cobbles, 10 percent gravel, and 10 percent stones; neutral (pH 6.6).

Thickness of the combined A and AC horizons ranges from 13 to 30 inches. Rock fragments make up 35 to 85 percent of the A and C horizons. Reaction ranges from neutral through mildly alkaline. The A horizon is brown to grayish brown. The texture is loam or sandy loam. The C horizon is brown to grayish brown.

### Leadville series

The Leadville series consists of deep, well drained soils that formed in material weathered from sandstone. Leadville soils are on mountainsides and ridges and have slopes of 15 to 55 percent. The average annual precipitation is about 23 inches, the average annual air temperature is about 32 degrees F, and the frost-free season is 30 to 50 days. Elevation is 10,500 to 12,000 feet.

Leadville soils are similar to Frisco soils and are near Peeler and Grenadier soils. Frisco and Peeler soils have hue of 7.5YR or yellower. Grenadier soils have a weakly developed B horizon.

Typical pedon of Leadville gravelly loam, 15 to 55 percent slopes, about 10 miles southeast of Breckenridge and about 50 feet east and 750 feet north of the southwest corner of sec. 22, T. 7 S., R. 77 W.:

O1—1 inch to 0; undecomposed organic material, mainly needles, twigs, and bark.

A21—0 to 7 inches; light reddish brown (5YR 6/4) gravelly loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure that parts to weak fine granular; soft, very friable; 20 percent gravel, 10 percent cobbles; strongly acid (pH 5.1); gradual smooth boundary.

A22—7 to 16 inches; light reddish brown (2.5YR 6/4) gravelly loam, yellowish red (2.5YR 5/6) moist; moderate fine subangular blocky structure that parts to moderate medium granular; slightly hard, very friable; 20 percent gravel and 10 percent cobbles; strongly acid (pH 5.2); gradual smooth boundary.

A&B—16 to 26 inches; light reddish brown (2.5YR 6/4) and reddish brown (2.5YR 5/4) gravelly loam, reddish brown (2.5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, very friable; thin and patchy clay films on faces of clayey peds; 20 percent gravel and 10 percent cobbles; strongly acid (pH 5.4); gradual wavy boundary.

B2t—26 to 42 inches; reddish brown (2.5YR 5/4) very cobbly light clay loam, dark reddish brown (2.5YR 3/4) moist; strong and moderate medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; thin nearly continuous clay films on faces of peds; 40 percent cobbles and 20 percent gravel; strongly acid (pH 5.4); irregular wavy boundary.

Cr—42 to 60 inches; partially weathered and fractured red sandstone.

Thickness of the solum ranges from 26 to 40 inches. Bedrock ranges from 40 to 60 inches. Rock fragments make up 35 to 85 percent of the Bt horizon. Reaction is strongly acid throughout the profile. The A2 horizon is loam or sandy loam texture. The B2t horizon is reddish brown to weak red loam to clay loam.

### Leavitt series

The Leavitt series consists of deep, well drained soils that formed in local alluvium derived from a variety of sources. Leavitt soils are on fans, mountainsides, and ridges and have slopes of 0 to 55 percent. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Leavitt soils are similar to Youga soils and are near Youga and Cimarron soils. Youga soils lack lime accumulation in the solum. Cimarron soils average more than 35 percent clay in the B horizon.

Typical pedon of Leavitt loam, 6 to 15 percent slopes, about 14 miles south of Kremmling and about 1,100 feet south and 800 feet east of the northwest corner of sec. 12, T. 2 S., R. 80 W.:

A11—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; soft, very friable, slightly sticky and slightly plastic; 10 percent fine gravel; mildly alkaline (pH 7.4); clear smooth boundary.

A12—4 to 8 inches; grayish brown (10YR 5/2) light clay loam, very dark grayish brown (10YR 3/2) moist, moderate medium subangular blocky structure that parts to moderate medium granular; slightly hard, very friable, slightly sticky and slightly plastic; 10 percent fine gravel; neutral (pH 7.2); clear smooth boundary.

B2t—8 to 25 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium and fine subangular blocky structure;

slightly hard, very friable, slightly sticky and slightly plastic; thin nearly continuous clay films on faces of peds; 20 percent gravel; neutral (pH 7.2); gradual smooth boundary.

B3ca—25 to 29 inches; light olive brown (2.5Y 5/3) light clay loam, olive brown (2.5Y 4/3) moist; hard, friable, slightly sticky and slightly plastic; thin patchy clay films on faces of peds; 10 percent gravel; mildly alkaline (pH 6.6); gradual smooth boundary.

Cca—29 to 60 inches; light olive brown (2.5Y 5/3) light clay loam, olive brown (2.5Y 4/3) moist; massive; very hard, firm, slightly sticky and slightly plastic; few visible streaks and seams of lime accumulation; moderately alkaline (pH 8.0).

Thickness of the solum ranges from 24 to 44 inches. Rock fragments make up 0 to 25 percent of the solum. Reaction is neutral to mildly alkaline. The A horizon is brown to grayish brown. The texture is loam or clay loam. The B2t horizon is brown to light olive brown. It ranges from a loam to clay loam. The C horizon is brown to light olive brown.

### Muggins series

The Muggins series consists of deep, well drained soils that formed in glacial drift derived from a variety of rocks. Muggins soils are on alluvial fans, mountainsides, and ridges and have slopes of 0 to 35 percent. The average annual precipitation is about 18 inches, the average annual air temperature is about 34 degrees F, and the frost-free season is 30 to 50 days. Elevation is 7,600 to 10,000 feet.

Muggins soils are near Frisco, Peeler, and Anvik soils. Frisco, Peeler, and Anvik soils average less than 35 percent clay in the B horizon. Frisco soils contain more than 35 percent rock fragments in the solum. Frisco and Peeler soils have hue of 7.5YR or yellower. Anvik soils have a thick, dark-colored A horizon.

Typical pedon of Muggins sandy loam, 6 to 15 percent slopes, about 1 mile west of Silverthorne and 1,890 feet west of the center of sec. 13, T. 5 S., R. 78 W.:

- O1—3 inches to 1 inch; undecomposed twigs and needles.  
 O2—1 inch to 0; organic mat of decomposed twigs and needles.  
 A2—0 to 12 inches; pinkish gray (7.5YR 7/2) sandy loam, light brown (7.5YR 6/4) moist; weak medium platy structure that parts to moderate coarse granular; soft, very friable; 10 percent gravel and cobbles; slightly acid (pH 6.2); clear wavy boundary.  
 A&B—12 to 18 inches; pinkish gray (7.5YR 7/2) light sandy clay loam, light brown (7.5YR 6/4) and reddish brown (5YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; peds are very hard, firm; patchy clay films on the more clayey portions of peds and discontinuous clay films in root channels and pores; 10 percent cobbles; slightly acid (pH 6.4); gradual smooth boundary.  
 B2t—18 to 45 inches; light reddish brown (5YR 6/4) sandy clay, reddish brown (5YR 5/4) moist; moderate coarse and medium angular blocky structure; slightly hard, very friable, sticky and plastic; peds are extremely hard, very firm; continuous clay films on faces of peds and in root channels and pores; 10 percent cobbles; slightly acid (pH 6.2); gradual smooth boundary.  
 B3—45 to 50 inches; light reddish brown (5YR 6/4) light sandy clay, reddish brown (5YR 5/4) moist; weak coarse angular blocky structure; hard, friable, sticky and plastic; peds are extremely hard, firm; thin patchy clay films on faces of peds and in root channels and pores; 10 percent cobbles; medium acid (pH 5.8); gradual smooth boundary.  
 C—50 to 60 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) moist; massive; very hard, very firm, slightly sticky and slightly plastic; 10 percent cobbles; medium acid (pH 5.8).

Thickness of the solum ranges from 17 to 48 inches. Rock fragments make up 0 to 25 percent of the solum. Reaction ranges from slightly acid

to medium acid. The A2 horizon is pinkish gray to very pale brown. The B2t horizon is reddish brown or light reddish brown. It ranges from sandy clay to clay.

### Peeler series

The Peeler series consists of deep, well drained soils that formed in glacial drift derived from a variety of mixed rocks. Peeler soils are on alluvial fans, terraces, till plains, and valley sides and have slopes of 6 to 65 percent. The average annual precipitation is about 22 inches, the average annual air temperature is about 34 degrees F, and the frost-free season is 30 to 60 days. Elevation is 8,500 to 11,000 feet.

Peeler soils are near Frisco, Leadville, Muggins, and Grenadier soils. Leadville and Muggins soils have hue of 5YR or redder. Frisco soils contain more than 35 percent rock fragments throughout the profile. Grenadier soils have no B2t horizon and have very strongly acid reaction.

Typical pedon of Peeler sandy loam in an area of Frisco-Peeler complex, 6 to 25 percent slopes, about 7 miles northeast of Breckenridge and about 2,600 feet north and 75 feet east of the southwest corner of sec. 13, T. 3 S., R. 78 W.:

- O1—3 to 2 inches; undecomposed organic material, principally needles, bark, and twigs.  
 O2—2 inches to 0; partially decomposed organic materials like those of the horizon above.  
 A2—0 to 15 inches; very pale brown (10YR 7/3) sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, very friable; 5 percent cobbles; slightly acid (pH 6.5); clear smooth boundary.  
 A&B—15 to 22 inches; 60 percent very pale brown (10YR 7/3) and 40 percent light yellowish brown (10YR 6/4) cobbly sandy clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 20 percent cobbles and stones; slightly acid (pH 6.5); gradual smooth boundary.  
 B21t—22 to 34 inches; light yellowish brown (10YR 6/4) cobbly sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; thin patchy clay films on faces of peds and inside root channels; 20 percent cobbles and stone; slightly acid (pH 6.5); gradual smooth boundary.  
 B22t—34 to 47 inches; pale brown (10YR 6/3) cobbly sandy clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; thin nearly continuous clay films on faces of peds and as fillings inside of root channels and pores; 25 percent cobbles and gravel; slightly acid (pH 6.4); gradual smooth boundary.  
 B3—47 to 55 inches; light yellowish brown (10YR 6/4) cobbly light sandy clay loam, yellowish brown (10YR 5/4) moist; weak medium and coarse subangular blocky structure; hard, friable; thin patchy clay films of faces of peds; 30 percent cobbles, gravel, and stones; slightly acid (pH 6.4); gradual smooth boundary.  
 C—55 to 60 inches; light yellowish brown (10YR 6/4) cobbly light sandy clay loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; 30 percent cobbles and gravel; slightly acid (pH 6.4).

Thickness of the solum ranges from 30 to 70 inches. Rock fragments make up 0 to 35 percent of the solum and are dominantly less than 10 inches in diameter. Reaction ranges from medium acid through mildly alkaline. The A2 horizon is pale yellow to white. The texture is sandy loam. The B2t horizon is pale olive to light brown. It is sandy clay loam, loam, or clay loam. The C horizon is pale olive to light brown.

### Quander series

The Quander series consists of deep, well drained soils that formed in glacial drift derived from a variety of rocks. Quander soils are on mountainsides, ridges, moraines, fans, and terraces. Slopes are 0 to 55 percent. The average annual precipitation is about 18 inches, the average annual air temperature is about 34 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,500 feet.

Quander soils are similar to Handran soils and are near Handran, Youga, and Anvik soils. Handran soils do not have a B horizon. Youga soils average less than 25 percent rock fragments in the solum. Anvik soils average less than 35 percent coarse fragments in the solum and have a bleached A2 horizon.

Typical pedon of Quander cobbly loam, 15 to 55 percent slopes, about 20 miles south of Kremmling and approximately in the center of sec. 18, T. 3 S., R. 78 W.:

- A1—0 to 10 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 30 percent cobbles and gravel; neutral (pH 7.0); clear smooth boundary.
- B1—10 to 15 inches; brown (10YR 5/3) very cobbly loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few thin patchy clay films on faces of peds and a few discontinuous clay films on the inside of root channels; 50 percent cobbles and gravel; neutral (pH 7.0); gradual smooth boundary.
- B2t—15 to 48 inches; brown (10YR 5/3) very cobbly sandy clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; nearly continuous clay films on faces of peds and on the inside of root channels and pores; 50 percent cobbles and gravel; neutral (pH 6.8); clear smooth boundary.
- B3—48 to 59 inches; brown (10YR 5/3) very cobbly sandy clay loam, dark brown (10 YR 4/3) moist; weak coarse subangular blocky structure; a few patchy clay films on faces of peds and on the inside of some root channels and pores; 50 percent cobbles and gravel; neutral (pH 6.8); gradual smooth boundary.
- C—59 to 60 inches; yellowish brown (10YR 5/4) very cobbly sandy clay loam, dark brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; 50 percent cobbles and gravel; neutral (pH 6.8).

Thickness of the solum ranges from 30 to 63 inches. Rock fragments range from 30 to 80 percent of the solum. Reaction ranges from slightly acid to mildly alkaline. The A1 horizon is grayish brown to dark grayish brown. The texture is loam or sandy loam. The B2t horizon is olive brown to dark brown. It ranges from sandy clay loam to clay loam. The C horizon is olive to yellowish brown.

### Youga series

The Youga series consists of deep, well drained soils that formed in glacial drift derived from a variety of sources. Youga soils are on fans, mountainsides and ridges and have slopes of 0 to 50 percent. The average annual precipitation is about 18 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Youga soils are similar to Leavitt soils and are near Leavitt, Quander, and Cimarron soils. Leavitt soils have

visible lime accumulation in the solum. Quander soils average more than 35 percent rock fragments in the solum. Cimarron soils average more than 35 percent clay in the B2t horizon.

Typical pedon of Youga loam, 6 to 15 percent slopes, about 15 miles south of Kremmling and about 1,100 feet west and 750 feet south of the northeast corner of sec. 24, T. 2 S., R. 79 W.:

- A1—0 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse subangular blocky structure that parts to weak fine granular; slightly hard, very friable; neutral (pH 6.8); clear smooth boundary.
- B1—12 to 25 inches; yellowish brown (10YR 5/4) light clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few thin patchy clay films on faces of peds; neutral (pH 6.8); clear smooth boundary.
- B21t—25 to 44 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; strong medium angular blocky structure; very hard, firm, sticky and plastic; thin nearly continuous clay films on faces of peds; neutral (pH 6.6); clear smooth boundary.
- B22t—44 to 58 inches; strong brown (7.5YR 5/6) clay loam, strong brown (7.5YR 4/6) moist; strong medium and coarse angular blocky structure; very hard, firm, sticky and plastic; thin nearly continuous clay films on faces of peds; neutral (pH 7.0); clear smooth boundary.
- B3—58 to 65 inches; yellowish brown (10YR 5/8) light clay loam, dark yellowish brown (10YR 4/8) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; thin patchy clay films on faces of peds; neutral (pH 7.1); clear smooth boundary.
- C—65 to 70 inches; light yellowish brown (10YR 6/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable; neutral (pH 7.1).

Thickness of the solum ranges from 37 to 75 inches. Rock fragments make up 0 to 25 percent of the solum. Reaction is slightly acid through mildly alkaline. The A1 horizon is dark brown to dark grayish brown. The texture is loam or fine sandy loam. The B2t horizon is light olive brown to brown. It ranges from clay loam to sandy clay loam. The C horizon is light yellowish brown to light brown.

### Yovimpa series

The Yovimpa series consists of shallow, moderately well drained soils that formed in material weathered from shale and slate bedrock. Yovimpa soils are on mountainsides and ridges and have slopes of 6 to 45 percent. The average annual precipitation is about 14 inches, the average annual air temperature is about 37 degrees F, and the frost-free season is 30 to 75 days. Elevation is 7,500 to 9,000 feet.

Yovimpa soils are similar to Cimarron soils and are near Cimarron and Bucklon soils. Cimarron soils have bedrock at a depth of more than 40 inches. Bucklon soils average less than 35 percent clay in the control section.

Typical pedon of Yovimpa clay loam, 15 to 45 percent slopes, and about 17 miles south of Kremmling and 1,100 feet east and 700 feet north of the southwest corner of sec. 27, T. 3 S., R. 78 W.:

- A1—0 to 2 inches; grayish brown (10 YR 5/2) light clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; moderately alkaline (pH 8.2); clear smooth boundary.

- B1—2 to 7 inches; grayish brown (10YR 5/2) heavy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; thin patchy clay films on faces of peds; moderately alkaline (pH 8.2); clear wavy boundary.
- B2t—7 to 18 inches; light yellowish brown (10YR 6/4) clay, dark brown (10YR 3/4) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and very plastic; thin patchy clay films on faces of peds; moderately alkaline (pH 8.2); gradual wavy boundary.
- Cr—18 to 25 inches; calcareous clay shale.

Thickness of the solum ranges from 9 to 20 inches. Rock fragments make up 0 to 35 percent of the solum and are dominantly 1/2 to 1 1/2 inches in diameter. Reaction ranges from neutral to moderately alkaline. The A1 horizon is grayish brown to dark grayish brown. The texture is loam or clay loam. The B2t horizon is pale olive to light yellowish brown. It ranges from clay loam to clay but averages more than 35 percent clay. The C horizon is partially weathered clay shale.

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## Glossary

- Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.
- Alkali (sodic) soil.** A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.
- Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.
- Area reclaim.** An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.
- Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	<i>Inches</i>
Very low .....	0 to 3
Low .....	3 to 6
Moderate .....	6 to 9
High .....	More than 9

**Calcareous soil.** A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

**Channery soil.** A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

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

**Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

**Colluvium.** Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

**Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

*Loose.*—Noncoherent when dry or moist; does not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

*Sticky.*—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard; little affected by moistening.

**Erosion.** The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

*Erosion (geologic).* Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

*Erosion (accelerated).* Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

**Excess fines.** Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

**Flooding.** The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

**Frost action.** Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

**Glacial drift (geology).** Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unsorted material deposited by streams flowing from glaciers.

**Gravelly soil material.** Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter

**Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

*O horizon.*—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

*A horizon.*—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

*A<sub>2</sub> horizon.*—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

*B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

*C horizon.*—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

*R layer.*—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

**Hydrologic soil groups.** Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

**Leaching.** The removal of soluble material from soil or other material by percolating water.

**Low strength.** Inadequate strength for supporting loads.

**Mottling, soil.** Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

**Parent material.** The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

**Pedon.** The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

**Percs slowly.** The slow movement of water through the soil adversely affecting the specified use.

**Permeability.** The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

**pH value.** (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

**Piping.** Formation by moving water of subsurface tunnels or pipelike cavities.

**Plastic limit.** The moisture content at which a soil changes from a semisolid to a plastic state.

**Profile, soil.** A vertical section of the soil extending through all its horizons and into the parent material.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	<i>pH</i>
Extremely acid .....	Below 4.5
Very strongly acid .....	4.5 to 5.0
Strongly acid .....	5.1 to 5.5
Medium acid .....	5.6 to 6.0
Slightly acid .....	6.1 to 6.5
Neutral .....	6.6 to 7.3
Mildly alkaline .....	7.4 to 7.8
Moderately alkaline .....	7.9 to 8.4
Strongly alkaline .....	8.5 to 9.0
Very strongly alkaline .....	9.1 and higher

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Residuum (residual soil material).** Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

**Rock fragments.** Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

**Runoff.** The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

**Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

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

**Soil.** A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Solum.** The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

**Stratified.** Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

**Structure, soil.** The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular

or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Substratum.** The part of the soil below the solum.

**Subsurface layer.** Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

**Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

**Texture, soil.** The relative proportions of sand, silt, and clay particles in

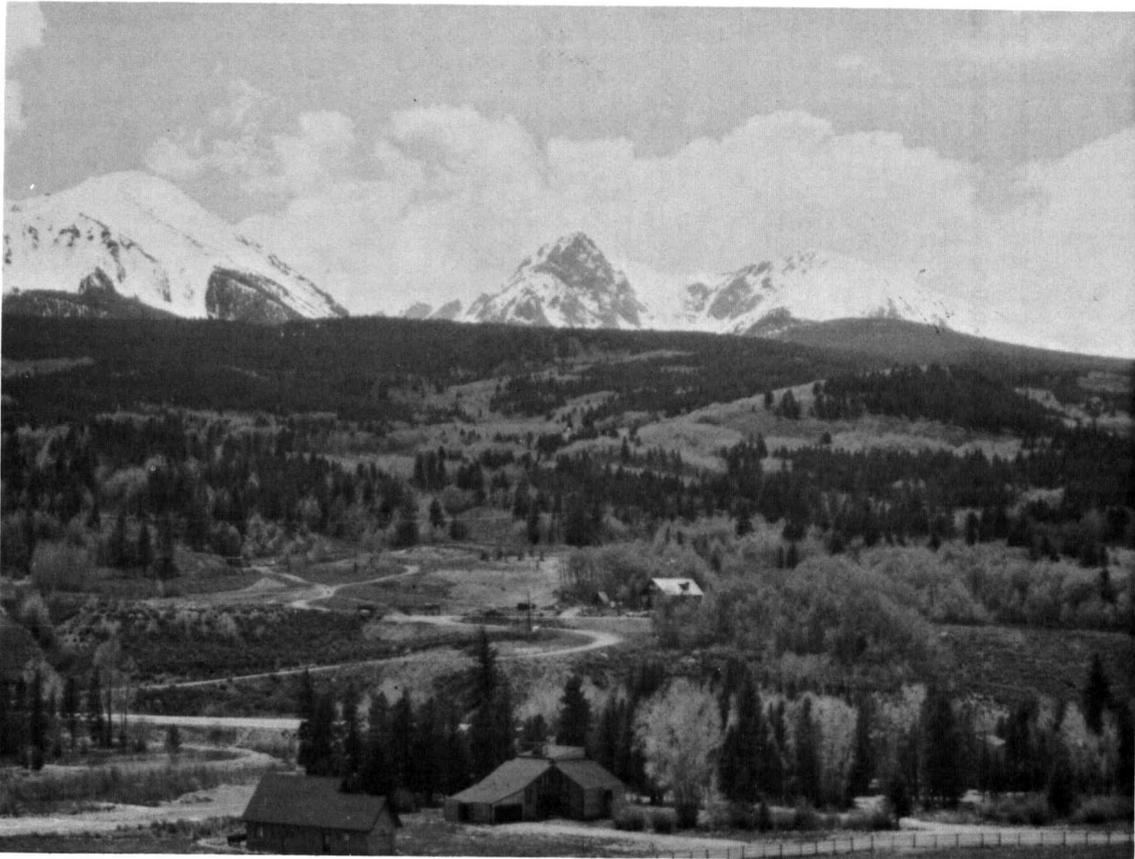
a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt*, *silt loam*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes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

**Thin layer.** Otherwise suitable soil material too thin for the specified use.

**Water table.** The upper limit of the soil or underlying rock material that is wholly saturated with water.

*Water table, apparent.* A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

## **Illustrations**



*Figure 1.*—This area of Handran soils and Cumulic Cryaquolls is being converted to use as homesites. Muggins soils are in the background.



*Figure 2.*—An area of Mine dumps. Frisco and Peeler soils are in the background.



*Figure 3.*—This area of Mine dumps is revegetating to quaking aspen. Grenadier and Leadville soils are in the adjacent areas.



*Figure 4.*—An area of Rock-outcrop-Cryoborolls complex on alpine slopes in the background. Grenadier gravelly loam is the soil in the foreground.

## **Tables**

## SOIL SURVEY

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Recorded in the period 1951-74]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days <sup>1</sup>	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum higher than--	Minimum lower than--			Less than--	More than--		
	°F	°F	°F	°F	°F		In	In	In		In
Green Mountain Dam											
January----	30.7	5.5	18.1	52	-30	13	1.12	.47	1.64	4	15.4
February----	34.7	6.6	20.7	53	-26	10	.96	.61	1.26	4	13.2
March-----	42.3	13.6	28.0	62	-14	26	1.36	.83	1.82	5	15.5
April-----	53.7	24.4	39.1	72	3	86	1.40	.78	1.89	5	9.4
May-----	65.1	32.9	49.1	80	19	287	1.43	.76	1.96	4	.9
June-----	74.9	39.4	57.2	88	27	316	1.31	.45	1.99	4	.0
July-----	80.5	45.1	62.9	91	34	710	1.51	.88	2.06	5	.0
August-----	78.5	43.8	61.2	89	32	657	1.69	.99	2.30	5	.0
September--	71.6	36.5	54.1	86	22	423	1.47	.49	2.25	4	1.0
October----	61.0	28.2	44.6	77	10	178	1.06	.37	1.60	3	4.0
November----	43.8	17.3	30.6	62	-9	26	1.08	.63	1.47	4	13.1
December----	32.0	7.4	19.8	53	-21	0	1.14	.60	1.57	4	15.7
Year-----	55.7	25.1	40.5	92	-31	2,932	15.53	13.06	17.85	51	88.2
Dillon											
January----	32.5	.3	16.5	51	-31	0	1.07	.42	1.59	4	21.9
February----	34.7	1.7	18.2	54	-29	0	1.09	.54	1.53	4	21.7
March-----	39.2	6.8	23.1	57	-22	6	1.33	.76	1.77	5	25.1
April-----	48.0	17.0	32.5	64	-8	22	1.45	.78	1.98	5	19.0
May-----	59.9	25.3	42.6	74	10	118	1.35	.62	1.94	5	7.1
June-----	69.4	31.5	50.5	82	20	315	1.13	.51	1.66	4	1.0
July-----	75.0	37.1	56.1	83	27	499	1.68	1.08	2.21	6	.0
August-----	72.9	35.8	54.3	82	23	443	1.74	.97	2.37	6	.0
September--	67.1	28.3	47.7	80	13	236	1.28	.52	1.89	4	3.0
October----	57.4	20.9	39.2	72	0	82	.85	.35	1.25	3	7.7
November----	41.7	10.7	26.2	60	-19	8	.91	.59	1.19	4	17.1
December----	34.0	2.5	18.3	53	-25	0	1.18	.55	1.68	4	23.1
Year-----	52.7	18.2	35.4	84	-33	1,729	15.88	12.17	17.80	54	146.7

<sup>1</sup>A growing degree day is an index of the amount of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40°F.).

SUMMIT COUNTY AREA, COLORADO

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74]

Probability	Minimum temperature					
	Green Mountain Dam			Dillon		
	24°F or lower	28°F or lower	32°F or lower	24°F or lower	28°F or lower	32°F or lower
Last freezing temperature in spring:						
1 year in 10 later than--	May 18	June 5	June 23	June 19	July 1	July 3
2 years in 10 later than--	May 14	June 1	June 16	June 14	June 27	July 1
5 years in 10 later than--	May 5	May 24	June 9	June 5	June 19	June 26
First freezing temperature in fall:						
1 year in 10 earlier than--	September 18	September 1	August 8	August 9	July 1	June 19
2 years in 10 earlier than--	September 24	September 8	August 16	August 17	July 14	June 27
5 years in 10 earlier than--	October 6	September 20	September 2	September 3	August 9	July 13

TABLE 3.--GROWING SEASON LENGTH

[Data recorded for the period 1951-74]

Probability	Daily minimum temperature during growing season					
	Green Mountain Dam			Dillon		
	Higher than 24°F	Higher than 28°F	Higher than 32°F	Higher than 24°F	Higher than 28°F	Higher than 32°F
	Days	Days	Days	Days	Days	Days
9 years in 10	131	95	55	58	5	0
8 years in 10	138	103	63	69	20	0
5 years in 10	153	118	84	90	30	16
2 years in 10	168	134	103	111	79	35
1 year in 10	175	141	113	122	95	43

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1D	Anvik loam, 6 to 15 percent slopes-----	525	0.5
1F	Anvik loam, 15 to 35 percent slopes-----	4,750	4.6
2F	Bucklon loam, 15 to 35 percent slopes-----	2,890	2.8
3D	Cimarron loam, 6 to 15 percent slopes-----	2,370	2.3
3F	Cimarron loam, 15 to 35 percent slopes-----	2,660	2.6
4	Cumulic Cryaquolls, nearly level-----	3,500	3.4
5E	Frisco-Peeler complex, 6 to 25 percent slopes-----	5,195	5.1
5F	Frisco-Peeler complex, 25 to 65 percent slopes-----	21,690	21.1
6	Gravel pits-----	60	0.1
7C	Grenadier gravelly loam, 0 to 6 percent slopes-----	1,240	1.2
7D	Grenadier gravelly loam, 6 to 15 percent slopes-----	2,480	2.4
7F	Grenadier gravelly loam, 15 to 55 percent slopes-----	8,995	8.7
8B	Handran gravelly loam, 0 to 3 percent slopes-----	2,820	2.7
8D	Handran gravelly loam, 3 to 15 percent slopes-----	420	0.4
9F	Handran bouldery loam, 15 to 55 percent slopes-----	650	0.6
10	Histic Cryaquolls, nearly level-----	2,080	2.0
11F	Leadville gravelly loam, 15 to 55 percent slopes-----	1,810	1.8
12C	Leavitt loam, 0 to 6 percent slopes-----	180	0.2
12D	Leavitt loam, 6 to 15 percent slopes-----	1,430	1.4
12F	Leavitt loam, 15 to 55 percent slopes-----	910	0.9
13	Mine dumps-----	650	0.6
14C	Muggins sandy loam, 0 to 6 percent slopes-----	500	0.5
14D	Muggins sandy loam, 6 to 15 percent slopes-----	2,380	2.3
14F	Muggins sandy loam, 15 to 35 percent slopes-----	430	0.4
15	Placer diggings-----	1,170	1.1
16C	Quander cobbly loam, 0 to 6 percent slopes-----	270	0.3
16D	Quander cobbly loam, 6 to 15 percent slopes-----	1,430	1.4
16E	Quander cobbly loam, 15 to 55 percent slopes-----	3,940	3.8
17F	Quander-Youga complex, 15 to 55 percent slopes-----	1,290	1.3
18	Rock outcrop-Cryoborolls complex-----	8,500	8.3
19C	Youga loam, 0 to 6 percent slopes-----	1,140	1.1
19D	Youga loam, 6 to 15 percent slopes-----	1,770	1.7
19F	Youga loam, 15 to 45 percent slopes-----	2,190	2.1
20D	Youga loam, thick surface, 6 to 15 percent slopes-----	830	0.8
20F	Youga loam, thick surface, 15 to 50 percent slopes-----	650	0.6
21D	Yovimpa clay loam, 6 to 15 percent slopes-----	640	0.6
21F	Yovimpa clay loam, 15 to 45 percent slopes-----	3,680	3.6
	Water-----	4,861	4.7
	Total-----	102,976	100.0

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITITES

[Only the soils that support rangeland vegetation are listed]

Soil name and map symbol	Range site name	Potential production		Characteristic vegetation	Composition				
		Kind of year	Dry weight						
			Lb/acre		Pct				
Anvik: 1D, 1F-----	Subalpine loam-----	Favorable	4,000	Thurber fescue-----	45				
		Normal	3,000	Parry oatgrass-----	10				
		Unfavorable	2,000	Nodding brome-----	5				
				Muttongrass-----	5				
				Bearded wheatgrass-----	5				
Bucklon: 2F-----	Dry mountain loam-----	Favorable	1,200	Western wheatgrass-----	15				
		Normal	1,000	Big sagebrush-----	15				
		Unfavorable	800	Muttongrass-----	13				
				Needlegrasses-----	10				
				Squirreltail-----	5				
				Indian ricegrass-----	5				
Cimarron: 3D, 3F-----	Mountain loam-----	Favorable	1,800	Idaho fescue-----	15				
		Normal	1,600	Western wheatgrass-----	10				
		Unfavorable	1,200	Big sagebrush-----	10				
				Bearded wheatgrass-----	5				
				Slender wheatgrass-----	5				
				Nodding brome-----	5				
				Mountain brome-----	5				
Cumulic Cryaquolls: 4-----	Mountain meadow-----	Favorable	3,000	Tufted hairgrass-----	45				
		Normal	2,500	Sedge-----	12				
		Unfavorable	2,000	Slender wheatgrass-----	10				
				Rush-----	5				
				American bistort-----	5				
Handran: 8B, 8D-----	Stony loam-----	Favorable	2,000	Bluebunch wheatgrass-----	15				
		Normal	1,500	Western wheatgrass-----	10				
		Unfavorable	1,000	Needlegrasses-----	10				
				Fescue-----	10				
				Muttongrass-----	10				
				Serviceberry-----	10				
				Big sagebrush-----	8				
				Indian ricegrass-----	5				
				Snowberry-----	5				
				Bitterbrush-----	5				
				9F-----	Stony loam-----	Favorable	2,000	Big sagebrush-----	30
						Normal	1,300	Idaho fescue-----	10
						Unfavorable	1,000	Bitterbrush-----	10
Western wheatgrass-----	10								
Bluebunch wheatgrass-----	5								
Muttongrass-----	5								
				Nodding brome-----	5				
				Needle-and-thread-----	5				
				Serviceberry-----	5				
				Low rabbitbrush-----	5				
Histic Cryaquolls: 10-----	Mountain meadow-----	Favorable	1,500	Sedge-----	25				
		Normal	1,000	Rush-----	20				
		Unfavorable	800	Willows-----	20				
				Tufted hairgrass-----	10				
				Shrubby cinquefoil-----	10				
				American bistort-----	5				

SOIL SURVEY

TABLE 5.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Potential production		Characteristic species	Composition
		Kind of year	Dry weight		
				Lb/acre	Pct
Leavitt: 12C, 12D, 12F-----	Mountain loam-----	Favorable	1,800	Idaho fescue-----	15
		Normal	1,600	Wheatgrass-----	15
		Unfavorable	1,200	Sandberg bluegrass-----	10
				Big sagebrush-----	10
				Needlegrasses-----	5
				Bottlebrush squirreltail-----	5
				Sedge-----	5
				Brome-----	5
Prairie junegrass-----	5				
Quander: 16C, 16D, 16E-----	Stony loam-----	Favorable	2,000	Bluebunch wheatgrass-----	15
		Normal	1,700	Western wheatgrass-----	10
		Unfavorable	1,000	Muttongrass-----	10
				Idaho fescue-----	10
				Serviceberry-----	10
				Big sagebrush-----	8
				Mountain muhly-----	5
				Bitterbrush-----	5
Snowberry-----	5				
Lupine-----	5				
<sup>1</sup> 17F: Quander part-----	Stony loam-----	Favorable	2,000	Bluebunch wheatgrass-----	15
		Normal	1,700	Western wheatgrass-----	10
		Unfavorable	1,000	Muttongrass-----	10
				Idaho fescue-----	10
				Serviceberry-----	10
				Big sagebrush-----	8
				Mountain muhly-----	5
				Bitterbrush-----	5
Snowberry-----	5				
Lupine-----	5				
Youga part-----	Mountain loam-----	Favorable	1,800	Wheatgrass-----	20
		Normal	1,500	Idaho fescue-----	15
		Unfavorable	1,200	Sagebrush-----	10
				Thurber fescue-----	5
				Nodding brome-----	5
				Muttongrass-----	5
Mountain brome-----	5				
Youga: 19C, 19D, 19F-----	Mountain loam-----	Favorable	1,800	Wheatgrass-----	20
		Normal	1,600	Idaho fescue-----	15
		Unfavorable	1,200	Sagebrush-----	10
				Thurber fescue-----	5
				Nodding brome-----	5
				Muttongrass-----	5
Mountain brome-----	5				
20D, 20F-----	Subalpine loam-----	Favorable	3,000	Thurber fescue-----	45
		Normal	2,500	Parry oatgrass-----	10
		Unfavorable	2,000	Sagebrush-----	6
				Nodding brome-----	5
				Wheatgrass-----	5
Muttongrass-----	5				
Yovimpa: 21D, 21F-----	Mountain shale-----	Favorable	700	Wheatgrasses-----	55
		Normal	500	Indian ricegrass-----	10
		Unfavorable	300	Bottlebrush squirreltail-----	5
				Winterfat-----	5

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that the information was not available]

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity	
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Plant competition	Important trees	Site index
Anvik: 1D, 1F-----	6r	Moderate	Slight	Moderate	Slight	Slight	Quaking aspen----- Lodgepole pine----- Douglas-fir-----	--- 50 ---
Frisco: 15E: Frisco part-----	4o	Slight	Slight	Moderate	Slight	Slight	Engelmann spruce---- Subalpine fir----- Lodgepole pine-----	56 --- 65
Peeler part-----	4o	Slight	Slight	Moderate	Slight	Slight	Lodgepole pine----- Engelmann spruce---- Subalpine fir-----	74 55 ---
15F: Frisco part-----	4r	Severe	Severe	Moderate	Slight	Slight	Engelmann spruce---- Subalpine fir----- Lodgepole pine-----	56 --- 65
Peeler part-----	4r	Severe	Severe	Moderate	Slight	Slight	Lodgepole pine----- Engelmann spruce---- Subalpine fir-----	74 55 ---
Grenadier: 7C, 7D, 7F-----	6f	Severe	Severe	Moderate	Slight	Slight	Engelmann spruce---- Lodgepole pine----- Subalpine fir-----	40 52 ---
Leadville: 11F-----	5r	Moderate	Moderate	Slight	Slight	Slight	Lodgepole pine----- Engelmann spruce---- Subalpine fir-----	64 56 ---
Muggins: 14C, 14D-----	4o	Slight	Slight	Moderate	Slight	Slight	Lodgepole pine----- Engelmann spruce---- Subalpine fir-----	66 56 ---
14F-----	4r	Moderate	Moderate	Moderate	Slight	Slight	Lodgepole pine----- Engelmann spruce---- Subalpine fir-----	66 56 ---

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

## SOIL SURVEY

TABLE 7.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Anvik: 1D-----	Moderate: slope.	Moderate: slope, low strength, shrink-swell.	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength, frost action.
1F-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bucklon: 2F-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, low strength.
Cimarron: 3D-----	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, low strength.
3F-----	Severe: too clayey, slope.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.	Severe: shrink-swell, slope, low strength.
Cumulic Cryaquolls: 4-----	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: wetness, floods, frost action.	Severe: wetness, floods, frost action.	Severe: wetness, floods, frost action.
Frisco: 15E, 15F: Frisco part-----	Severe: large stones, slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Peeler part-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gravel pits: 6.					
Grenadier: 7C-----	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Moderate: large stones, frost action.
7D-----	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Moderate: slope, large stones, frost action.
7F-----	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Handran: 8B-----	Severe: large stones, small stones.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones, low strength.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Handran: 8D-----	Severe: large stones, small stones.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, large stones, low strength.
9F-----	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope.
Histic Cryaquolls: 10-----	Severe: wetness, floods, excess humus.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.
Leadville: 11F-----	Severe: large stones, slope, small stones.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Leavitt: 12C-----	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength, frost action.
12D-----	Moderate: slope, too clayey.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Moderate: slope, shrink-swell, low strength.
12F-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mine dumps: 13.					
Muggins: 14C-----	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
14D-----	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell.
14F-----	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.
Placer diggings: 15.					
Quander: 16C-----	Severe: cutbanks cave, small stones, large stones.	Slight-----	Slight-----	Slight-----	Moderate: frost action.
16D-----	Severe: cutbanks cave, small stones, large stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
16E-----	Severe: cutbanks cave, small stones, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

## SOIL SURVEY

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Quander: <sup>1</sup> 17F: Quander part-----	Severe: cutbanks cave, small stones, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Youga part-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop: <sup>1</sup> 18: Rock outcrop part.					
Cryoborolls part-	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.
Youga: 19C-----	Slight-----	Moderate: low strength.	Slight-----	Moderate: low strength.	Moderate: low strength, frost action.
19D, 20D-----	Moderate: slope.	Moderate: low strength, slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.
19F, 20F-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Yovimpa: 21D-----	Severe: depth to rock.	Moderate: depth to rock, slope, low strength.	Severe: depth to rock.	Severe: slope.	Moderate: low strength, slope, depth to rock.
21F-----	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 8.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," and "fair." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Anvik: 1D-----	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope, too clayey.
1F-----	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope.	Poor: slope.
Bucklon: 2F-----	Severe: depth to rock, slope, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: thin layer, slope, area reclaim.
Cimarron: 3D-----	Severe: percs slowly.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: slope.	Poor: too clayey.
3F-----	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey, slope.	Severe: slope.	Poor: too clayey, slope.
Cumulic Cryaquolls: 4-----	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Frisco: 15E: Frisco part-----	Severe: large stones, slope.	Severe: slope, large stones, seepage.	Severe: large stones.	Severe: slope, seepage.	Poor: large stones, slope, small stones.
Peeler part-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage, slope.	Poor: slope.
15F: Frisco part-----	Severe: large stones, slope.	Severe: slope, large stones, seepage.	Severe: slope, large stones.	Severe: slope, seepage.	Poor: large stones, slope, small stones.
Peeler part-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Gravel pits: 6.					
Grenadier: 7C-----	Severe: large stones.	Severe: seepage.	Severe: large stones, seepage.	Severe: seepage.	Poor: large stones.
7D-----	Severe: large stones.	Severe: slope, seepage.	Severe: large stones, seepage.	Severe: seepage.	Poor: large stones.
7F-----	Severe: large stones, slope.	Severe: slope, seepage.	Severe: large stones, slope, seepage.	Severe: slope, seepage.	Poor: large stones, slope.

See footnote at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Handran: 8B-----	Moderate: large stones.	Severe: seepage, large stones.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones, large stones.
8D-----	Moderate: slope, large stones.	Severe: seepage, large stones, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones, large stones.
9F-----	Severe: large stones, slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
Histic Cryaquolls: 10-----	Severe: wetness, floods.	Severe: wetness, floods, excess humus.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, excess humus.
Leadville: 11F-----	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope, depth to rock.	Severe: slope.	Poor: large stones, slope, small stones.
Leavitt: 12C-----	Moderate: percs slowly.	Moderate: slope, seepage.	Slight-----	Slight-----	Fair: too clayey.
12D-----	Moderate: slope, percs slowly.	Severe: slope.	Slight-----	Moderate: slope.	Fair: slope, too clayey.
12F-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Mine dumps: 13.					
Muggins: 14C-----	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight-----	Poor: too clayey.
14D-----	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Poor: too clayey.
14F-----	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: too clayey, slope.
Placer diggings: 15.					
Quander: 16C-----	Moderate: percs slowly.	Severe: large stones, small stones.	Slight-----	Slight-----	Poor: large stones, small stones.
16D-----	Moderate: slope, percs slowly.	Severe: large stones, slope, small stones.	Slight-----	Moderate: slope.	Poor: large stones, small stones.

See footnote at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Quander--continued 16E-----	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: slope.	Poor: large stones, slope, small stones.
<sup>1</sup> 17F: Quander part-----	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: slope.	Poor: large stones, slope, small stones.
Youga part-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Rock outcrop: <sup>1</sup> 18: Rock outcrop part.					
Cryoborolls part--	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: thin layer, slope.
Youga: 19C-----	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----	Slight-----	Good.
19D, 20D-----	Moderate: percs slowly, slope.	Severe: slope.	Slight-----	Moderate: slope.	Fair: slope.
19F, 20F-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Yovimpa: 21D-----	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
21F-----	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Poor: slope, thin layer.

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 9.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Anvik: 1D-----	Fair: low strength, frost action.	Unsuited-----	Unsuited-----	Fair: slope.
1F-----	Poor: slope.	Unsuited-----	Unsuited-----	Poor: slope.
Bucklon: 2F-----	Poor: thin layer, slope, area reclaim.	Unsuited-----	Unsuited-----	Poor: slope, area reclaim.
Cimarron: 3D-----	Poor: shrink-swell, low strength.	Unsuited-----	Unsuited-----	Poor: thin layer, area reclaim.
3F-----	Poor: shrink-swell, slope, low strength.	Unsuited-----	Unsuited-----	Poor: thin layer, area reclaim, slope.
Cumelic Cryaquolls: 4-----	Poor: wetness, frost action.			Poor: wetness.
Frisco: 15E: Frisco part-----	Fair: slope, low strength, frost action.	Unsuited-----	Unsuited-----	Poor: slope.
Peeler part-----	Fair: slope, frost action.	Poor: excess fines.	Poor: excess fines.	Poor: small stones, slope.
15F: Frisco part-----	Poor: slope.	Unsuited-----	Unsuited-----	Poor: slope.
Peeler part-----	Poor: slope.	Poor: excess fines.	Poor: excess fines.	Poor: small stones, slope.
Gravel pits: 6.				
Grenadier: 7C, 7D-----	Fair: large stones, frost action.	Unsuited: large stones.	Unsuited: large stones.	Poor: large stones.
7F-----	Poor: slope.	Unsuited: large stones.	Unsuited: large stones.	Poor: large stones, slope.
Handran: 8B, 8D-----	Fair: large stones, low strength.	Poor: excess fines.	Poor: excess fines.	Poor: small stones.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Handran: 9F-----	Poor: large stones, slope.	Unsuited: large stones.	Unsuited: large stones.	Poor: large stones, slope.
Histic Cryaquolls: 10-----	Poor: excess humus, wetness, frost action.			Poor: wetness.
Leadville: 11F-----	Poor: slope.	Unsuited-----	Unsuited-----	Poor: slope, small stones.
Leavitt: 12C-----	Fair: shrink-swell, low strength, frost action.	Unsuited-----	Unsuited-----	Fair: thin layer.
12D-----	Fair: shrink-swell, low strength, frost action.	Unsuited-----	Unsuited-----	Fair: slope, thin layer.
12F-----	Poor: slope.	Unsuited-----	Unsuited-----	Poor: slope.
Mine dumps: 13.				
Muggins: 14C-----	Poor: shrink-swell.	Unsuited-----	Unsuited-----	Fair: thin layer.
14D-----	Poor: shrink-swell.	Unsuited-----	Unsuited-----	Fair: thin layer, slope.
14F-----	Poor: shrink-swell, slope.	Unsuited-----	Unsuited-----	Poor: slope.
Placer diggings: 15.				
Quander: 16C, 16D-----	Fair: frost action.	Unsuited-----	Unsuited-----	Poor: small stones.
16E-----	Poor: slope.	Unsuited-----	Unsuited-----	Poor: slope, small stones.
117F: Quander part-----	Poor: slope.	Unsuited-----	Unsuited-----	Poor: slope, small stones.
Youga part-----	Poor: slope.	Unsuited-----	Unsuited-----	Poor: slope, small stones.
Rock outcrop: 118: Rock outcrop part.				

See footnote at end of table.

## SOIL SURVEY

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Rock outcrop: Cryoborolls part---	Poor: slope, thin layer.	Unsuited-----	Unsuited-----	Poor: slope, large stones.
Yauga: 19C, 19D, 20D-----	Fair: low strength, frost action.	Unsuited-----	Unsuited-----	Poor: small stones.
19F, 20F-----	Poor: slope.	Unsuited-----	Unsuited-----	Poor: slope, small stones.
Yovimpa: 21D-----	Poor: thin layer.	Unsuited-----	Unsuited-----	Fair: slope, too clayey.
21F-----	Poor: slope, thin layer.	Unsuited-----	Unsuited-----	Poor: slope.

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 10.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Anvik: 1D, 1F-----	Seepage, slope.	Shrink-swell, low strength.			Slope-----	Slope.
Bucklon: 2F-----	Depth to rock, slope.	Thin layer, shrink-swell, low strength.			Slope, depth to rock.	Slope, rooting depth.
Cimarron: 3D, 3F-----	Slope-----	Hard to pack, low strength.	Slope, percs slowly.	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
Cumulic Cryaquolls: 4-----			Floods, wetness.	Wetness, floods.	Wetness-----	Wetness.
Frisco: 15E, 15F: Frisco part----	Slope, seepage.	Large stones----			Slope, large stones.	Slope, droughty.
Peeler part----	Seepage, slope.	Seepage-----			Slope-----	Slope.
Gravel pits: 6.						
Grenadier: 7C, 7D, 7F-----	Seepage, slope, large stones.	Large stones, piping.			Large stones, slope.	Large stones, slope.
Handran: 8B, 8D-----	Seepage-----	Seepage, large stones.			Large stones----	Favorable.
9F-----	Seepage, slope.	Large stones, seepage.			Large stones, slope.	Large stones, slope.
Histic Cryaquolls: 10-----			Wetness, floods.	Wetness, floods.	Wetness-----	Wetness.
Leadville: 11F-----	Slope, seepage.	Large stones, seepage.			Slope, large stones.	Slope.
Leavitt: 12C-----	Seepage-----	Shrink-swell, low strength, piping.	Slope-----	Slope-----	Favorable-----	Favorable.
12D, 12F-----	Slope, seepage.	Shrink-swell, low strength, piping.	Slope-----	Slope-----	Slope-----	Slope.
Mine dumps: 13.						
Muggins: 14C, 14D, 14F----	Slope-----	Shrink-swell, hard to pack.			Slope, percs slowly.	Slope, percs slowly.

See footnote at end of table.

## SOIL SURVEY

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Placer diggings: 15.						
Quander: 16C-----	Seepage-----	Large stones---			Large stones---	Favorable.
16D, 16E-----	Slope, seepage.	Large stones---			Slope, large stones.	Slope.
<sup>1</sup> 17F: Quander part---	Slope, seepage.	Large stones---			Slope, large stones.	Slope.
Youga part-----	Slope-----	Low strength, shrink-swell, compressible.			Slope, percs slowly.	Slope, percs slowly.
Rock outcrop: <sup>1</sup> 18: Rock outcrop part.						
Cryoborolls part-----	Depth to rock, slope.	Thin layer, large stones.			Depth to rock, slope.	Rooting depth, slope.
Youga: 19C, 19D, 19F, 20D, 20F-----	Slope-----	Low strength, shrink-swell, compressible.			Slope, percs slowly.	Slope, percs slowly.
Yovimpa: 21D, 21F-----	Slope, depth to rock.	Low strength, piping.			Slope, depth to rock, piping.	Slope, depth to rock, rooting depth.

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Anvik: 1D-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
1F-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bucklon: 2F-----	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.
Cimarron: 3D-----	Moderate: percs slowly.	Moderate: slope.	Severe: slope.	Slight.
3F-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Cumulic Cryaquolls: 4-----	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Frisco: 15E: Frisco part-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Peeler part-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
15F: Frisco part-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Peeler part-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gravel pits: 6.				
Grenadier: 7C-----	Moderate: large stones.	Moderate: large stones.	Moderate: large stones, slope.	Moderate: large stones.
7D-----	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: large stones.
7F-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Handran: 8B-----	Slight-----	Slight-----	Moderate: small stones.	Slight.
8D-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
9F-----	Severe: large stones, slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.

See footnote at end of table.

## SOIL SURVEY

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Histic Cryaquolls: 10-----	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
Leadville: 11F-----	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Severe: slope.
Leavitt: 12C-----	Slight-----	Slight-----	Moderate: slope.	Slight.
12D-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
12F-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mine dumps: 13.				
Muggins: 14C-----	Moderate: percs slowly.	Slight-----	Moderate: percs slowly, slope.	Slight.
14D-----	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight.
14F-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Placer diggings: 15.				
Quander: 16C-----	Severe: small stones.	Severe: small stones.	Severe: small stones.	Severe: small stones.
16D-----	Severe: small stones.	Severe: small stones.	Severe: small stones, slope.	Severe: small stones.
16E-----	Severe: small stones, slope.	Severe: small stones, slope.	Severe: small stones, slope.	Severe: small stones, slope.
<sup>1</sup> 17F: Quander part-----	Severe: small stones, slope.	Severe: small stones, slope.	Severe: small stones, slope.	Severe: small stones, slope.
Youga part-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop: 118: Rock outcrop part.				
Cryoborolls part---	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.
Youga: 19C-----	Slight-----	Slight-----	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Youga: 19D, 20D-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
19F, 20F-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Yovimpa: 21D-----	Moderate: slope, too clayey.	Moderate: slope, too clayey.	Severe: slope, depth to rock.	Moderate: too clayey.
21F-----	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

## SOIL SURVEY

TABLE 12.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--				
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
Anvik: 1D-----	Very poor.	Poor	Good	---	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	---
1F-----	Very poor.	Very poor.	Good	---	Good	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	---
Bucklon: 2F-----	Very poor.	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Cimarron: 3D, 3F-----	Very poor.	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Cumulie Cryaquolls: 4-----	Very poor.	Poor	Good	---	---	Fair	Good	Fair	Poor	---	Fair	Fair.
Frisco: 15E: Frisco part-----	Very poor.	Poor	Fair	---	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	---
Peeler part-----	Very poor.	Poor	Good	---	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	---
15F: Frisco part-----	Very poor.	Very poor.	Fair	---	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	---
Peeler part-----	Very poor.	Very poor.	Good	---	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	---
Gravel pits: 6.												
Grenadier: 7C, 7D, 7F-----	Very poor.	Very poor.	Good	---	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	---
Handran: 8B, 8D-----	Very poor.	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
9F-----	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Histic Cryaquolls: 10-----	Very poor.	Very poor.	Poor	---	---	Poor	Good	Good	Very poor.	---	Good	---
Leadville: 11F-----	Very poor.	Very poor.	Good	---	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	---
Leavitt: 12C, 12D-----	Very poor.	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
12F-----	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Mine dumps: 13.												

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--				
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
Muggins: 14C, 14D-----	Very poor.	Poor	Fair	---	Good	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	---
14F-----	Very poor.	Very poor.	Fair	---	Good	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	---
Placer diggings: 15.												
Quander: 16C, 16D-----	Very poor.	Poor	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
16E-----	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
117F: Quander part----	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Youga part-----	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Rock outcrop: 118: Rock outcrop part.												
Cryoborolls part	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	---	---	Very poor.	Fair.
Youga: 19C, 19D, 20D-----	Very poor.	Poor	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
19F, 20F-----	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Yovimpa: 21D, 21F-----	Very poor.	Very poor.	Poor	---	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

## SOIL SURVEY

TABLE 13.--ENGINEERING PROPERTIES

[The symbol &gt; means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
Anvik: 1D, 1F-----	0-15	Loam-----	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	50-70	20-40	5-15
	15-48	Clay loam, loam, cobble clay loam.	CL	A-6	0-30	90-100	75-95	70-90	55-75	30-40	10-20
	48-60	Loam, gravelly loam, cobbly clay loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-50	75-100	65-95	55-85	40-70	20-40	5-20
Bucklon: 2F-----	0-10	Loam-----	CL	A-6	0	95-100	95-100	80-100	60-80	25-40	10-20
	10-18	Clay loam, loam, slaty clay loam.	CL	A-6, A-7	0	60-100	60-95	55-95	50-85	25-50	10-25
	18	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Cimarron: 3D, 3F-----	0-14	Loam-----	ML	A-4	0	90-100	90-100	85-95	60-75	20-30	NP-5
	14-45	Clay, clay loam	CH, CL	A-7	0-10	95-100	95-100	90-100	75-90	45-70	30-45
	45-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Cumelic Cryaquolls: 4-----	0-60	Variable-----	---	---	---	---	---	---	---	---	---
Frisco: 15E, 15F: Frisco part-----	0-16	Sandy loam-----	GM, GM-GC, CL-ML, ML	A-2, A-4	0-5	55-90	50-85	50-75	30-60	15-20	NP-5
	16-60	Very stony sandy clay loam, very cobble sandy clay loam, very gravelly clay loam.	GC, SC	A-2	35-50	50-75	35-60	30-40	20-35	20-35	10-15
Peeler part-----	0-15	Sandy loam-----	SM	A-2, A-4	0	90-95	80-90	50-65	25-40	20-25	NP-5
	15-60	Gravelly sandy clay loam, gravelly sandy clay, cobbly sandy clay loam.	SC	A-2, A-6	0-30	65-90	50-75	30-45	20-40	30-35	10-15
Gravel pits: 6.											
Grenadier: 7C, 7D, 7F-----	0-6	Gravelly loam---	ML, GM	A-4	0-5	50-80	50-75	45-70	40-55	25-35	NP-10
	6-19	Gravelly loam, gravelly sandy clay loam.	SM, GM	A-4	5-15	50-80	50-75	45-75	40-50	25-35	NP-10
	19-60	Very cobbly sandy loam, very stony loam.	SM, GM	A-2, A-4	50-80	50-75	50-75	45-65	30-50	25-35	NP-10
Handran: 8B, 8D-----	0-15	Gravelly loam---	GM, SM	A-2, A-1	10-15	50-90	50-75	40-50	20-35	15-25	NP-5
	15-60	Very cobbly sandy loam, very stony sandy loam.	SM, GM	A-1	30-55	50-80	40-75	20-50	15-20	15-25	NP-5

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
Handran: 9F-----	0-12	Bouldery loam---	SM	A-1, A-2, A-4	65-80	60-70	40-60	30-50	10-40	15-25	NP-5
	12-60	Very stony coarse sandy loam, very bouldery sandy loam.	SM	A-1, A-2	50-65	65-75	50-65	35-45	15-30	15-25	NP-5
Histic Cryaquolls: 10-----	0-60	Variable-----	---	---	---	---	---	---	---	---	---
Leadville: 11F-----	0-26	Gravelly loam---	GM, SM	A-4	0-20	60-80	60-75	55-65	40-50	20-35	NP-10
	26-42	Very stony clay loam, very cobbly clay loam.	GC, SC	A-2, A-6	25-70	30-80	25-70	25-50	20-45	30-40	10-20
	42-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Leavitt: 12C, 12D, 12F-----	0-4	Loam-----	ML, SM	A-4	0	75-100	75-100	70-90	40-60	25-35	NP-5
	4-60	Clay loam, loam	CL	A-6	0	75-100	75-100	70-100	55-80	30-40	10-15
Mine dumps: 13.											
Muggins: 14C, 14D, 14F-----	0-12	Sandy loam-----	SM	A-2	5-20	75-95	75-85	45-55	30-35	15-20	NP-5
	12-18	Stratified sandy loam to clay loam.	CL, SC	A-6	10-25	95-100	85-95	65-75	45-55	30-35	10-15
	18-50	Sandy clay, clay, clay loam.	CH, CL	A-7	15-40	95-100	90-100	70-80	50-75	40-55	20-30
	50-60	Sandy clay loam, clay loam.	CL, SC	A-6	15-40	95-100	85-95	65-75	45-55	30-40	10-15
Placer diggings: 15.											
Quander: 16C, 16D, 16E-----	0-10	Cobbly loam-----	SM	A-4	15-30	70-85	65-80	50-65	35-50	25-40	NP-10
	10-60	Cobbly sandy clay loam, stony sandy clay loam, very cobbly sandy clay loam.	SC, GC	A-2	25-55	50-75	35-60	30-50	20-30	25-40	10-20
117F: Quander part-----	0-10	Cobbly loam-----	SM	A-4	15-30	70-85	65-80	50-65	35-50	25-40	NP-10
	10-60	Cobbly sandy clay loam, stony sandy clay loam, very cobbly sandy clay loam.	SC, GC	A-2	25-55	50-75	35-60	30-50	20-30	25-40	10-20
Youga part-----	0-12	Loam-----	ML, SM, CL-ML, SM-SC	A-4	0-20	75-95	75-90	60-80	40-60	25-40	5-10
	12-60	Clay loam, gravelly loam, gravelly clay loam.	CL, SC, GC	A-6	0-25	65-90	60-80	55-75	45-65	25-40	10-15
	60-70	Gravelly sandy clay loam.	SC	A-2, A-6	5-25	75-90	50-75	40-65	25-40	25-35	10-15

See footnote at end of table.

## SOIL SURVEY

TABLE 13.--ENGINEERING PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
Rock outcrop: 118: Rock outcrop part.	In				Pct					Pct	
Cryoborolls part	0-25 25	Variable----- Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Yauga: 19C, 19D, 19F-----	0-12	Loam-----	ML, SM, CL-ML, SM-SC	A-4	0-20	75-95	75-90	60-80	40-60	25-40	5-10
	12-60	Clay loam, gravelly loam, gravelly clay loam.	CL, SC, GC	A-6	0-25	65-90	60-80	55-75	35-65	25-40	10-15
	60-70	Gravelly sandy clay loam.	SC	A-2, A-6	5-25	75-90	50-75	40-65	25-40	25-35	10-15
20D, 20F-----	0-10	Loam-----	ML, SM, CL-ML	A-4	0-15	75-95	75-90	60-80	40-60	25-45	5-10
	10-30	Gravelly loam---	SM-SC, GM-GC	A-4	0-20	65-90	60-75	55-65	40-50	20-30	5-10
	30-60	Gravelly sandy clay loam.	SC	A-2, A-6	5-25	75-90	50-75	40-65	25-40	25-35	10-15
Yovimpa: 21D, 21F-----	0-7	Clay loam-----	CL	A-6	0	75-100	75-100	70-100	65-80	30-40	10-20
	7-18	Clay loam, clay	CL, CH	A-6, A-7	0	75-100	75-100	70-100	65-90	30-70	10-45
	18	Weathered bedrock.	---	---	---	---	---	---	---	---	---

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

SUMMIT COUNTY AREA, COLORADO

TABLE 14--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
Anvik: 1D, 1F-----	0-15 15-48 48-60	2.0-6.0 0.6-2.0 2.0-6.0	0.16-0.18 0.18-0.20 0.12-0.15	6.1-7.3 6.1-7.3 6.6-7.8	<2 <2 <2	Low----- Moderate Low-----	Moderate Moderate High-----	Low----- Low----- Low-----	0.28 0.32 0.17	5	5
Bucklon: 2F-----	0-10 10-18 18	0.2-0.6 0.2-0.6 ---	0.17-0.20 0.16-0.18 ---	6.6-7.8 6.6-7.8 ---	<2 <2 ---	Moderate Moderate ---	High----- High----- ---	Low----- Low----- ---	0.32 0.37 ---	1	5
Cimarron: 3D, 3F-----	0-14 14-45 45-60	0.6-2.0 0.06-0.2 ---	0.16-0.18 0.14-0.16 ---	6.6-7.8 6.6-7.8 ---	<2 <2 ---	Low----- High----- ---	High----- High----- ---	Low----- Low----- ---	0.37 0.32 ---	5	5
Cumulic Cryaquolls: 4-----	0-60	---	---	---	---	---	---	---	---	---	---
Frisco: 15E, 15F: Frisco part-----	0-16 16-60	2.0-6.0 0.6-2.0	0.07-0.13 0.05-0.09	5.1-7.3 5.1-7.3	<2 <2	Low----- Low-----	High----- High-----	Moderate Moderate	0.17 0.15	5	3
Peeler part-----	0-15 15-60	2.0-6.0 0.6-2.0	0.12-0.14 0.14-0.16	6.1-7.3 6.1-7.3	<2 <2	Low----- Low-----	High----- Moderate	Low----- Low-----	0.28 0.15	5	3
Gravel pits: 6.											
Grenadier: 7C, 7D, 7F-----	0-6 6-19 19-60	0.6-2.0 0.6-2.0 2.0-6.0	0.16-0.18 0.10-0.13 0.04-0.08	4.8-5.5 4.8-5.5 4.8-5.5	<2 <2 <2	Low----- Low----- Low-----	High----- High----- High-----	High----- High----- High-----	0.28 0.15 0.10	5	8
Handran: 8B, 8D-----	0-15 15-60	2.0-6.0 6.0-20	0.08-0.12 0.06-0.08	6.6-7.8 6.6-7.8	<2 <2	Low----- Low-----	Moderate High-----	Low----- Low-----	0.15 0.15	5	8
9F-----	0-12 12-60	6.0-20.0 6.0-20.0	0.05-0.07 0.07-0.09	6.6-7.8 6.6-7.8	<2 <2	Low----- Low-----	Moderate High-----	Low----- Low-----	0.10 0.15	3	8
Histic Cryaquolls: 10-----	0-60	---	---	---	---	---	---	---	---	---	---
Leadville: 11F-----	0-26 26-42 42-60	0.6-2.0 0.6-2.0 ---	0.16-0.18 0.06-0.10 ---	5.1-6.0 5.1-6.5 ---	<2 <2 ---	Low----- Low----- ---	High----- High----- ---	Moderate Moderate ---	0.20 0.10 ---	5	8
Leavitt: 12C, 12D, 12F-----	0-4 4-60	0.6-2.0 0.6-2.0	0.19-0.21 0.16-0.18	6.6-7.8 6.6-8.4	<2 <2	Low----- Moderate	High----- High-----	Low----- Low-----	0.37 0.32	5	5
Mine dumps: 13.											
Muggins: 14C, 14D, 14F-----	0-12 12-18 18-50 50-60	6.0-20 0.2-0.6 0.06-0.2 0.2-0.6	0.11-0.13 0.14-0.16 0.15-0.17 0.14-0.16	6.1-6.5 6.1-6.5 5.6-6.5 5.6-6.5	<2 <2 <2 <2	Low----- Moderate High----- Moderate	Moderate Moderate High----- High-----	Low----- Low----- Moderate Moderate	0.15 0.15 0.10 0.10	5	---

See footnote at end of table.

## SOIL SURVEY

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
Placer diggings: 15.											
Quander: 16C, 16D, 16E-----	0-10 10-60	0.6-2.0 0.6-2.0	0.16-0.18 0.08-0.12	6.1-7.8 6.1-7.8	<2 <2	Low----- Low-----	Moderate High-----	Low----- Low-----	0.15 0.10	5	8
<sup>1</sup> 17F: Quander part-----	0-10 10-60	0.6-2.0 0.6-2.0	0.16-0.18 0.08-0.12	6.1-7.8 6.1-7.8	<2 <2	Low----- Low-----	Moderate High-----	Low----- Low-----	0.15 0.10	5	8
Yauga part-----	0-12 12-60 60-70	0.6-2.0 0.2-0.6 0.6-2.0	0.10-0.18 0.12-0.18 0.12-0.14	6.6-7.8 6.6-7.8 6.6-7.8	<2 --- ---	Low----- Moderate Moderate	Moderate High----- High-----	Low----- Low----- Low-----	0.24 0.20 0.20	5	5
Rock outcrop: <sup>1</sup> 18: Rock outcrop part.											
Cryoborolls part	0-25 25	--- ---	--- ---	--- ---	--- ---	----- -----	----- -----	----- -----	--- ---	--- ---	---
Yauga: 19C, 19D, 19F-----	0-12 12-60 60-70	0.6-2.0 0.2-0.6 0.6-2.0	0.10-0.18 0.12-0.18 0.12-0.14	6.6-7.3 6.6-7.3 6.6-7.8	<2 <2 ---	Low----- Moderate Moderate	Moderate High----- High-----	Low----- Low----- Low-----	0.24 0.20 0.20	5	5
20D, 20F-----	0-10 10-30 30-60	0.6-2.0 0.6-2.0 0.2-0.6	0.10-0.18 0.10-0.18 0.12-0.14	6.6-7.3 6.6-7.3 6.6-7.8	--- --- ---	Low----- Low----- Moderate	Moderate Moderate High-----	Low----- Low----- Low-----	0.24 0.20 0.20	5	5
Yovimpa: 21D, 21F-----	0-7 7-18 18	0.2-0.6 0.06-0.2 ---	0.16-0.18 0.16-0.18 ---	6.6-8.4 6.6-8.4 ---	<2 <2 ---	Moderate Moderate ---	High----- High----- ---	Moderate Moderate ---	0.28 0.32 ---	1	6

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

SUMMIT COUNTY AREA, COLORADO

TABLE 15.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "none," "brief," and "apparent." The symbol > means greater than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
Anvik: 1D, 1F-----	B	None-----	---	---	<u>Ft</u> >6.0	---	---	<u>In</u> >60	---	Moderate.
Bucklon: 2F-----	D	None-----	---	---	>6.0	---	---	10-20	Rippable	Moderate.
Cimarron: 3D, 3F-----	C	None-----	---	---	>6.0	---	---	40-60	Rippable	Moderate.
Cumulic Cryaquolls: 4-----	C	Common-----	Brief-----	May-Jun	1.0-2.0	Apparent	Jun-Jul	>60	---	High.
Frisco: 15E, 15F: Frisco part----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate.
Peeler part----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate.
Gravel pits: 6.										
Grenadier: 7C, 7D, 7F-----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate.
Handran: 8B, 8D, 9F-----	A	None-----	---	---	>6.0	---	---	>60	---	Low.
Histic Cryaquolls: 10-----	C	Common-----	Long-----	May-Jun	0-1.0	Apparent	Jun-Jul	>60	---	High.
Leadville: 11F-----	B	None-----	---	---	>6.0	---	---	40-60	Rippable	Moderate.
Leavitt: 12C, 12D, 12F-----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate.
Mine dumps: 13.										
Muggins: 14C, 14D, 14F-----	C	None-----	---	---	>6.0	---	---	>60	---	Moderate.
Placer diggings: 15.										
Quander: 16C, 16D, 16E-----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate.
117F: Quander part----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate.
Youga part----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate.
Rock outcrop: 118: Rock outcrop part.										
Cryoborolls part-----	C	None-----	---	---	>6.0	---	---	10-40	Hard	---

See footnote at end of table.

## SOIL SURVEY

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
Youga: 19C, 19D, 19F, 20D, 20F-----	B	None-----	---	---	Ft >6.0	---	---	In >60	---	Moderate.
Yovimpa: 21D, 21F-----	D	None-----	---	---	>6.0	---	---	15-20	Rippable	Moderate.

<sup>1</sup>This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

TABLE 16.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Anvik-----	Fine-loamy, mixed Boralfic Cryoborolls
Bucklon-----	Loamy, mixed, shallow Typic Cryoborolls
Cimarron-----	Fine, montmorillonitic Argic Vertic Cryoborolls
Cryoborolls-----	Cryoborolls
Cumulic Cryaquolls-----	Cumulic Cryaquolls
Frisco-----	Loamy-skeletal, mixed Typic Cryoboralfs
Grenadier-----	Loamy-skeletal, mixed Dystric Cryochrepts
Handran-----	Loamy-skeletal, mixed Typic Cryoborolls
Histic Cryaquolls-----	Histic Cryaquolls
Leadville-----	Loamy-skeletal, mixed Typic Cryoboralfs
Leavitt-----	Fine-loamy, mixed Argic Cryoborolls
Muggins-----	Fine, montmorillonitic Typic Cryoboralfs
Peeler-----	Fine-loamy, mixed Typic Cryoboralfs
Quander-----	Loamy-skeletal, mixed Argic Cryoborolls
Youga-----	Fine-loamy, mixed Argic Cryoborolls
Yovimpa-----	Clayey, mixed, shallow Argic Cryoborolls

# NRCS Accessibility Statement

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