SOIL SURVEY OF

Sierra Valley Area, California, Parts of Sierra, Plumas and Lassen Counties

United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
University of California
Agricultural Experiment Station

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

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

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

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

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

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

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

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

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

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

Cover: Forest Service woodland on north fringe of survey area. (Grizzly Valley in foreground)

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Issued October 1975

Reissued August 1993

SOIL SURVEY OF SIERRA VALLEY AREA, CALIFORNIA, PARTS OF SIERRA, PLUMAS, AND LASSEN COUNTIES

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

THE SIERRA VALLEY AREA is in the northeastern part of California (fig. 1), near the junction of

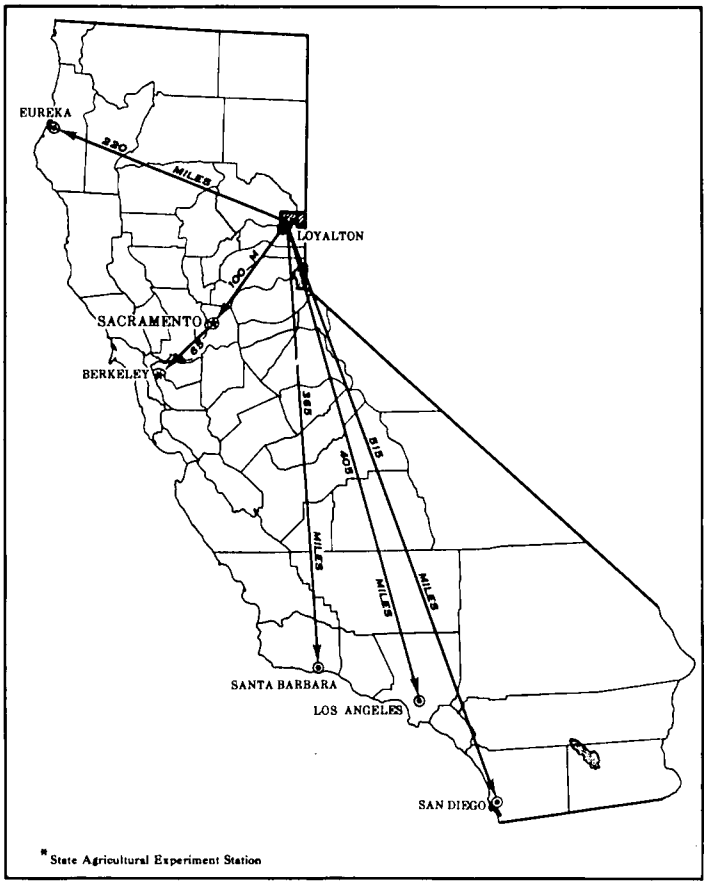

Figure 1.—**Location of Sierra Valley Area in California.**

the Sierra Nevada and Cascade mountain ranges. It occupies eastern Plumas and Sierra Counties and the southern tip of Lassen County. The State of Nevada bounds the Area on the east. About 205,000 acres are in the Area. Loyalton, the largest town, has a population of about 1,000.

The most conspicuous feature of the Area is the broad intermountain valley known as Sierra Valley, at an elevation of about 4,850 feet. Pine forest provides light to moderate cover in the encircling mountainous uplands. Grass meadows and sagebrush cover the valley floor, and the vegetation on the highlands in the east is predominantly sagebrush and grass. Sierra Valley forms the headwaters of the Middle Fork of the Feather River, which flows westward to the Pacific Ocean. Part of the Area drains to the Honey Lake Basin in the north.

The farm economy of the Area is based on livestock, mainly beef cattle, and lumber. The principal crops are hay and pasture, but the choice of crops is severely restricted by the climate. The length of the frost-free season ranges from 30 to 90 days. Most precipitation falls as snow. The summers are generally mild, and midday temperatures are around 80° F. Winter temperatures are often around 0° F.

The basin of Sierra Valley is nearly flat. The central part averages less than 5 feet of fall per mile. The gradient from the valley floor rises gently through a series of inclined tabular terraces and alluvial fans to the precipitous mountainous uplands.

How This Survey Was Made

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

The soil scientists made comparisons among the

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

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

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Dotta sandy loam, 0 to 2 percent slopes, is one of several phases within the Dotta series.

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

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

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit, the soil complex, is shown on the soil map of the Sierra Valley Area. A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Aldax-Millich complex, 5 to 30 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Riverwash is a land type in this survey area.

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

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

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

A map showing soil associations is useful to people who want a general idea of the soils in the Area, who want to compare different parts of the Area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in the Area have been grouped into four general kinds of landscapes for broad interpretative purposes. Each of the broad groups and the soil associations in each group are described in the following pages. The terms for texture used in the titles

of several of the associations apply to the texture of the surface layer. For example, in the title of association 2, the words "loamy coarse sands" refer to the texture of the surface layer.

Soils on Mountainous Uplands

The mountainous uplands that encircle the more extensive valley basins are the dominant feature outside of and adjacent to the survey area. The mountains rise rather abruptly from the valley floors to elevations of 4,500 to 8,000 feet. Gradients range from 20 to 75 percent, rising from the upper terraces to some of the higher peaks. Rock formations are predominantly volcanic, of andesitic origin, but in places they are granitic or metamorphic.

Annual precipitation ranges from 30 inches near Sierraville to about 10 inches in the Peterson Mountains east of Long Valley. The natural vegetation is chiefly pine-conifer forest in the western part of the Area and dominantly a mixture of sagebrush and grass in the more arid eastern part.

Three of the associations in the Sierra Valley Area are in the mountainous uplands. They make up about 32 percent of the Area.

1. Trojan-Delleker-Portola association

Well-drained, gently sloping to steep sandy loams, cobbly sandy loams, and stony sandy loams forming in materials weathered from volcanic rocks

This association is on mountainous uplands, mostly above the basin and alluvial fans. About two-thirds of the acreage of the association, particularly that part on the western and southern perimeters of the Sierra Valley basin, is covered with pines, mixed conifers, oaks, and brush. In the eastern part the pine forest thins, becomes scattered and open, and eventually merges into stands of sagebrush dotted with thickets of juniper.

The soils are forming in material weathered mostly from volcanic conglomerate, breccia, ash (mainly of andesite and basalt), and tuff and partly from metamorphic rock.

Elevation ranges from 4,800 to 6,000 feet. The average annual precipitation is 12 to 24 inches, the average annual temperature is 45° to 47° F, and the frost-free season is 50 to 60 days.

This association makes up about 10 percent of the Sierra Valley Area. Trojan soils make up about 35 percent of the association; Delleker soils, about 25 percent; and Portola soils, about 20 percent. Minor soils in the Aldax, Glean, Newlands, Sattley, and Sierraville series make up the remaining 20 percent.

Trojan soils have a surface layer of dark-brown and strong-brown stony sandy loam and a subsoil of brown, light-brown, strong-brown, and reddish-yellow gravelly loam and gravelly light clay loam. It is underlain by andesitic and basaltic breccia or conglomerate at a depth of 40 inches or more.

Delleker soils have a surface layer of brown sandy loam or cobbly sandy loam and pale-brown and brown loam or cobbly loam. The subsoil is pale-brown and light yellowish-brown sandy clay loam and clay loam or cobbly sandy clay loam and cobbly clay loam. It is underlain by volcanic tuffaceous sediment at a depth of 40 to 60 inches.

Portola soils have a surface layer of light-gray and light brownish-gray cobbly coarse sandy loam or coarse sandy loam. The subsoil is very pale brown and light-brown coarse sandy loam. It is underlain by softly consolidated tuffaceous material at a depth of 30 to 40 inches.

The soils in this association are used mainly for timber production and for grazing. Most areas capable of producing timber have been logged, and present stands consist of regrowth. Growth rates of pine are moderate. Sagebrush land and open areas in woods are commonly grazed by livestock, deer, and other animals.

2. Toiyabe-Bonta-Haypress association

Excessively drained to well-drained, gently sloping to very steep loamy coarse sands forming in materials weathered from acid igneous rocks.

This association is on uplands that rise abruptly above the floors of valleys. It is mostly in the upper drainage area of Last Chance Creek in the northeastern part of Sierra Valley and in the Diamond Mountains. The wooded upland area of this association near Sattley in the southwestern part of the Area is precipitous. Less steep, rolling areas are on the northern fringe of Sierra Valley and extend to Beckwourth Pass. A few areas are on the floor and sides of Long Valley.

Most areas of the association are wooded, but the density of the stands and canopies varies greatly. Jeffrey pine and ponderosa pine are the dominant species, but a few cedar, fir, and black oak are also present. The understory is manzanita, mountainmahogany, sagebrush, grasses, and forbs. Fingers of the wooded areas extend down to the floors of the valleys, but the stands are generally thicker above 5,200 feet. The thin stands at lower elevations are due, in part, to destruction of the trees by fires or the easy accessibility of the trees nearer the valley floor to farmers. Sagebrush and grasses are the dominant vegetation near Beckwourth Pass, and this type of vegetation extends into Long Valley. Also, a few scattered thickets of juniper are in Long Valley.

The soils are forming in material weathered mostly from granitic rock, chiefly granodiorite, quartz diorite, and granite. The rock is generally deeply weathered where it is under a mantle of soil, but numerous outcroppings, bare peaks, and sheer cliff faces are exposed and are slightly weathered, hard, and brittle.

Elevation ranges from 4,900 to 8,000 feet. The average annual precipitation is 10 to 30 inches, the average annual temperature is 45° to 47° F, and the frost-free season is 30 to 65 days.

This association makes up about 8 percent of the Sierra Valley Area. Toiyabe soils make up about 35 percent of the association; Bonta soils, 25 percent; and Haypress soils, about 15 percent. Minor soils in the Glenbrook and Galeppi series and Acidic rock land make up the remaining 25 percent.

Toiyabe soils are excessively drained, grayish-brown and light brownish-gray loamy coarse sand. They are underlain by granodiorite at a depth of 6 to 18 inches.

Bonta soils are well drained. They have a surface layer of pale-brown loamy coarse sand. The subsoil is very pale brown coarse sandy loam and sandy loam. It is underlain by weathered quartz diorite at a depth of 24 to 60 inches.

Haypress soils are somewhat excessively drained. They have a surface layer of grayish-brown loamy coarse sand and a substratum of brown and pale-brown loamy coarse sand. Weathered granitic rock is at a depth of 40 to more than 60 inches.

The soils in this association are used for timber. Most areas capable of producing timber have been logged at least once. Thus, the present stands are made up of trees that have replaced the original ones. These soils are also used for growing Christmas trees. Other wood products are firewood, poles, and posts. Brush encroachment, particularly by manzanita, sagebrush, and ceanothus, is a concern. Selected sites have served as a source of decomposed granite used as road base and topdressing for local roads.

3. *Basic rock land-Aldax-Millich association*

Rock land and well-drained and somewhat excessively drained, moderately sloping to very steep gravelly sandy loams and very stony loams forming in materials weathered from basic igneous rocks

This association is mostly on broken mountainous uplands, but some lesser areas are on rolling and hilly uplands (fig. 2). The largest single area is on a series of hills and peaks that roughly divide Sierra Valley and Long Valley, extending from about three miles east of Loyalton northward almost to the villages of Vinton and Chilcoot.

***Figure 2.*—Typical landscape in association 3.**

Vegetation is variable, but is mostly scattered and sparse. It includes pockets of wooded areas that are open to dense stands of sagebrush, understories of cheat grass, and other grasses, forbs, and browse.

Most of the soils are forming in hard, slightly weathered volcanic tuff, conglomerate, and breccia. Where this is occurring, the landscape is dotted with conspicuous volcanic plugs, necks, and cones, and most slopes are strewn with brecciated or cobbly loose stones.

Elevation ranges from 4,500 to 8,000 feet. The average annual precipitation is 10 to 20 inches, and the average annual temperature is 45° to 47° F. The frost-free season is 30 to 90 days.

This association makes up about 14 percent of the Sierra Valley Area. Basic rock land makes up about 50 percent of the association; Aldax soils, 20 percent; and Millich soils, 10 percent. Minor soils in the Bieber series, Acidic rock land, and Rough broken land make up the remaining 20 percent.

Basic rock land consists of rough, rocky, broken land on which 50 to 90 percent of the surface is covered by outcrops of hard pyroclastic breccia, tuff-cemented conglomerate, and andesitic or basaltic rocks. The thin soil mantle between rock outcrops is typically less than 10 inches thick.

Aldax soils are somewhat excessively drained. They are brown and dark yellowish-brown gravelly sandy loam and very gravelly loam underlain by meta-andesite at a depth of 6 to 15 inches.

Millich soils are well drained. They have a surface layer of grayish-brown very stony loam and a subsoil of dark grayish-brown cobbly clay loam and grayish-brown clay. Andesite bedrock is at a depth of 12 to 20 inches.

The sparse vegetative cover on the Aldax and Millich soils is used by livestock and wildlife. Basic rock land and the included areas of Acidic rock land and Rough broken land have no value for farming. The steep, stony, rather inaccessible areas provide protection and cover for deer, upland birds, and small mammals. These shallow uplands have high runoff rates and make up a sizable part of the watersheds that contribute to the Last Chance Creek and Long Valley Creek drainages.

Soils on Terraces and Fans Bordering Sierra Valley

The terraces that rim Sierra Valley are mostly undulating and hilly. They become smooth and nearly level as they merge with the valley basins and progressively steeper as they join the mountainous uplands. Elevation ranges from 4,500 to 5,500 feet. The soils are forming mostly in stratified alluvium that is generally gravelly. Some of this material is very old and has cemented hardpan layers interbedded with cobbly, gravelly conglomerate and sandstones. Much of it was deposited when the lake basins were filled by an ancient lake. Part of the alluvium is of recent deposition or is mixed with colluvium that has moved down from the uplands by gravity.

Annual precipitation ranges from 8 to 18 inches. The natural vegetation is chiefly a mixture of sagebrush and grass, except for a sprinkling of pine and juniper on part of the western and southern slopes of Sierra Valley.

Two of the associations in the Sierra Valley Area are on the terraces and fans around Sierra Valley. The terraces make up about 13 percent of the Area.

4. *Mottsville-Quincy association*

Excessively drained, gently sloping to strongly sloping loamy sands and sands

This association is on fans and terraces north of the villages of Vinton and Chilcoot in the northeastern part of Sierra Valley. Areas of this association are also on alluvial fans in western Long Valley, north of Hallelujah Junction. The soils are mostly smooth except where cut by gullies and major drainageways.

The soils are forming in coarse-textured alluvium weathered from granitic rocks. The natural vegetation is mostly big sagebrush with an understory of cheatgrass. Scattered areas have other grasses and forbs, and a few pockets of trees are present in places.

Elevation ranges from 4,800 to 5,500 feet. The average annual precipitation is 8 to 16 inches, the average annual temperature is 48° to 50° F, and the frost-free season is 60 to 90 days.

This association is inextensive and makes up about 2 percent of the Sierra Valley Area. Mottsville soils make up about 65 percent of the association and Quincy soils, about 15 percent. Minor soils in the Ormsby and Galeppi series, the land type Riverwash, and sand and gravel pits make up the remaining 20 percent.

Mottsville soils have a surface layer of dark-brown and brown loamy sand and loamy coarse sand. It is underlain by brown and yellowish-brown loamy sand that extends to a depth of more than 60 inches.

Quincy soils are pale-brown, brown, and very pale brown sand to a depth of 60 inches or more.

The soils in this association are used mainly for unimproved range. These soils are droughty, moderately steep in places, and easily eroded. They are in areas where a system for providing irrigation water has not been developed. The Quincy soils are on an unstabilized landscape where dunes and drifting sand are common.

5. *Dotta-Martineck-Bieber association*

Well-drained, nearly level to moderately steep sandy loams, gravelly sandy loams, cobbly sandy loams, and very stony sandy loams

This association is on terraces and alluvial fans that encircle the Sierra Valley basin and, to a lesser extent, on terraces in Long Valley. The terraces are benched and tabular in places. On the valley floor some terraces are partly buried or obscured by valley-filling alluvium. These terraces ascend gradually from the valley floor and merge with the rocky uplands. The most extensive bodies of these soils occupy the terraces east of State Highway 49, between Loyalton and Vinton on the east side of Sierra Valley.

The natural vegetation is dominantly big sagebrush. The brush stands on Dotta, Badenaugh, and Correco soils are thick and mixed in varying densities with bitterbrush, rabbitbrush, cheat grass, and other grasses and forbs. The sagebrush and natural cover on the shallow, claypan-hardpan Bieber and Martineck soils is sparse, slow growing, and stunted. Wooded pockets are on the southern and western slopes of Sierra Valley in areas of Dotta soils.

The soils are forming mostly in basic alluvium laid down near the shoreline of the ancient lake. Some of the alluvium is mixed with stony detritus carried down from the rocky uplands.

Elevation ranges from 4,500 to 5,200 feet. The average annual precipitation is 8 to 18 inches, the average annual temperature is 48° or 49° F, and the frost-free season is 30 to 90 days.

This association makes up about 11 percent of the Sierra Valley Area. Dotta soils make up about 50 percent of the association; Martineck soils, about 20 percent; and Bieber soils, about 15 percent. Minor soils of the Badenaugh and Correco series make up the remaining 15 percent.

Dotta soils have a surface layer of gray sandy loam and loam. The subsoil is gray loam and grayish-brown sandy clay loam. The next layers are light brownish-gray sandy loam and pale-brown coarse sandy loam. In places the Dotta soils are gravelly or cobbly throughout their profiles.

Martineck soils have a surface layer of grayish-brown and gray very stony sandy loam. The subsoil is dark grayish-brown very stony sandy clay loam and brown very stony clay. It is underlain by a pale-yellow hardpan at a depth of 10 to 20 inches.

Bieber soils have a surface layer of gray and grayish-brown gravelly sandy loam and heavy sandy loam. The subsoil is brown sandy clay loam and sandy clay. It is underlain by a hardpan at a depth of 10 to 40 inches.

About half of the soils in this association are too stony, too cobbly, or too shallow to be used for other than unimproved range. In places areas of the Dotta and Bieber soils are used for growing pasture plants, small grains, and some alfalfa.

Soils on Terraces Bordering Long Valley

The terraces surrounding Long Valley are characterized by tabular plateaus and faulted scarp blocks that are somewhat rounded by erosion and are blended together by alluvial fans and valley fill. These landforms are narrowly defiled by mountainous uplands on either side. The crests extend in a northwest-southeast strike. The central trough of the valley is entrenched by an intermittently dry stream—Long Valley Creek. Elevation ranges from about 4,500 feet at the creek bottom to about 5,500 feet on the upper terraces.

Annual precipitation is lower on these associations than it is on any other association in the Area, averaging about 6 to 12 inches. Consecutive years with less than 6 inches of precipitation are common. The vegetation is predominantly a mixture of sagebrush and

grass, but junipers dot the hillsides on the eastern slopes.

Two of the associations in the Sierra Valley Area are on terraces bordering Long Valley. They make up about 14 percent of the Area.

6. *Trosi-Saralegui association*

Well-drained, gently sloping to moderately steep loamy very stony sandy loams, and extremely stony sandy loams.

This association is on the west side of Long Valley. It occupies secondary or intermediate terrace benches south of Beckwourth Pass, extending to the southeast corner of the survey area and into the State of Nevada. Slopes are nearly level and smooth, except near terrace breaks along Long Valley Creek and in the upper reaches where the terraces merge with the residual soils forming on the uplands.

The vegetation is open and sparse. It consists chiefly of slow-growing or stunted big sagebrush and low sagebrush. The understory is cheat grass and a few forbs and perennial grasses. Plants are on pedestals. Rilled, open, barren areas are common.

The soils are forming in stony, stratified, Pleistocene lake sediment.

Elevation ranges from 4,500 to 5,200 feet. The average annual precipitation is 6 to 12 inches, the average annual temperature is 48° to 50° F, and the frost-free season is 60 to 90 days.

This association makes up about 5 percent of the Sierra Valley Area. Trosi soils make up about 70 percent of the association and Saralegui soils, about 20 percent. Minor soils of the Reno and Reba series make up the remaining 10 percent.

Trosi soils have a surface layer of light brownish-gray and brown very stony sandy loam or extremely stony sandy loam. The subsoil is brown very cobbly light sandy clay loam and very cobbly clay. It is underlain by a hardpan at a depth of 12 to 30 inches.

Saralegui soils have a surface layer of light-gray sandy loam. The subsoil is light brownish-gray heavy loam, sandy clay loam, and gravelly sandy clay loam. The substratum is light-gray light sandy loam.

The soils in this association are used mainly for range and as watershed.

7. *Galeppi-Reno-Reba association*

Well drained, gently sloping to moderately steep loamy coarse sands, cobbly loamy coarse sands, and sandy loams.

This association is on terraces, fans, and flats, mostly in Long Valley east of Long Valley Creek. Soils on terraces are undulating or hilly, and those on fans are gently sloping. The association extends to both sides of the creek north of State Highway 70. Slopes range up to 30 percent on some of the steeper terrace breaks, but they are generally less than 15 percent. Terrain is undulating or hilly.

The natural vegetation is mainly big sagebrush. The understory is cheat grass and a few other grasses and forbs. Thickets of juniper are common east of U.S. Highway 395.

The soils are forming in old Pliocene lake deposits. The deposits are mainly alluvium from granitic sources, but they are mixed in places with alluvium from basic rock, ash, and stony detritus.

Elevation ranges from 4,500 to 5,500 feet. The average annual precipitation is 6 to 12 inches, the average annual temperature is 48° to 50° F, and the frost-free season is 60 to 90 days.

This association makes up about 9 percent of the Sierra Valley Area. Galeppi soils make up about 75 percent of the association and Reno and Reba soils, about 10 percent each. Soils of the Saralegui series make up the remaining 5 percent.

Galeppi soils have a surface layer of grayish-brown loamy coarse sand and sandy loam. The subsoil is brown and dark-brown sandy clay loam and dark yellowish-brown light sandy clay loam. It is underlain by light yellowish-brown sandy loam and pale-brown loamy sand. In some areas these soils are cobbly throughout the profile.

Reno soils have a surface layer of light brownish-gray gravelly loamy coarse sand and light-gray and grayish-brown sandy loam. The subsoil is brown and light olive-brown clay and light brownish-gray silty clay. It is underlain by a hardpan at a depth of 20 to 36 inches.

Reba soils have a surface layer of light brownish-gray sandy loam and grayish-brown sandy clay loam. The subsoil is grayish-brown silty clay and sandy clay loam. The substratum is light brownish-gray heavy sandy loam and coarse sandy loam.

These soils are used mostly for range. A few areas are used for growing irrigated truck crops or other crops.

Soils in the Valley Bottoms

The valley basins are the most extensive physiographic features in the survey area. Elevation ranges from 4,000 to 5,500 feet. Characteristically the soils are nearly level or gently sloping. They are mostly wet, and they are commonly dark colored and high in organic-matter content. The soils vary from fine textured to coarse textured. Those affected by salts and alkali and those that have a high lime content are light colored. The soils are forming in valley-filling alluvium, mainly weathered from andesitic and granitic rock. Commonly the soils have variably stratified substrata that include sand, gravel, clayey sediment, ash, and diatomite.

Annual precipitation ranges from 8 to 20 inches. The natural vegetation is dominantly water-tolerant plants, including sedges, rushes, grasses, and forbs. Silver sagebrush is common on better drained sites.

Three of the associations in the Sierra Valley Area are in the valley bottoms. They make up about 41 percent of the Area.

8. *Ramelli-Balman-Pasquetti association*

Very poorly drained to moderately well drained, nearly level to gently sloping clays, mucky silty clays, and loams

This association is the most extensive in the survey area. The largest area of the association is in the central basin part of Sierra Valley. Also, fingerlike bodies fan inward along major drainageways coming into the valley, and a small acreage is in upper Long Valley near the head of Long Valley Creek. About nine-tenths of the acreage is on nearly level valley bottoms. Slopes are often less than one-tenth of one percent in the central part of the valley. The relief is smooth but weakly entrenched by a meandering, twisting drainage pattern. Creeks, waterways, water-spreading ditches, and channels appear as an interwoven network that laces most of the valley. They coalesce and form into a single channel only, south of the village of Beckwourth, where they leave the valley to form the Middle Fork of the Feather River.

The dominant vegetation is meadow-type species such as wire grass, sedge, camas, tufted hairgrass, bluegrass, aster, plantain, and other water-tolerant grasses and forbs. Silver sagebrush and cheat grass invade some of the better drained sites.

The soils are forming mostly in clayey alluvium derived from mixed rock sources, but some of the soils are forming in loamy alluvium derived from mixed rock sources.

Elevation ranges from 4,000 to 5,000 feet. The average annual precipitation is 10 to 20 inches, the average annual temperature is 48° to 50° F, and the frost-free season is 80 to 90 days.

This association makes up about 20 percent of the Sierra Valley Area. Ramelli soils make up about 40 percent of the association; Balman soils, about 25 percent; and Pasquetti soils, about 20 percent. Minor soils of the James Canyon, Coolbrith, and Smithneck series make up the remaining 15 percent.

Ramelli soils are poorly drained and very poorly drained. They have a surface layer of dark-gray silty clay and dark grayish-brown or gray clay. The subsoil is dark-gray clay and gray sandy clay loam. The substratum is light brownish-gray, mottled coarse sandy loam, loamy coarse sand, sandy loam, and coarse sand. The water table is at the surface in the spring, then recedes to a depth of 60 inches or more in some areas late in summer.

Balman soils are somewhat poorly drained They have a surface layer of light brownish-gray and gray loam. The substratum is gray and light-gray, stratified sandy clay loam to loamy sand. A water table is at a depth of 60 inches or more.

Pasquetti soils are poorly drained and very poorly drained. They have a surface layer of very dark gray mucky silty clay and very dark gray and dark gray silty clay. It is underlain by dark-gray and light-gray, mottled clay loam; white very fine sandy loam; and grayish-brown sandy loam. Depth to the water table ranges from at or near the surface to about 30 inches.

The soils in this association are used for native or meadow pasture, irrigated pasture, small grains, and hay.

9. *Beckwourth-Loyalton-Ormsby association*

Poorly drained to moderately well drained, nearly level to gently sloping loamy coarse sands, coarse sandy loams, fine sandy loams, and silt loams

This association is in the basin of the Sierra Valley and on stream levees and fans in Long Valley. The topography is generally nearly level but often hummocky, a typical characteristic of claypan areas. The most extensive areas extend northwestward from Correco Canyon in eastern Sierra Valley toward the village of Beckwourth in the northwest corner of the valley. The soil pattern is somewhat alined with or parallel to the relict and present drainage system of Last Chance Creek as it flows across the valley.

Saltgrass and other salt-tolerant plants are more common in this association than anywhere else in the Area. Silver sagebrush, rabbitbrush, cheat grass, Great Basin wildrye, and other grasses and forbs are common in areas slightly affected by salts and alkali.

The soils are forming in alluvium, predominantly from mixed rock sources. Part of the alluvium, however, is micaceous and coarse-textured and from granitic sources.

Elevation ranges from 4,000 to 5,200 feet. The average annual precipitation is 12 to 20 inches, the average annual temperature is 48° to 50° F, and the frost-free season is 50 to 90 days.

This association makes up about 15 percent of the Sierra Valley Area. Beckwourth soils make up about 35 percent of the association; Loyalton soils, about 30 percent; and Ormsby soils, about 25 percent. Soils of the Bellavista and Calpine series and Ormsby series, hardpan variant, make up the remaining 10 percent.

Beckwourth soils are somewhat poorly drained. They have a surface layer of very dark gray and dark grayish-brown loamy coarse sand or sandy loam. The subsoil is generally weakly cemented, brown loamy coarse sand and pale-brown coarse sandy loam, but in places it is brown and pale-brown, weakly cemented heavy sandy loam. The substratum is typically light yellowish-brown loamy coarse sand and pale-brown coarse sand, but in places texture is coarse sandy loam or clay. Some areas are affected by salt and alkali. A water table is at a depth of 36 to more than 60 inches.

Loyalton soils are moderately well drained. They have a surface layer of light brownish-gray loamy sand, gray fine sandy loam, and light-gray sandy loam or light brownish-gray, gray, and light-gray silt loam. The subsoil is grayish-brown and light-gray sandy clay loam, light-gray and pale-brown clay loam, and white and pale-yellow sandy clay loam or grayish-brown and light-gray silty clay. The substratum is pale-yellow loamy coarse sand and coarse sand that is gravelly in many places.

Ormsby soils are somewhat poorly drained and poorly drained. They have a surface layer of dark grayish-brown and dark-gray loamy coarse sand and loamy sand or dark-gray coarse sandy loam. It is underlain by brown loamy sand and pale-brown loamy sand, loamy coarse sand, and gravelly coarse sand. A water table is at a depth of 24 to more than 60 inches.

These soils are used for cereal rye, alfalfa, irrigated pasture, small grains, annual pasture, and range.

10. Calpine-Lovejoy-Dotta association

Well drained and moderately well drained, nearly level to moderately sloping coarse sandy loams, sandy loams, clay loams, and loams

This association is on valley plains and on fans and inclined planes that merge with the upper terraces. The soils on valley plains are smooth and nearly level, and the soils on fans and inclined planes are moderately sloping. The largest areas of this association are in the west-central Sierra Valley basin between the villages of Sattley and Beckwourth. A lesser acreage is on fan terraces near the western rim of the valley, a few miles northeast of the village of Calpine. Isolated parcels are in Long Valley. Relief is mostly smooth, but in places it is benched or on large, slightly raised plateaus, particularly in the central part of Sierra Valley.

The natural vegetation is silver sagebrush and cheat grass and some rabbitbrush, dryland sedge, shoestring, grasses, and forbs.

The Calpine soils are forming in alluvium that has a granitic influence, and the Lovejoy soils are forming in ancient alluvium. The Dotta soils are forming in alluvium carried down from the basic volcanic uplands.

Elevation ranges from 4,500 to 5,500 feet. The average annual precipitation is 8 to 20 inches, the average annual temperature is 48° to 50° F, and the frost-free season is 50 to 90 days.

This association makes up about 6 percent of the Sierra Valley Area. Calpine soils make up about 50 percent of the association; Lovejoy soils, about 30 percent; and Dotta soils, about 10 percent. Minor soils of the Ormsby and Beckwourth series and Ormsby series, hardpan variant, and Calpine series, clayey variant, make up the remaining 10 percent.

Calpine soils are well drained. They have a surface layer of dark grayish-brown coarse sandy loam and sandy loam. The subsoil is brown, light yellowish-brown, and yellow sandy clay loam. The substratum is light yellowish-brown stratified loamy fine sand to coarse sand.

Lovejoy soils are moderately well drained. They have a surface layer of gray loam, light brownish-gray clay loam, and light-gray loam. The subsoil is pale-brown clay. It is underlain by a hardpan at a depth of 10 to 30 inches.

Dotta soils are well drained. They have a surface layer of gray sandy loam and light loam. The subsoil is gray loam and grayish-brown sandy clay loam. It is underlain by light brownish-gray sandy loam and pale-brown coarse sandy loam.

The soils in this association are used for small grains, cheat grass, irrigated pasture, row crops, hay, annual pasture, and range.

Descriptions of the Soils

This section describes the soil series and mapping units in the Sierra Valley Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series is described. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An imporant part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

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

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and, where applicable, the range site and woodland suitability group in which the mapping unit has been placed. The page for the description of each capability unit is given and the range site, woodland suitability group, wildlife suitability group, and Storie index rating can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*12*).[1]

Acidic Rock Land

Acidic rock land (AcG) is a land type that consists of rough, broken areas on granitic uplands. Granodiorite, quartz diorite, or granite crop out on 50 percent or more of the surface. The principal acreage is in the northeastern part of the Area, and some fingers skirt the northern and western boundaries of Sierra Valley. In many places granitic areas are covered by younger volcanic flows and plugs, as is the case around The Buttes and Sugar Loaf Mountain in the north. Topography ranges from steep bald peaks to nearly level intervalley and fan areas. Areas of generally sandy soil material between rocks support some brush, grass, and trees in pockets; but many areas are nearly bare (fig. 3).

[1] Italic numbers in parentheses refer to Literature Cited, p. 118.

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

Soil	Acres	Percent
Acidic rock land	6,309	3.0
Aldax-Rock outcrop complex, 15 to 75 percent slopes	3,015	1.5
Aldax-Millich complex, 5 to 30 percent slopes	2,062	1.0
Aldax-Millich complex, 30 to 75 percent slopes	3,188	1.6
Badenaugh very cobbly sandy loam, 2 to 30 percent slopes	2,899	1.4
Badenaugh extremely cobbly clay loam, poorly drained variant, 2 to 5 percent slopes	1,176	.6
Balman loam, 0 to 2 percent slopes	2,526	1.2
Balman loam, 2 to 5 percent slopes	294	.1
Balman-Ramelli complex, 0 to 2 percent slopes	7,871	3.8
Basic rock land	14,198	6.9
Beckwourth loamy coarse sand	4,564	2.2
Beckwourth loamy coarse sand, clayey substratum	259	.1
Beckwourth sandy loam	778	.4
Beckwourth-Loyalton complex, saline-alkali, 0 to 2 percent slopes	4,423	2.2
Beckwourth-Ormsby loamy coarse sands	2,045	1.0
Bellavista loam, 0 to 2 percent slopes	1,576	.8
Bellavista loam, 2 to 5 percent slopes	356	.2
Bidwell sandy loam, 0 to 2 percent slopes	2,212	1.1
Bidwell sandy loam, 2 to 5 percent slopes	670	.3
Bidwell sandy loam, sandy substratum, 0 to 2 percent slopes	786	.4
Bidwell loam, 0 to 2 percent slopes	608	.3
Bieber gravelly sandy loam, 0 to 5 percent slopes	2,730	1.3
Bieber sandy loam, moderately deep, 0 to 2 percent slopes	655	.3
Calpine coarse sandy loam, 0 to 2 percent slopes	2,649	1.3
Calpine coarse sandy loam, 2 to 5 percent slopes	1,226	.6
Calpine coarse sandy loam, 5 to 9 percent slopes	942	.5
Calpine-Lovejoy complex, 0 to 5 percent slopes, eroded	3,856	1.9
Calpine coarse sandy loam, clayey variant, 0 to 2 percent slopes	1,501	.7
Coolbrith silt loam, 0 to 2 percent slopes	3,481	1.7
Coolbrith silt loam, 2 to 5 percent slopes	1,517	.7
Correco sandy loam, 2 to 5 percent slopes	844	.4
Correco sandy loam, 5 to 15 percent slopes	594	.3
Correco very cobbly sandy loam, 2 to 30 percent slopes	1,094	.5
Delleker sandy loam, 2 to 15 percent slopes, eroded	1,447	.7
Delleker cobbly sandy loam, 2 to 30 percent slopes	3,448	1.7
Dotta sandy loam, 0 to 2 percent slopes	423	.2
Dotta sandy loam, 2 to 9 percent slopes	5,912	2.9
Dotta gravelly sandy loam, 9 to 30 percent slopes	601	.3
Dotta cobbly sandy loam, 2 to 30 percent slopes	2,768	1.4
Dotta-Lovejoy complex, 0 to 9 percent slopes	2,488	1.2
Galeppi loamy coarse sand, 2 to 5 percent slopes	1,923	.9
Galeppi loamy coarse sand, 5 to 30 percent slopes	8,203	4.0
Galeppi cobbly loamy coarse sand, 5 to 30 percent slopes	1,952	1.0
Glean extremely stony sandy loam, 9 to 50 percent slopes	2,233	1.1
Glenbrook-Rock outcrop complex, 5 to 50 percent slopes	2,595	1.3
Haypress-Toiyabe loamy coarse sands, 2 to 30 percent slopes	882	.4
Haypress-Toiyabe loamy coarse sands, 30 to 75 percent slopes	1,432	.7
James Canyon gravelly loam, 2 to 5 percent slopes	597	.3
James Canyon silt loam, 0 to 2 percent slopes	3,537	1.7
Lovejoy loam, 0 to 5 percent slopes	1,703	.8
Loyalton fine sandy loam	5,319	2.6
Loyalton silt loam	244	.1
Martineck very stony sandy loam, 2 to 30 percent slopes	3,936	1.9
Mixed alluvial land	517	.3
Mottsville loamy sand, 2 to 9 percent slopes	2,197	1.0
Newlands-Rock outcrop complex, 2 to 30 percent slopes	2,163	1.1
Ormsby loamy coarse sand, 0 to 2 percent slopes	3,592	1.8
Ormsby loamy coarse sand, 2 to 5 percent slopes	973	.5
Ormsby coarse sandy loam, poorly drained, 0 to 2 percent slopes	442	.2
Ormsby coarse sandy loam, poorly drained, 2 to 5 percent slopes	179	.1
Ormsby loamy sand, hardpan variant, 0 to 2 percent slopes	309	.2
Pasquetti mucky silty clay	4,034	2.0
Pasquetti mucky silty clay, thick surface	3,034	1.5
Portola cobbly coarse sandy loam, 9 to 30 percent slopes	1,127	.6
Portola cobbly coarse sandy loam, 30 to 50 percent slopes	3,360	1.6
Portola loam, moderately well drained variant	523	.3
Quincy sand, 2 to 15 percent slopes	456	.2
Ramelli clay	14,060	6.8
Ramelli clay, very poorly drained	901	.4
Ramelli clay, very poorly drained, channeled	899	.4
Reba sandy loam, 2 to 30 percent slopes	1,549	.8
Reno sandy loam, 2 to 15 percent slopes	2,113	1.0
Riverwash	464	.2
Rough broken land	3,976	1.9
Saralegui sandy loam, 2 to 15 percent slopes	1,605	.8
Sattley extremely stony sandy loam, 2 to 50 percent slopes	1,306	.6
Sierraville stony sandy loam, 2 to 30 percent slopes	283	.1
Smithneck sandy loam	1,407	.7
Toiyabe-Bonta loamy coarse sands, 2 to 30 percent slopes	1,726	.9
Toiyabe-Bonta loamy coarse sands, 30 to 75 percent slopes	2,763	1.4
Trojan stony sandy loam, 2 to 30 percent slopes	3,594	1.8
Trojan stony sandy loam, 30 to 50 percent slopes	3,050	1.5
Trosi very stony sandy loam, 2 to 15 percent slopes	4,906	2.4
Trosi extremely stony sandy loam, 2 to 15 percent slopes	908	.4
Trosi-Saralegui complex, 15 to 50 percent slopes, eroded	1,548	.8
Areas excavated as gravel	105	(1)
Areas under water in ponds and reservoirs	332	.2
Total	204,948	100.0

[1] Less than 0.05 percent.

Figure 3.—**Typical area of Acidic rock land.**

This land type provides scant habitat and browse for wildlife. Watershed areas bring water to the valley. Capability unit VIIIs–1.

Aldax Series

The Aldax series consists of somewhat excessively drained soils. They are forming in material weathered from metamorphic rock or cobbly volcanic conglomerate and breccia that is at a depth of 6 to 15 inches. Slopes range from 5 to 75 percent on uplands. Elevation ranges from 4,500 to 8,000 feet. Annual precipitation is 10 to 20 inches, and the average annual temperature is 45° to 47° F. The frost-free period is 30 to 60 days. The natural vegetation is dominantly big sagebrush and cheat grass. Aldax soils are associated mainly with Millich and Bieber soils (fig. 4).

In a representative profile these soils are brown, medium acid gravelly sandy loam and dark yellowish-brown, slightly acid very gravelly loam. Meta-andesite bedrock is at a depth of about 12 inches.

Permeability is moderately rapid in these soils. Available water capacity is ½ to 1½ inches. The effective rooting depth is 6 to 15 inches.

These soils are used for unimproved range. They provide habitat for deer and such upland birds as quail and chukar. They are a major part of the watershed that contributes to the drainage of the Area.

Representative profile of Aldax gravelly sandy loam in an area facing southwest near the crest of a ridge where slope is 38 percent; under stunted sagebrush and annual grasses at an elevation of 5,880 feet (800 feet northeast of the west quarter corner of sec. 8, T. 22 N., R. 17 E.; 1.25 miles south of Beckwourth Pass) :

Figure 4.—**Vegetation and relief in an area of an Aldax-Millich complex.**

A11—0 to 3 inches, brown (10YR 4/3) gravelly heavy sandy loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; medium acid; clear, smooth boundary.

A12—3 to 12 inches, dark yellowish-brown (10YR 4/4) very gravelly loam, dark yellowish brown (10YR 3/4) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores; slightly acid; abrupt, irregular boundary.

R—12 inches, grayish-white, moderately hard schistose or foliated meta-andesite; roots follow cleavage planes in upper part; rock protrudes irregularly into the A horizon.

Depth to bedrock ranges from 6 to 15 inches. Where the bedding of the bedrock is tilted nearly upright, the strata ends are exposed, and the soils are less than 10 inches deep. Loose stone fragments, ranging from ¼ inch to 12 inches in length, make up 40 to 70 percent, by volume, of the soil material.

The A horizon is dark grayish brown, dark brown, brown, or dark yellowish brown. Texture is gravelly, stony, very stony, or very gravelly loam or sandy loam.

Aldax-Rock outcrop complex, 15 to 75 percent slopes (AkG).—About 75 to 90 percent of this complex is Aldax gravelly sandy loam, and 10 to 25 percent is Rock outcrop. It has the profile described as representative for the Aldax series. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high. Included in mapping are small areas of Millich soils.

The lower areas of this complex are used by livestock for light grazing. These soils provide habitat for deer, rabbit, quail, chukar, dove, and other wildlife. Some areas are rather inaccessible but provide good

escape cover. Some areas are used as watershed. Capability unit VIIs–1; Aldax part in range site 3.

Aldax-Millich complex, 5 to 30 percent slopes (AmE).—These moderately sloping to moderately steep soils are on uplands and are so intermingled that it was not feasible to map them separately. Commonly, the Aldax soils are on shallow crests and the steepest sides of ridges, and the Millich soils have concave slopes or are on steep sidehills. About 50 percent of this complex is Aldax soils, and 30 percent is Millich soils. The remaining 20 percent is mostly Rock outcrop and rubble areas, such as those adjacent to the large outcrops known as Elephants Head, near Loyalton.

The Aldax soil in this complex has a profile similar to the one described as representative for the Aldax series, and the Millich soil has the profile described as representative for the Millich series. Runoff is medium to rapid. The hazard of erosion is moderate to high on both soils.

These soils are used for range, watershed, and wildlife habitat. Capability unit VIIs–1; range site 3.

Aldax-Millich complex, 30 to 75 percent slopes (AmG).—These steep to very steep soils on uplands are so intermingled that it was not feasible to map them separately. The Aldax soils are mostly on the crests and very steep sides of ridges, and the Millich soils are commonly less steep and are on foot slopes. About 50 percent of this complex is Aldax soils, and 30 percent is Millich soils. The remaining 20 percent is mainly Basic rock land.

Both soils have profiles similar to the ones described as representative for their respective series. Runoff is rapid to very rapid. The hazard of erosion is high to very high.

These soils are used for range, watershed, and wildlife habitat. Capability unit VIIs–1; range site 3.

Badenaugh Series

The Badenaugh series consists of well-drained soils that are forming in cobbly terrace alluvium. This sediment is near the shoreline of the ancient lake that once filled the valley basins, mostly on the perimeter of Sierra Valley. Slopes range from 15 to 30 percent near the uplands and from 2 to 15 percent where the terraces merge with the valley floor. Elevation ranges from 4,800 to 5,200 feet. Annual precipitation is 12 to 25 inches, and the average annual temperature is 48° to 49° F. The frost-free period is about 50 to 60 days. Badenaugh soils are associated with Dotta and Martineck soils.

In a representative profile (fig. 5) the surface layer is brown, neutral very cobbly sandy loam about 6 inches thick. The subsoil is brown, slightly acid and medium acid very cobbly heavy loam, very cobbly clay loam, and very cobbly sandy clay loam. It is about 21 inches thick. The substratum is brown, medium acid very cobbly sandy clay loam that extends to a depth of 60 inches or more.

Permeability is moderately rapid in these soils. Available water capacity is 5 to 8 inches. The effective rooting depth is 48 to more than 60 inches.

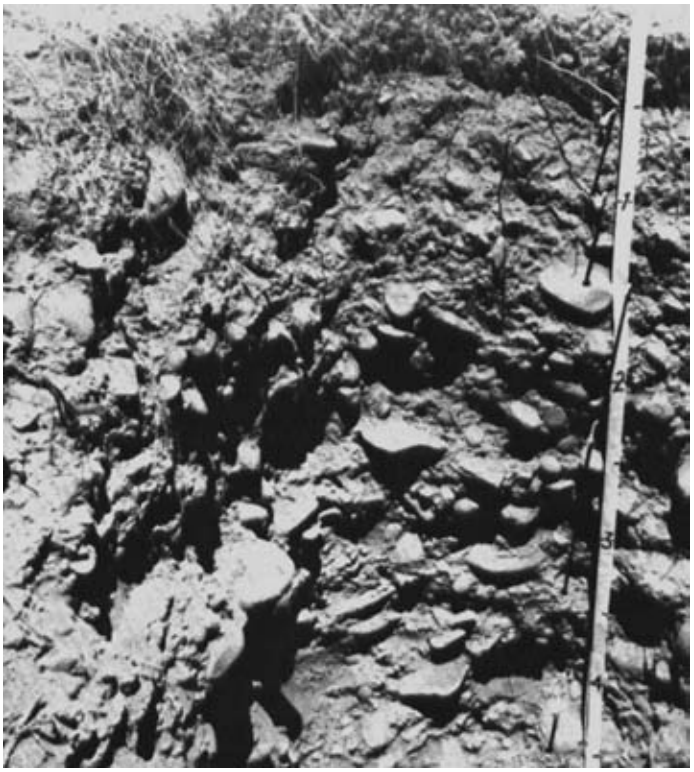

Figure 5.—**Profile of Badenaugh very cobbly sandy loam, 2 to to 30 percent slopes.**

These soils are used chiefly for range. Other uses include wildlife habitat and watershed.

Representative profile of Badenaugh very cobbly sandy loam in an area facing northwest where slope is 2 percent; under scattered ponderosa pine, sagebrush, and annual grasses (1,500 feet south-southeast of the north quarter corner of sec. 19, T. 21 N., R. 16 E.; 1 mile southeast of Loyalton on Smithneck Canyon Road):

A11—0 to 2 inches, brown (7.5YR 4/2) very cobbly sandy loam, very dark brown (10YR 2/2) when moist; weak, very fine, granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots, common medium roots, and few coarse roots; many very fine and fine interstitial pores; neutral; abrupt, smooth boundary.

A12—2 to 6 inches, brown (7.5YR 4/2) very cobbly sandy loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots, common medium roots, and few coarse roots; common very fine and fine tubular and interstitial pores; very few thin clay films in pores and as bridges; neutral; gradual, smooth boundary.

B1t—6 to 12 inches, brown (7.5YR 4/2) very cobbly heavy loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure, massive in places; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; common very fine and fine tubular and interstitial pores; few thin clay films in pores and as bridges; slightly acid; clear, smooth boundary.

B2t—12 to 17 inches, brown (7.5YR 4/2) very cobbly clay loam, dark brown (7.5YR 3/2) when moist; weak, medium, subangular blocky structure; very hard, slightly firm, slightly sticky and plastic; common very fine and fine roots and very few medium roots; common very fine and fine interstitial pores and few medium tubular pores; common moderately thick clay films in pores and as bridges; slightly acid; clear, smooth boundary.

B3—17 to 27 inches, brown (7.5YR 4/2) very cobbly sandy clay loam that has variable mineral color and some black manganese stains; brown (10YR 4/3) and dark brown (7.5YR 3/2) with variable mineral color and black mineral stains when moist; massive; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; few very fine and fine tubular and interstitial pores; common moderately thick clay films in pores, as bridges, and on faces of cobblestones; medium acid; gradual, wavy boundary.

C1—27 to 50 inches, brown (7.5YR 5/2) very cobbly sandy clay loam, brown (10YR 4/3) and dark brown (7.5YR 3/2) when moist; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; very few very fine and fine interstitial pores; moderately thick clay films on faces of cobbles and as bridges between sand grains; medium acid; gradual, wavy boundary.

C2—50 to 60 inches, brown (10YR 5/3) extremely cobbly sandy clay loam that has variable mineral colors; brown (10YR 4/3) and dark brown (7.5YR 3/2) with variable mineral color and some black manganese stains when moist; massive; hard, firm slightly sticky and slightly plastic; very few fine roots; very few very fine and fine pores; moderately thick clay films on faces of cobbles and between sand grains; medium acid.

Reaction is about neutral at the surface and remains constant or becomes slightly acid or medium acid with increasing depth. Throughout the profile are abundant, mostly rounded, predominantly andesitic rock fragments that vary from gravel to cobbles to stones in size. In most cases the content of rock fragments exceeds 35 percent, by volume, though it ranges to 80 percent in places.

Depth to an extremely gravelly or cobbly substratum ranges from 24 to 48 inches.

The A horizon is grayish-brown to brown to very dark brown very gravelly or very cobbly sandy loam or loam. The B2t horizon is massive or, in places, has weak to moderate, subangular blocky structure. It ranges from light brownish gray to dark grayish brown to brown in color and from very cobbly sandy clay loam to very cobbly clay loam in texture. Stoniness increases with increasing depth. The C horizon is gravelly, stratified, sandy and very cobbly to stony or extremely cobbly stony lake sediment. It is weakly cemented with silica in places.

Badenaugh very cobbly sandy loam, 2 to 30 percent slopes (BaE).—This gently sloping to moderately steep soil is on terraces and older alluvial fans. Included in mapping are areas of Sattley soils and areas of Basic rock land.

This is the only Badenaugh soil in the Sierra Valley Area. Runoff is slow to rapid. The hazard of erosion is slight to high.

This soil is used chiefly for range, but it also furnishes food and cover for rabbits, quail, and deer. A few small areas between Loyalton and Sierraville have trees suitable for lumber and poles. Capability unit VIIs–1; range site 1.

Badenaugh Series, Poorly Drained Variant

This variant of the Badenaugh series consists of poorly drained meadowland. Slopes range from 2 to 5 percent. These soils are on alluvial fans and bottom land near Sierraville. Elevation ranges from 4,900 to 5,200 feet. Annual rainfall is 16 to 22 inches, and the average annual temperature is 48° to 50° F. The frost-free period is 50 to 60 days. The natural vegetation is meadow pasture, including sedges, wire grass, bluegrass, tufted hairgrass, forbs, and scattered silver sage. Soils of the Badenaugh series, poorly drained variant, are associated mainly with Portola, Ramelli, and Pasquetti soils.

In a representative profile a sod of grass roots, grass residue, and decaying vegetation about four inches thick is at the surface. The surface mineral layer is dark-gray and gray, slightly acid extremely cobbly clay loam about 13 inches thick. The subsoil is gray, light brownish-gray or grayish-brown, mottled, slightly acid and medium acid very cobbly clay and very gravelly sandy clay loam about 31 inches thick. The substratum is grayish-brown, medium acid very gravelly clay loam. It extends to a depth of 60 inches or more.

Permeability is slow in these soils. The effective rooting depth extends to the substratum—a depth of 30 to 60 inches. The depth of the water table is 12 to 48 inches, and the available water capacity is 4 to 6 inches, based on a drained profile.

These soils are irrigated by random flooding and are used for pasture. The excessive stoniness of the surface prevents the use of haymaking machinery.

Representative profile of Badenaugh extremely cobbly clay loam, poorly drained variant, in native pasture, on the Webber ranch (1,000 feet southeast of the northwest corner of sec. 13, T. 20 N., R. 14 E.; 800 feet south of State Highway, Nos. 89 and 49, and 0.75 mile west of Sierraville):

O1 and O2—4 inches to 0, mat of grass roots, leaves, and stems, decaying with depth; abrupt, smooth boundary.

A11—0 to 7 inches, dark-gray (10YR 4/1) extremely cobbly light clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard, friable, sticky and plastic; many very fine, fine, and medium roots; many very fine and fine interstitial pores and common medium interstitial pores; slightly acid; clear, smooth boundary.

A12—7 to 13 inches, gray (10YR 5/1) extremely cobbly clay loam, very dark gray (10YR 3/1) when moist; moderate, fine, angular blocky structure; slightly hard, friable, sticky and plastic; many very fine, fine, and medium roots; many very fine and fine interstitial pores and common medium interstitial pores; slightly acid; clear, smooth boundary.

B2t—13 to 27 inches, gray (10YR 5/1) very cobbly clay that has common, medium, distinct, pale-brown (10YR 6/3) mottles, dark grayish brown (2.5YR 4/2) when moist; moderate, medium, prismatic structure; hard, firm, sticky and very plastic; common very fine and fine roots and few medium roots; common very fine, fine, and medium interstitial pores; common thin clay films in pores and on faces of peds; slightly acid; abrupt, smooth boundary.

B31—27 to 36 inches, light brownish-gray (10YR 6/2) and greenish-gray (5GY 5/1) very gravelly sandy clay loam that has many, medium, distinct, brownish-yellow (10YR 6/6) mottles; dark grayish brown (2.5Y 4/2) and has few, fine, distinct, light olive-brown (2.5Y 5/4) mottles when moist; gravel

and sand are variably colored; massive; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine, fine, and medium interstitial pores; few thin clay films as bridges; 50 percent gravel; slightly acid; clear, smooth boundary.

B32—36 to 44 inches, grayish-brown (10YR 5/2) very gravelly light sandy clay loam that has few, fine, distinct, light yellowish-brown (10YR 6/4) mottles; dark grayish brown (2.5Y 4/2) and has mixed gravel and sand colors when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common fine and medium tubular and interstitial pores; few thin clay films as bridges; 60 percent gravel; medium acid; clear, smooth boundary.

C—44 to 60 inches, material about the same as in B32 horizon, except slightly more gravelly; some manganese stains on sand and gravel; nonplastic.

The A horizon ranges from gray to dark gray cobbly very gravelly heavy loam to very cobbly or very gravelly clay loam. Stone content ranges from 10 to 30 percent by volume, and stones and cobbles commonly litter the surface. In places the surface has spotty vegetation and many bare spots. The structure of the A11 horizon ranges from platy to granular.

The B2t horizon ranges from gray to grayish brown. It commonly has medium to coarse, distinct, pale-brown to yellowish-brown mottles mixed with variable stone and mineral grain colors. This horizon is very gravelly or very cobbly clay or heavy clay loam. Structure is prismatic or angular blocky. Stones, cobbles, and gravel make up more than 50 percent of the B2t horizon and increase in volume in the B3 horizon. The B3 horizon is very gravelly or very cobbly, gleyed and mottled sandy clay loam or heavy sandy loam. In places it has stratified lenses of sand and clay. The B3 horizon is weakly cemented with iron in places.

The C horizon is highly variably stratified very gravelly sandy loam to very gravelly clay loam.

Reaction ranges from slightly acid in the A horizon to medium acid in the C horizon. In places lenses of white ash occur below the B2t horizon.

Badenaugh extremely cobbly clay loam, poorly drained variant, 2 to 5 percent slopes (BbB).—This gently sloping soil is in wet meadows. It is the only Badenaugh poorly drained variant in the survey area. Included in mapping are areas of soils that have slopes of less than 2 percent and areas of Pasquetti soils. Runoff is slow. The hazard of erosion is slight.

This soil is used for range. Livestock grazing is somewhat hampered by the stones on the surface. Capability unit VIw–1; range site 8.

Balman Series

The Balman series consists of somewhat poorly drained soils that are forming in alluvium from various sources. These soils are on the valley floor and on alluvial fans, mainly in the Sierra Valley basin. Slopes range from 0 to 5 percent. Elevation ranges from 4,000 to 5,000 feet. Annual precipitation is 10 to 20 inches, and the average annual temperature is 48° to 49° F. The frost-free period is about 80 to 90 days. The natural vegetation is silver sagebrush, grasses, sedges, and herbs. Balman soils are associated mainly with Ramelli soils.

In a representative profile the surface layer is light brownish-gray or gray, strongly alkaline and very strongly alkaline, highly calcareous loam about 17 inches thick. The substratum is gray or light-gray, moderately alkaline, highly calcareous, highly stratified loam, sandy clay loam, sandy loam and loamy coarse sand. It extends to a depth of more than 60 inches.

Permeability is moderately slow. The effective rooting depth is more than 60 inches. The available water capacity is 7 to 9 inches. The water table is at a depth of 60 to 84 inches.

Balman soils are used for improved irrigated pasture and for hay and grain. Large areas are also used for range.

Representative profile of Balman loam in a field of tall wheatgrass in a nearly level valley basin (400 feet north of the west quarter corner of sec. 35, T. 22 N., R. 15 E.; 3 miles northwest of Loyalton) :

Ap1ca—0 to 2½ inches, light brownish-gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots and few fine and medium roots; many very fine, mostly horizontal, tubular pores and common fine interstitial pores; very strongly alkaline; strongly effervescent; lime disseminated; clear, smooth boundary.

Ap2ca—2½ to 10 inches, gray (10YR 6/1) loam, very dark grayish brown (10YR 3/2) when moist; moderate, thin, platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots and common fine and medium roots; many very fine tubular pores, few fine and medium tubular pores, and common fine interstitial pores; strongly alkaline; strongly effervescent; lime disseminated; clear, smooth boundary.

ACca—10 to 17 inches, gray (10YR 6/1) loam, very dark grayish brown (10YR 3/2) when moist; moderate, thin, platy structure; soft, friable, slightly sticky and slightly plastic; many very fine roots, common fine roots, and few medium roots; many very fine and fine tubular pores, few medium tubular pores, and few very fine interstitial pores; strongly alkaline; strongly effervescent; lime disseminated; clear, smooth boundary.

C1ca—17 to 22 inches, gray (10YR 6/1) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine roots and few fine roots; common very fine tubular pores, few fine and medium tubular pores, and few very fine interstitial pores; moderately alkaline; strongly effervescent; lime disseminated; clear, smooth boundary.

C2ca—22 to 30 inches, gray (10YR 6/1) sandy clay loam, very dark brown (10YR 2/2) when moist; weak, medium and coarse, subangular blocky structure; hard, very firm, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and medium tubular pores, common very fine interstitial pores, and few fine interstitial pores; moderately alkaline; strongly effervescent; lime disseminated; gradual, smooth boundary.

C3ca—30 to 42 inches, light-gray (10YR 7/2) fine sandy loam, dark grayish-brown (10YR 4/2) when moist; weak, medium and coarse, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; very few very fine and fine roots; many very fine tubular pores, common fine and medium tubular pores, common very fine interstitial pores, and few fine interstitial pores; moderately alkaline; strongly effervescent; filaments or threads of lime; gradual, smooth boundary.

C4—42 to 53 inches, light-gray (10YR 7/2) sandy loam and loamy coarse sand, dark grayish-brown (10YR 4/2) when moist; massive; hard, friable, slightly

sticky and slightly plastic; very few very fine and fine roots; many very fine and fine tubular pores, few medium tubular pores, and common very fine, fine, and medium interstitial pores; moderately alkaline; strongly effervescent; lime disseminated; gradual, smooth boundary.

C5—53 to 67 inches, light-gray (10YR 7/2) sandy loam and loamy coarse sand, dark grayish-brown (10YR 4/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; very few very fine and fine roots; common very fine, fine, and medium tubular and interstitial pores; moderately alkaline; strongly effervescent; lime disseminated.

The A horizon ranges from sandy loam to loam. Vesicular porosity is common. The content of salt and sodium ranges from slight to strong. It is generally sufficient to cause some difficulty in establishing some of the less tolerant plants, especially immediately after fields have been leveled. Some areas may have a boron excess or toxicity, especially areas that are irrigated from deep wells and warm mineralized water. In some areas the C horizon is light gray below a depth of 40 inches and has some reddish-brown mottles and black manganese stains. In other areas it is light olive gray or nearly white below this depth.

Balman loam, 0 to 2 percent slopes (BcA).—This nearly level soil is on the valley floor. It has the profile described as representative for the Balman series. Runoff is slow to very slow, and the hazard of erosion is none to slight.

Included with this soil in mapping are areas of a soil that is similar to the Balman loam but has a micaceous loam surface layer abruptly underlain, at a depth of about 40 inches, by sand and gravel. Also included are areas of soils that have a layer of sandy overwash material at the surface. In places in small local depressions, the soil has a high content of salt and alkali, and the subsoil is very slowly permeable clay.

Most of this soil is in improved pasture, hay, and grain crops, mainly wheatgrasses, alfalfa, and oats. A large area is used for native pasture. Capability unit IIIs–6.

Balman loam, 2 to 5 percent slopes (BcB).—This gently sloping soil is on alluvial fans and on the valley floor. It is similar to the soil that has the profile described as representative for the Balman series, but this soil has steeper slopes. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping in places are small areas of gray or grayish-brown claypan-hardpan soils, similar to those on the surrounding uplands.

This soil is used for improved pasture, cereal rye, and grain crops. Some areas are unimproved and are used for dry range. Capability unit IIIs–6.

Balman-Ramelli complex, 0 to 2 percent slopes (BdA).—These nearly level soils are on the floor of Sierra Valley where relief is hummocky. Balman soils are on the mounds, and Ramelli soils are in the interlacing drainageways and swales. The soils are in a mixed spotted pattern of islands and dendritic drainageways. Each soil makes up about 50 percent of the complex.

Both soils have profiles similar to the ones described as representative for their respective series. The Balman soils have slow runoff and a slight hazard of erosion. The Ramelli soils have very slow runoff or are ponded, and the hazard of erosion is essentially none to slight.

These soils are used mainly for meadow pasture, but some areas are used to grow hay or grains. A few areas have been seeded to improved grasses and legumes. Capability unit IIIw–5.

Basic Rock Land

Basic rock land (BeG) is a land type that consists of rough, rocky, broken areas. Outcrops of rock and very shallow soil material over rock occupy as much as 50 to 90 percent of the surface. These areas are in parts of the gently sloping to very steep mountainous uplands that encircle Sierra Valley and on the western slope of Long Valley. The rock material consists of hard pyroclastic breccia, plugs, vents, flow rock, and tuff-cemented conglomerate. This material is predominantly of basaltic and andesitic origin. The kind and density of the vegetation vary. Vegetation is lacking on a few of the more prominent peaks, such as Beckwourth Peak, Sugar Loaf, and Elephants Head, and in a few of the interconnecting areas. Most areas have a spotty cover of sagebrush and grass and scattered pockets of woods.

This land type has little value for farming, other than serving as part of a protected watershed and as part of the habitat and escape cover for wildlife. Capability unit VIIIs–1.

Beckwourth Series

The Beckwourth series consists of somewhat poorly drained soils that formed in material weathered from mixed valley fill, dominantly granitic alluvium. Slopes range from 0 to 2 percent. These soils are mainly on the plains between the villages of Vinton and Beckwourth. Elevation ranges from 4,000 to 5,200 feet. Annual precipitation is 12 to 18 inches, and the average annual temperature is about 48° F. The frost-free period is about 80 to 90 days. The natural vegetation is dominantly silver sagebrush, annual grasses, dryland sedge, and a few forbs. Beckwourth soils are associated mainly with Ormsby and Loyalton soils.

In a representative profile (fig. 6) the surface layer is very dark gray or dark grayish-brown loamy coarse sand about 15 inches thick, and the subsoil is brown or pale-brown loamy coarse sand and coarse sandy loam about 19 inches thick. Reaction is medium acid in the surface layer and neutral or moderately alkaline in the subsoil. The subsoil is calcareous. The substratum is light yellowish-brown and pale-brown loamy coarse sand and coarse sand that extends to a depth of more than 60 inches. It, too, is calcareous and is moderately alkaline in reaction.

The water table fluctuates between depths of 3 and 7 feet.

These soils are used for unimproved range. A few areas have been cleared and planted to improved pasture, small grains, grain hay, and alfalfa.

Representative profile of Beckwourth loamy coarse sand in an area of sagebrush and grasses on a nearly level flood plain (0.6 mile north and 0.2 mile west of

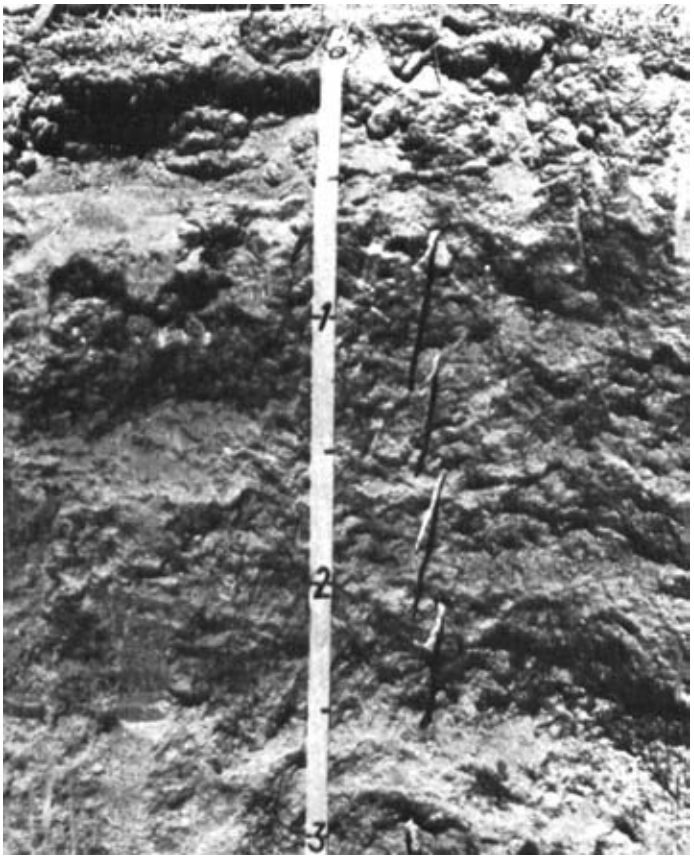

Figure 6.—**Profile of Beckwourth loamy coarse sand. This soil is forming in granitic alluvium.**

the southeast corner of sec. 21, T. 22 N., R. 15 E.; 4.5 miles north of the junction of State Route 49 and Heriot Lane and 0.25 mile east of Heriot Lane) :

A11—0 to 2½ inches, very dark gray (10YR 3/1) loamy coarse sand, black (10YR 2/1) when moist; moderate, very thin, platy structure; soft, very friable, nonsticky and nonplastic; many very fine and few fine and medium roots; many very fine tubular and interstitial pores; medium acid; clear, smooth boundary.

A12—2½ to 15 inches, dark grayish-brown (10YR 4/2) loamy coarse sand, very dark brown (10YR 2/2) when moist; weak, thick, platy structure; soft, very friable, nonsticky and nonplastic; few very fine, fine, medium, and coarse roots; many very fine interstitial and common very fine and fine tubular pores; medium acid; clear, slightly wavy boundary.

B1—15 to 23 inches, brown (10YR 5/3) loamy coarse sand, dark brown (10YR 4/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine, fine, medium, and coarse roots; many very fine interstitial pores and common very fine and fine tubular pores; few thin clay films in pores; neutral; clear, smooth boundary.

B2tca—23 to 34 inches, pale-brown (10YR 6/3) coarse sandy loam; common, medium, distinct mottles that are white (10YR 8/2) and brown (10YR 5/3) when moist; massive; hard, firm, slightly sticky and slightly plastic; few very fine and coarse roots; common very fine interstitial pores and common very fine and fine tubular pores; common thin clay films in pores and as bridges; moderately alkaline; strongly effervescent; soft masses of lime; clear, smooth boundary.

C1—34 to 48 inches, light yellowish-brown (10YR 6/4) loamy coarse sand, brown (10YR 4/3) when moist; common, fine, faint mottles that are very dark grayish brown (10YR 3/2) when moist; massive; soft, friable, nonsticky and nonplastic; very few fine roots; common fine interstitial pores; moderately alkaline; very slightly effervescent, scattered, soft masses of lime; gradual, smooth boundary.

C2—48 to 60 inches, pale-brown (10YR 6/3) coarse sand, brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky and nonplastic; no roots; many very fine interstitial pores; moderately alkaline; very slightly effervescent, soft masses of lime.

The A horizon is loamy coarse sand or loamy sand. Color ranges from very dark gray to dark grayish brown. In undisturbed areas this horizon has platy structure, but in places in cultivated areas the structure is granular.

The B horizon is brown to pale-brown to light-gray loamy coarse sand, coarse sandy loam, or sandy loam. In a few places color is reddish brown. This horizon is hard, and it is weakly cemented with lime or silica. It has few, faint, very dark grayish-brown mottles, which in places are obscured by the varied color of the sand grains of the soil mass. Olive-gray clay layers are between depths of 3½ and 10 feet.

Beckwourth loamy coarse sand (Bf).—This nearly level soil is away from the valley rim on fans and the valley floor. It has the profile described as representative for the Beckwourth series. Included in mapping are small areas of Loyalton and Ormsby soils.

Permeability is moderate in this soil. The available water capacity is 3.5 to 6 inches, and the effective rooting depth is generally more than 60 inches. The nature of the subsoil somewhat restricts the growth of roots. A seasonal water table is at a depth of 36 to more than 60 inches. Runoff is very slow. The hazard of erosion by water is none to slight, and the hazard of wind erosion is moderate.

Many areas of this soil are unimproved and are used for range. A small nonirrigated acreage is planted to alfalfa, grass and legume pasture, and cereal rye. A few areas are used for dryland grains. Capability unit IVw–4.

Beckwourth loamy coarse sandy, clayey substratum (Bh).—This nearly level soil is on slightly elevated terraces. Included in mapping are small areas of Loyalton and Ormsby soils.

This soil is underlain at a depth of 40 to 60 inches by slightly acid to neutral clayey lake sediment, but the profile is otherwise similar to the one described as representative for the series.

Permeability of the lake sediment is very slow. Available water capacity is 3.5 to 5 inches in the 40- to 60-inch root zone. A water table is at a depth of 72 inches. Runoff is very slow. The hazard of erosion by water is none to slight, and the hazard of wind erosion is moderate.

This soil is used mostly for pasture and unimproved range. A few areas are used for hay and small grains. Capability unit IVw–4.

Beckwourth sandy loam (Bk).—This nearly level soil is on alluvial plains. Included in mapping are small areas of Loyalton and Ormsby soils.

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This soil is sandy loam throughout, but the profile is otherwise similar to the one described as representative for the Beckwourth series.

Permeability is moderate. The available water capacity is 5 to 7 inches, based on drained soil. This soil has a water table at a depth of 40 to more than 60 inches. Runoff is very slow, and the hazards of erosion and soil blowing are none to slight.

Alfalfa, improved pasture, cereal hay, and grains are the commonly grown crops. Capability unit IIIw–2.

Beckwourth-Loyalton complex, saline-alkali, 0 to 2 percent slopes (BmA).—These nearly level soils are so intermingled that it was not feasible to map them separately. Beckwourth soils have broad, flat, nearly level, smooth slopes. Loyalton soils are in relic drainageways, in small depressional sinks, or on hummocky flats. About 50 percent of this complex is Beckwourth soils, and 40 percent is Loyalton soils. The remaining 10 percent is areas of Ormsby soils.

Beckwourth loamy coarse sand is moderately saline-alkali, but its profile is otherwise similar to the one described as representative for the series. Permeability is moderate in this soil. Available water capacity is 3.5 to 6 inches. A water table is at a depth of 36 to more than 60 inches.

Loyalton fine sandy loam is moderately saline-alkaline, but its profile is otherwise similar to the one described as representative for the Loyalton series.

Runoff is very slow, and the hazard of erosion is nonexistent to slight on Beckwourth and Loyalton soils. In places areas of Loyalton fine sandy loam are ponded.

These soils are used mostly for range, although a small acreage has been leveled and planted to improved pasture. A small acreage is also planted to cereal grains. Capability unit IVs–6.

Beckwourth-Ormsby loamy coarse sands (Bn).—These nearly level soils are so intermingled that it was not feasible to map them separately. Each soil makes up about 45 percent of the complex. The remaining 10 percent is mostly Loyalton soils.

Beckwourth loamy coarse sand has the profile described as representative for the Beckwourth series. Permeability is moderate in this soil. Available water capacity is 3.5 to 6 inches. A water table is at a depth of 36 to 60 inches.

Ormsby loamy coarse sand has the profile described as representative for the Ormsby series. It has a water table at a depth of 48 to more than 60 inches.

Runoff is very slow on these soils. The hazard of erosion is nonexistent to slight, and the hazard of soil blowing is moderate.

These soils are used mainly for dry range, although some areas are now planted to improved irrigated pasture or small grains. Capability unit IVw–4.

Bellavista Series

The Bellavista series consists of moderately well drained, highly calcareous soils that have intermittent lime-cemented hardpan layers at a depth of 20 to 40 inches. The soils are forming in calcareous alluvium of mixed mineralogy. Slopes are 0 to 5 percent, and relief is often hummocky. These soils are in basins, in depressional areas, and on terraces on the east side of Sierra Valley near Highway 49 between Dyson Lane and the town of Loyalton. Elevation ranges from 4,500 to 5,000 feet. Annual precipitation is 12 to 18 inches, and the average annual temperature is about 48° to 49° F. The frost-free period is about 50 to 90 days. The natural vegatation is sparse or spotty. Barren areas where whitish salts cover the surface are common. Most areas have some silver sagebrush, cheatgrass, Great Basin wildrye, saltgrass, rabbitbrush, and a few other grasses and forbs. Bidwell and Balman soils are in the same general area as Bellavista soils.

In a representative profile the surface layer is moderately alkaline, gray and light brownish-gray loam and fine sandy clay loam about 20 inches thick. It is underlain by a grayish-brown and light brownish-gray, lime-cemented, indurated hardpan that extends to a depth of more than 60 inches. The pan becomes less cemented with increasing depth.

Permeability is moderate above the hardpan. The hardpan itself is nearly impermeable. Available water capacity is 3 to 7 inches in the 20 to 40 inches of effective rooting depth. The soils are slightly to moderately saline-alkali.

Bellavista soils are used mainly for range. Small areas are used for improved pasture, alfalfa, and small grains.

Representative profile of Bellavista loam in an area of alfalfa-brome pasture on a nearly level, low terrace (1,400 feet west and 1,300 feet south of the northeast corner of sec. 17, T. 22 N., R. 16 E.; 50 feet east of the junction of Dyson Lane and State Highway 49) :

Apca—0 to 9 inches, gray (10YR 5/1) loam, dark grayish brown (10YR 4/2) when moist; weak, thick, platy structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine tubular and interstitial pores; moderately alkaline; strongly effervescent; lime is disseminated; clear, smooth boundary.

A12ca—9 to 20 inches, gray (10YR 6/1) and light brownish-gray (10YR 6/2) light fine sandy clay loam, dark grayish-brown (10YR 4/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine roots and common medium roots; many very fine tubular pores and common fine tubular pores; common thin clay films in pores; moderately alkaline; strongly effervescent; lime is disseminated; abrupt, wavy boundary.

C1mca—20 to 23 inches, grayish-brown (10YR 5/2) indurated pan that has light-gray (10YR 7/2) coatings of lime, dark grayish brown (10YR 4/2) with yellowish-brown (10YR 5/4) streaks of lime when moist; upper boundary of pan is capped with ¼-inch layer of silica and lime; massive; roots spread out above upper boundary; very few fine tubular pores; moderately alkaline; violently effervescent; lime is disseminated and occurs in seams; clear, wavy boundary.

C2mca—23 to 42 inches, light brownish-gray (10YR 6/2) indurated pan that has light-gray (10YR 7/2) streaks of lime, dark brown (10YR 3/3) with light-gray (10YR 7/2) streaks of lime when moist; massive; some soft spots; no roots; few fine tubular pores; moderately alkaline; violently effervescent; lime is disseminated and occurs in seams; clear, wavy boundary.

C3—42 to 64 inches, light brownish-gray (10YR 6/2) loamy coarse sand that has light-gray (10YR 7/2) streaks, dark yellowish brown with very pale brown (10YR 7/4) streaks when moist; strong, thin and medium, platy structure; hard, very firm, nonsticky and nonplastic; no roots; few fine tubular pores; moderately alkaline; noneffervescent.

The A horizon ranges from grayish brown to gray or light brownish gray. Texture ranges from sandy loam to silt loam.

Stratified sandy loam, coarse sand, and lenses of clay underlie the pan at depths of 48 to more than 60 inches. Depth to the indurated pan ranges from 20 to 40 inches. The cementation is variable, but the upper part is almost always indurated or strongly cemented.

Bellavista loam, 0 to 2 percent slopes (BoA).—This nearly level soil is in basins. It has the profile described as representative for the Bellavista series. Included in mapping are small areas of Balman and Loyalton soils. Runoff is very slow, and the hazard of erosion is none to slight.

This soil is used mainly for unimproved range. Some areas that have been roughly leveled have been planted to cereal grains and improved pasture. Capability unit IVs–6.

Bellavista loam, 2 to 5 percent slopes (BoB).—This gently sloping soil is on terraces that rise gently to the surrounding fans and uplands. It is similar to the soil that has the profile described as representative for the Bellavista series, but this soil has steeper slopes. Included in mapping are areas of Balman and Loyalton soils and areas where a gravel mantle is at the surface. Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for range. Small areas are used for irrigated and dryland pasture or for growing small grains. Capability unit IVs–6.

Bidwell Series

The Bidwell series consists of well-drained soils that are forming in alluvium or valley-fill material from various sources. These soils are in basins or on low terraces on the valley floor. Slopes range from 0 to 5 percent. Elevation ranges from 4,500 to 5,000 feet. Annual precipitation is 12 to 18 inches, and the average annual temperature is about 48° to 49° F. The frost-free period is about 80 to 90 days. The dominant vegetation in uncropped areas is silver sagebrush; such grasses as cheatgrass, Great Basin wildrye, and bluegrass; and weeds and forbs. Bidwell soils are associated mainly with Balman and Loyalton soils.

In a representative profile the surface layer is medium acid, dark-gray sandy loam and fine sandy loam about 6 inches thick. The subsoil is very dark gray and dark-gray sandy clay loam about 13 inches thick. It is slightly acid and mildly alkaline in reaction. The substratum is light-gray, grayish-brown, brown, and pale-brown sandy loam, loamy sand, and sand and gravel that extends to a depth of more than 60 inches. It is strongly alkaline and strongly calcareous. The lime is in seams and bands.

These soils are used for dryland pasture. Some areas are planted to alfalfa or alfalfa-grass mixtures. Some barley and cereal rye are grown for grain or harvested for hay.

Representative profile of Bidwell sandy loam in an area of alfalfa and wheatgrass on a nearly level valley floor (1,320 feet north and 1,320 feet west of the southeast corner of sec. 21, T. 23 N., R. 15 E.; 1 mile north of The Buttes) :

Ap1—0 to 2 inches, dark-gray (10YR 4/1) heavy sandy loam, black (10YR 2/1) when moist; moderate, thin, platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine interstitial pores; medium acid; abrupt, smooth boundary.

Ap2—2 to 6 inches, dark-gray (10YR 4/1) heavy fine sandy loam, black (10YR 2/1) when moist; moderate, coarse and very coarse, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine tubular pores; medium acid; gradual, smooth boundary.

B2t—6 to 14 inches, very dark gray (10YR 3/1) sandy clay loam, black (10YR 2/1) when moist; strong, coarse and very coarse, subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots; common very fine tubular pores; common thin clay films in pores and as bridges; slightly acid; gradual, smooth boundary.

B3t—14 to 19 inches, dark-gray (10YR 4/1) light sandy clay loam, very dark gray (10YR 3/1) when moist; strong, coarse and very coarse, subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; common very fine interstitial pores; very few thin clay films as bridges between mineral grains; mildly alkaline; noncalcareous; clear, smooth boundary.

C1ca—19 to 27 inches, light-gray (10YR 6/1) heavy sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine and fine interstitial and tubular pores; strongly alkaline; violently effervescent; lime in seams; gradual, smooth boundary.

C2ca—27 to 38 inches, grayish-brown (10YR 5/2) heavy sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular and interstitial pores; strongly alkaline; violently effervescent; lime in seams and as soft masses; clear, wavy boundary.

IIC3ca—38 to 58 inches, brown (10YR 5/3) and variable mineral and sand colors loamy sand, brown (10YR 4/3) when moist; single grained; loose, nonsticky and nonplastic; very few very fine roots; many very fine interstitial pores; strongly alkaline; slightly effervescent to strongly effervescent; lime disseminated; abrupt, wavy boundary.

IIC4ca—58 to 62 inches, pale-brown (10YR 6/3) and variable mineral colors coarse sand and fine gravel, dark yellowish brown (10YR 4/4) when moist; single grained; loose, nonsticky and nonplastic; strongly alkaline; noneffervescent to slightly effervescent.

The A horizon ranges from dark gray to dark grayish brown. The texture is sandy loam to loam. The B horizon is very dark gray to dark gray or dark grayish brown. The depth to the sand and gravel C horizon ranges from 40 to more than 60 inches, although one soil—Bidwell sandy loam, sandy substratum, 0 to 2 percent slopes—has sand and gravel at a depth of 22 to 40 inches. This soil is outside the range of the Bidwell series because of this depth, but it has similar use and management and was included with the Bidwell series in this Area.

Bidwell sandy loam, 0 to 2 percent slopes (BrA).—This nearly level soil is in basins or on low terraces near the valley floor. It has the profile described as representative for the Bidwell series.

Permeability is moderately slow in this soil. The available water capacity is 7 to 9 inches in the more than 60 inches of effective rooting depth. Runoff is very slow, and the hazard of water erosion is none to slight. The hazard of wind erosion is moderate.

Included with this soil in mapping are other soils in areas too small to delineate separately. As much as 10 percent of some areas consists of soils that have a heavy clay subsoil. In some areas little textural development has occurred, and the soil resembles soils of the Balman series. Also included are areas where the soil is eroded and channeled.

This soil is used mainly for unimproved pasture. Areas that are irrigated by random water-spreading ditches are used for meadowland, and the vegetation is commonly cut for hay. Some areas are planted to alfalfa-grass mixtures or grain and cereal rye that are grown without irrigation. Only a few crops planted in this soil are irrigated. Capability unit IIIc–1.

Bidwell sandy loam, 2 to 5 percent slopes (BrB).—This gently sloping soil is on terraces on the basin rim. It is similar to the soil that has the profile described as representative for the Bidwell series, but this soil has steeper slopes. Included in mapping are areas of Balman soils and small areas of a soil that has a clay subsoil.

Permeability is moderately slow. The available water capacity is 7 to 9 inches in the more than 60 inches of effective rooting depth. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

This soil is used mainly for improved pasture, but small areas are planted to alfalfa and small grains. Capability unit IIIe–1.

Bidwell sandy loam, sandy substratum, 0 to 2 percent slopes (BsA).—This nearly level soil has a profile similar to the one described as representative for the Bidwell series except that a substratum of sand and gravel is at a depth of 22 to 40 inches.

Permeability is moderately slow above the rapidly permeable sand and gravel substratum. The available water capacity is 3 to 6 inches. Runoff is very slow. The hazard of water erosion is none to slight. The hazard of wind erosion is moderate.

Included with this soil in mapping are areas of this soil that have a water table at a depth of 3½ to 6 feet. Also included are areas of other Bidwell soils and of Balman soils.

This soil is used mainly for unimproved pasture or range. A small acreage, irrigated by spring runoff water, is used for irrigated pasture. Other small areas are used for dryland grain. Capability unit IIIs–0.

Bidwell loam, 0 to 2 percent slopes (BtA).—This nearly level soil is on stream terraces and in isolated flats and basins. It is similar to the soil that has the profile described as representative for the Bidwell series, but this soil has a surface layer of loam and a subsoil of clay loam. The substratum, at a depth of 50 to over 60 inches, is stratified loamy sand that in places is weakly cemented with lime. Included in mapping are small areas of Bidwell sandy loam and of Balman soils.

Permeability is moderately slow. The available water capacity is 8 to 10 inches in the 50 to 60 inches or more of effective rooting depth. Runoff is very slow, and the hazard of erosion is none to slight.

This soil is used for small grains and for improved pasture. Capability unit IIIc–1.

Bieber Series

The Bieber series consists of well-drained soils that are forming in mixed, but dominantly basic, alluvium. These soils are on old terraces on the Sierra Valley floor and on higher terraces near the valley perimeter, in the general vicinity of the town of Loyalton. They have a clay subsoil that is underlain by a hardpan at a depth of 10 to 40 inches. Slopes range from 0 to 5 percent. Elevation ranges from 4,500 to 5,200 feet. Annual precipitation is 12 to 18 inches, and the average annual temperature is about 48° or 49° F. The frost-free period is about 50 to 90 days. The natural vegetation is mostly low sagebrush, some silver sagebrush, sparse grass, and a few forbs. Bieber soils are associated mainly with Martineck and Correco soils.

In a representative profile the surface layer is gray and grayish-brown, medium acid and slightly acid gravelly sandy loam and heavy sandy loam about 6 inches thick. The subsoil is brown, slightly acid light sandy clay loam and sandy clay about 11 inches thick. The subsoil rests abruptly on a very hard, silica-cemented hardpan at a depth of 17 inches.

Permeability is very slow in the subsoil, and the hardpan is nearly impermeable.

Bieber soils are used for range and some improved pasture. A few areas are planted to dryland grains.

Representative profile of Bieber gravelly sandy loam in an area of low sagebrush and annual grasses on a low terrace (400 feet east and slightly north of the center of sec. 1, T. 21 N., R. 15 E.; 330 feet east of Beckwith Road and 0.5 mile south of the Plumas County line) :

A11—0 to 3 inches, gray (10YR 5/1) gravelly sandy loam, dark brown (10YR 3/3) when moist; moderate, thick, platy structure; slightly hard, friable, non-sticky and nonplastic; common very fine, fine, and medium roots; common very fine and fine vesicular pores; medium acid; abrupt, smooth boundary.

A12—3 to 6 inches, grayish-brown (10YR 5/2) heavy sandy loam, dark brown (10YR 3/3) when moist; weak, thick, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common very fine and fine vesicular pores; slightly acid; clear, smooth boundary.

B1t—6 to 9 inches, brown (10YR 5/3) light sandy clay loam, dark brown (10YR 4/3) when moist; massive; hard, friable, sticky and slightly plastic; common fine and medium roots; common very fine and fine tubular and interstitial pores; common thin clay films in pores and as bridges between mineral grains; slightly acid; abrupt, slightly wavy boundary.

B2t—9 to 17 inches, brown (10YR 5/3) sandy clay, dark brown (10YR 4/3) when moist; strong, medium and coarse, prismatic structure; extremely hard, very firm, sticky and very plastic; common very fine and fine exped roots; few very fine and fine tubular pores; continuous moderately thick colloid coatings on faces of peds and in pores; slightly acid; abrupt, slightly wavy boundary.

C1m—17 to 23 inches, light-gray (10YR 7/2), very hard, silica-indurated pan, dark grayish-brown when moist; white (10YR 8/1) coatings; mat of fine roots at upper boundary.
C2—23 to 60 inches, stratified gravelly, sandy, and cobbly sediment; variably cemented, cementation becoming less with depth.

The A horizon ranges from grayish brown to gray. In gravelly areas the gravel forms an andesitic pavement on the surface. Some areas have a few cobbles on the surface that have moved down from the surrounding uplands. Depth to the B2t horizon ranges from 6 to 24 inches. This horizon is brown or dark yellowish-brown clay or sandy clay. The C1m horizon is at a depth of 10 to 40 inches.

Bieber gravelly sandy loam, 0 to 5 percent slopes (BuB).—This nearly level to gently sloping soil is on higher old terraces. It has the profile described as representative for the Bieber series. Included in mapping are areas of Correco and Martineck soils.

The available water capacity is 1 to 3 inches, and the effective rooting depth is 6 to 15 inches. A very small amount of water is slowly available from the clay subsoil. The depth to the hardpan is 10 to 20 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for range. Capability unit VIs–1; range site 4.

Bieber sandy loam, moderately deep, 0 to 2 percent slopes (BwA).—This nearly level soil is on older terraces. It is similar to the soil that has the profile described as representative for the Bieber series, but it lacks the surface gravel pavement described as typical for the series. The sandy clay subsoil is at a depth of 15 to 24 inches, and the hardpan is at a depth of 20 to 40 inches. Included in mapping are areas where there is a weakly cemented hardpan that resembles sandstone and areas of Correco and Martineck soils.

The available water capacity is 2 to 4 inches. Some water is slowly available from the sandy clay subsoil. In places the lower part of the subsoil or upper part of the hardpan contains seams of lime. Runoff is slow, and the hazard of erosion is slight.

This soil is used for range, improved pasture, and small areas of cereal rye or barley. Capability unit IVe–3; range site 4.

Bonta Series

The Bonta series consists of well-drained soils that are underlain by granitic rock at a depth of 24 to 60 inches. These soils are on mountainous uplands. Slopes range from 2 to 75 percent. Elevation ranges from 4,900 to 6,000 feet. Annual precipitation is 12 to 30 inches, and the average annual temperature is about 46° to 47° F. The frost-free period is about 30 to 60 days. The natural vegetation consists of open stands of ponderosa and Jeffrey pine mixed with other conifers, some black oak, juniper, mountainmahogany, sagebrush, bitterbrush, grasses, and forbs. Areas that have lower rainfall or those merging with the valley floor have open stands of trees mixed with brush. Bonta soils are associated mainly with Toiyabe and Haypress soils.

In a representative profile the surface layer is pale-brown, slightly acid loamy coarse sand about 12 inches thick. The subsoil is very pale brown, medium acid and strongly acid coarse sandy loam and sandy loam. Weathered quartz diorite is at a depth of 31 inches.

Permeability is moderate in these soils. The effective rooting depth is 24 to 60 inches, and the available water capacity is 3 to 8 inches.

Bonta soils are used mainly as woodland, but in places they provide limited grazing.

Representative profile of Bonta loamy coarse sand in an area facing to the southeast where slope is 26 percent; under ponderosa pine, sagebrush, and grass (2,000 feet northwest of the southeast corner of sec. 15, T. 23 N., R. 16 E., 2.75 miles north of Vinton and 0.75 mile west of Little Last Chance Creek) :

O1 and O2—3 inches to 0, fresh and partly decomposed litter of pine needles and leaves.
A11—0 to 4 inches, pale-brown (10YR 6/3) loamy coarse sand, brown (10YR 4/3) when moist; moderate, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots and common fine roots; many very fine interstitial pores and common very fine and fine tubular pores; slightly acid; gradual, smooth boundary.
A12—4 to 12 inches, pale-brown (10YR 6/3) loamy coarse sand, brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots; many very fine interstitial pores and common very fine and fine tubular pores; slightly acid; gradual, smooth boundary.
B1—12 to 20 inches, very pale brown (10YR 7/3) coarse sandy loam, brown (10YR 5/3) when moist; moderate, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and many medium and coarse roots; common very fine and fine tubular and interstitial pores; few thin colloid stains on mineral grains; medium acid; clear, smooth boundary.
B2t—20 to 31 inches, very pale brown (10YR 7/4) sandy loam, yellowish brown (10YR 5/4) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and slightly plastic; common fine and medium roots; common very fine and fine tubular and interstitial pores; common thin clay films in pores and on faces of peds; strongly acid; abrupt, wavy boundary.
C—31 inches, very pale brown (10YR 8/4) slightly weathered quartz diorite, light yellowish brown (10YR 6/4) when moist; very few fine and medium roots; few thin clay films on fracture planes; very strongly acid.

The A horizon ranges from dark grayish brown to pale brown. The structure (under forest litter) is generally weak, platy or weak to moderate, granular or subangular blocky. In barren areas the soil material is generally loose and structureless (single grained). The B2t horizon ranges from light yellowish brown to very pale brown. Structure ranges from weak to moderate blocky. Depth to weathered bedrock ranges from 24 to 60 inches. In areas where this soil is forming in quartz diorite, the texture throughout the profile is slightly more clayey than it is in other areas. In areas of granodiorite, the soils are somewhat gravelly and contain angular fragments of granitic rock.

Bonta soils are mapped only in a complex with Toiyabe soils. For individual mapping units, see the Toiyabe series.

Calpine Series

The Calpine series consists of well-drained soils that are forming in granitic alluvium. These soils are mainly on the western flats along the northern rim of the Sierra Valley basin and on the terraces in Long

Valley near Beckwourth Pass. They are on foot slopes, low terraces, and flood plains on the valley floor. Slopes range from 0 to 9 percent. Elevation ranges from 4,800 to 5,500 feet. Annual precipitation is about 10 to 20 inches, and the average annual temperature is 48° or 49° F. The frost-free period is about 80 to 90 days. The natural vegetation is big sagebrush, silver sagebrush, bitterbrush, rabbitbrush, grasses, sedges, and forbs. Calpine soils are associated with Lovejoy soils.

In a representative profile (fig. 7) the surface layer is dark grayish-brown, strongly acid coarse sandy loam 21 inches thick. The upper part of the subsoil is brown, medium acid sandy loam 9 inches thick. The remaining 16 inches of the subsoil is variegated light yellowish-brown and yellow, medium acid sandy clay loam. This is underlain by light yellowish-brown, medium acid, stratified loamy fine sand to coarse sand that extends to a depth of more than 60 inches.

Permeability is moderately rapid. Available water capacity is 6 to 8 inches in the 60 inches or more of effective rooting depth. Free water is at depths below 70 inches in most years.

The Calpine soils are used mainly for range pasture. Some areas are cropped to cereal grains or wheatgrass pasture. Few areas are irrigated.

Representative profile of nearly level Calpine coarse sandy loam under silver sagebrush-grass (in the center of NE¼SE¼ sec. 27, T. 23 N., R. 14 E.; about 0.5 mile southwest of Beckwourth) :

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) coarse sandy loam (nearly loamy sand), very dark brown (10YR 2/2) when moist; moderate, very thin, platy structure; soft, very friable, nonsticky and nonplastic; many very fine roots, common fine roots, and few medium roots; many very fine tubular and interstitial pores; strongly acid; clear, smooth boundary.

A12—3 to 13 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark brown (10YR 2/3) when moist; weak, thick, platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots, common fine roots, and few medium roots; many very fine tubular and interstitial pores; strongly acid; gradual, smooth boundary.

A3—13 to 21 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark brown (10YR 2/3) when moist; weak, medium and coarse, subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine roots, common fine roots, and few medium roots; common very fine tubular and interstitial pores and few fine and medium tubular pores; few thin clay films in pores and few clay bridges between sand grains; strongly acid; clear, smooth boundary.

B1—21 to 30 inches, brown (10YR 5/3) sandy loam, dark yellowish brown (10YR 3/4) when moist; weak, coarse, prismatic structure; hard, firm, nonsticky and nonplastic; common very fine roots and few fine and medium roots; common very fine tubular and interstitial pores and few fine and medium tubular pores; common thin clay films in pores and common clay bridges between sand grains; medium acid; gradual, smooth boundary.

B2—30 to 46 inches, variegated light yellowish-brown (10YR 6/4) and yellow (10YR 7/6) sandy loam, yellowish-brown (10YR 5/4) when moist; weak, coarse, prismatic structure; hard, firm, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine tubular and interstitial pores and few fine and medium tubular pores; common thin clay films in pores and as bridges between sand grains; medium acid; gradual, smooth boundary.

C1—46 to 59 inches, light yellowish-brown (10YR 6/4) loamy fine sand, dark yellowish brown (10YR 4/4) when moist; massive; slightly hard, firm, nonsticky and nonplastic; few fine, very fine, and me-

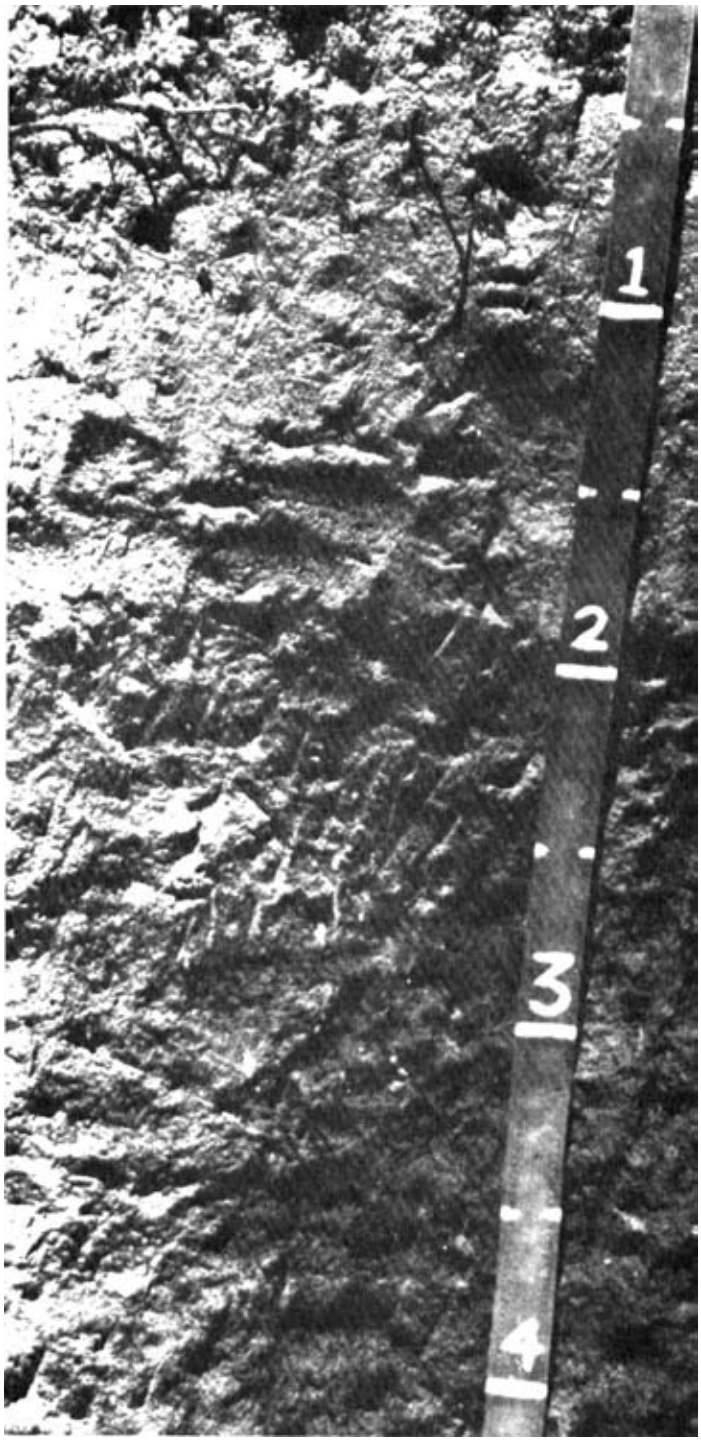

Figure 7.—**Profile of a Calpine coarse sandy loam.**

dium roots; many very fine interstitial pores and few fine and medium tubular pores; medium acid; clear, wavy boundary.

C2g—59 to 81 inches, light yellowish-brown (10YR 6/4), dark reddish-brown (5YR 3/2), and yellow (10YR 7/8) stratified layers of coarse sand and sand; reddish yellow (7.5YR 6/6), yellowish red (5YR 5/8), and dark reddish brown (2.5YR 3/4) when moist; manganese stains; massive; soft, friable, nonsticky and nonplastic; very few very fine, fine, and medium roots; many very fine interstitial pores and few very fine tubular pores; medium acid.

The A1 horizon is sandy loam to loamy coarse sand. The B2 horizon is light yellowish brown to reddish brown or yellow. In some areas weak silica cementation of the C horizon is common below a depth of 50 inches. All horizons are highly micaceous.

The C2g horizon is stratified loamy fine sand to coarse sand. Mottling occurs below a depth of 50 inches and becomes more prominent with depth. The soil material becomes gleyed at a depth of 70 inches or more. A gleyed horizon that has a sandy clay loam texture is at a depth of about 96 inches in some profiles.

Calpine coarse sandy loam, 0 to 2 percent slopes (CaA).—This nearly level soil is on alluvial fans. It has the profile described as representative for the Calpine series. Included in mapping are small areas of other Calpine soils and of Lovejoy soils. Also included are areas where the water table is at a depth of 50 inches or more. Runoff is very slow, and the hazard of erosion is none to slight.

This soil is used mostly for sagebrush pasture. Some areas are used for grains or improved pasture. If irrigated, most climatically adapted plants can be grown. Small areas are used for dryland small grains. Capability unit IIIs–4.

Calpine coarse sandy loam, 2 to 5 percent slopes (CaB).—This moderately sloping soil is on younger terraces just above the valley floor. It is similar to the soil that has the profile described as representative for the Calpine series, but this soil has steeper slopes. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping, on the east side of Long Valley, are some areas of a soil similar to Calpine soils that has a very gravelly substratum. Also included are areas of a wet soil that is similar to Calpine soils and areas of Lovejoy soils.

A small acreage of this soil is planted to wheatgrass pasture and small grains. Most areas are used for range. Capability unit IIIe–1.

Calpine coarse sandy loam, 5 to 9 percent slopes (CaC).—This moderately sloping soil is on fans, terraces, and knolls of the valley floor that have been rounded by geologic erosion. It is similar to the soil that has the profile described as representative for the Calpine series, but this soil has steeper slopes. It is underlain, in places, by stratified sands, silts, and clays at a depth of 50 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included with this soil in mapping are areas of a wet soil similar to Calpine soils and of Calpine soils that have slopes of more than 9 percent or less than 5 percent.

This soil is used for range. A small acreage is used for dryland grain and improved pasture. Capability unit IVe–1.

Calpine-Lovejoy complex, 0 to 5 percent slopes, eroded (CgB2).—These nearly level to gently sloping soils are so intermingled it was not feasible to map them separately. They are on low terraces and in basins. Calpine soils are on slightly elevated, smooth flats and fans. Lovejoy soils are in depressional, troughlike areas, where they are often overburdened by Calpine soil material. About 50 percent of this complex is Calpine soils, and 35 percent is Lovejoy soils. The remaining 15 percent is Dotta soils and Ormsby, hardpan variant, soils and Mixed alluvial land.

Both soils have profiles similar to those described as representative for their respective series. Runoff is very slow. Water ponds for short periods on the Lovejoy soils. The hazard of erosion is none to slight for both soils.

These soils are used mainly for range. Capability unit IVe–3.

Calpine Series, Clayey Variant

This clayey variant of the Calpine series consists of moderately well drained soils on terraces or on the valley floor. They are underlain by clayey sediment at a depth of 22 to 28 inches. Slopes range from 0 to 2 percent. Elevation ranges from 4,800 to 5,200 feet. Annual precipitation is 12 to 20 inches, and the average annual temperature is 48° or 49° F. The frost-free period is about 80 to 90 days. The natural vegetation is threadleaf sedge, shoestring, cheatgrass, and a sparse cover of silver sagebrush. Soils of the Calpine series, clayey variant, are associated with Beckwourth and Loyalton soils.

In a representative profile the surface layer is dark-gray or dark-brown, medium acid coarse sandy loam about 11 inches thick. The subsoil is yellowish-brown and pale-brown, mottled, slightly acid coarse sandy loam and heavy coarse sandy loam about 15 inches thick. The substratum is light-gray and light brownish-gray, slightly acid and neutral clay and silty clay. It is underlain at a depth of about 45 inches by weakly silica-cemented, loamy sediment that extends to a depth of more than 60 inches. A water table is generally below a depth of 60 inches.

Permeability is very slow in these soils. The available water capacity is 2.5 to 3.5 inches in the 22 to 28 inches of effective rooting depth.

Calpine clayey variant soils are used mostly for range or pasture.

Representative profile of Calpine coarse sandy loam, clayey variant, in an area used for range pasture (about 100 yards east of the center of sec. 25, T. 23 N., R. 41 E.; 200 yards south of State Highway 70 across from the Plumas County Airport, 100 yards east of a north-south fence) :

A11—0 to 5 inches, dark-gray (10YR 4/1) coarse sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, platy structure; soft, friable, nonsticky and nonplastic; many very fine and fine roots and common medium roots; many very fine and fine interstitial pores and common medium interstitial pores; medium acid; clear, smooth boundary.

A12—5 to 11 inches, dark-brown (10YR 3/3) coarse sandy loam, very dark brown (10YR 2/2) when moist; massive; slightly hard, friable, slightly sticky and nonplastic; common very fine and medium roots; common very fine and medium tubular and interstitial pores; medium acid; abrupt, wavy boundary.

B1—11 to 21 inches, yellowish-brown (10YR 5/4) coarse sandy loam; common, fine, distinct, dark grayish-brown (10YR 4/2) mottles, brown (10YR 4/3) with dark-brown (10YR 3/3) mottles when moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular and interstitial pores and common medium tubular and interstitial pores; few thin clay films in pores and bridging sand grains; slightly acid; gradual, wavy boundary.

B2—21 to 26 inches, pale-brown (10YR 6/3) heavy coarse sandy loam; common, fine, distinct, brown (7.5YR 5/4) mottles, brown (10YR 4/3) with common, fine, distinct, strong-brown (7.5YR 5/6) stains when moist; common manganese stains on sand grains; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine pores and few medium pores; common moderately thick clay films in pores and bridging sand grains; slightly acid; abrupt, wavy boundary.

IIA2b—26 to 26½ inches, light-grav (10YR 7/1) fine sandy loam, grayish brown (10YR 5/2) when moist; too thin to determine structure, consistence, and content of pores and roots; slightly acid; abrupt, irregular boundary. This horizon tongues into the horizon below.

IIB2tb—26½ to 36 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) when moist; strong, medium and coarse, columnar structure; extremely hard, very firm, sticky and very plastic; few fine and medium exped roots; common fine tubular pores; continuous, moderately thick clay films in tubular pores and on faces of peds; slightly acid; gradual, smooth boundary.

IIB3tb—36 to 45 inches, light-gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) when moist; moderate, medium and coarse, angular blocky structure; extremely hard, very firm, sticky and plastic; few fine exped roots; common very fine and fine tubular pores; continuous thin clay films in pores and on faces of peds; neutral; clear, smooth boundary.

IIC—45 to 60 inches, weakly silica-cemented loamy sediment; no roots; no pores; neutral.

Depth of clay ranges from 22 to 28 inches. The A horizon ranges from very dark brown to dark gray. Texture ranges from loamy sand to coarse sandy loam. Reaction in the A horizon is medium acid to slightly acid. The B horizon is mottled, pale-brown or brown to yellowish-brown coarse sandy loam to heavy sandy loam. Reaction in the B horizon is slightly acid or medium acid. A buried IIA2b horizon is present in places. The IIB2tb horizon is light-gray, light brownish-gray or dark-gray clay or silty clay. It is very hard to extremely hard when dry and is restrictive to roots and water. Structure is generally columnar or prismatic in this horizon. Reaction is slightly acid to neutral. The underlying material is generally dense, impermeable sediment that is weakly cemented with silica.

Calpine coarse sandy loam, clayey variant, 0 to 2 percent slopes (CmA).—This nearly level soil is on low terraces on the valley floor. It is the only Calpine, clayey variant, soil in the Sierra Valley Area. Runoff is very slow, and the hazard of erosion is none to slight.

Included with this soil in mapping are areas of clay spots or areas where the coarse sandy loam surface layer is less than 10 inches thick, particularly in low spots. Also included are soils that have a subsoil of calcareous coarse sandy loam that is similar to the one in Beckwourth soils.

This soil is used for range pasture. The natural vegetation is mainly cheatgrass, dryland sedge, and shoestring. Sagebrush is conspicuously absent in most places. Small areas are used for pasture, dryland hay, or small grains. Capability unit IVe–3.

Coolbrith Series

The Coolbrith series consists of somewhat poorly drained soils that are forming in alluvium from various sources. Slopes range from 0 to 5 percent. These soils are on low fans and bottoms, mainly in the Sierra Valley basin. Elevation ranges from 4,500 to 5,000 feet. Annual precipitation is 14 to 20 inches, and the average annual temperature is 48° to 50° F. The frost-free period is about 80 to 90 days. The dominant natural vegetation is silver sagebrush, perennial and annual grasses, sedges, and forbs. Coolbrith soils are associated with Bidwell and James Canyon soils.

In a representative profile (fig. 8) the surface layer is dark-gray, medium acid and slightly acid silt loam about 10 inches thick. The subsoil is dark grayish-brown and dark-brown, slightly acid clay loam, heavy sandy clay loam, and gravelly sandy clay loam about 33 inches thick. The substratum is light olive-brown, slightly acid coarse gravelly sand. It extends to a depth of more than 60 inches.

Permeability is moderately slow. In most places the effective rooting depth is more than 60 inches, although the sand and gravel substratum limit rooting somewhat in places. The available water capacity is 7 to 9 inches. The water table is below a depth of 6 feet in most places.

These soils are used for hay, grain, pasture, and seed crops. A large acreage is used for range or native pasture.

Representative profile of Coolbrith silt loam in an area of smooth brome and alfalfa on a nearly level alluvial fan (1,320 feet east and 990 feet south of the center of sec. 9, T. 21 N., R. 15 E.; 3 miles west of Loyalton):

Ap1—0 to 4 inches, dark-gray (10YR 4/1) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, very thick, platy structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine vesicular pores; medium acid; abrupt, smooth boundary.

Ap2—4 to 10 inches, dark-gray (10YR 4/1) silt loam, very dark grayish brown (10YR 3/2) when moist; strong, fine, angular blocky structure; slightly hard, friable, sticky and slightly plastic; many very fine and fine roots and common medium roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, slightly wavy boundary.

B21t—10 to 17 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; strong, fine and medium, angular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots and common medium roots; common very fine and fine tubular and interstitial pores; common thin clay films in pores and bridging mineral grains; slightly acid; clear, slightly wavy boundary.

B22t—17 to 26 inches, dark-brown (10YR 4/3) heavy sandy clay loam, dark brown (10YR 3/3) when moist;

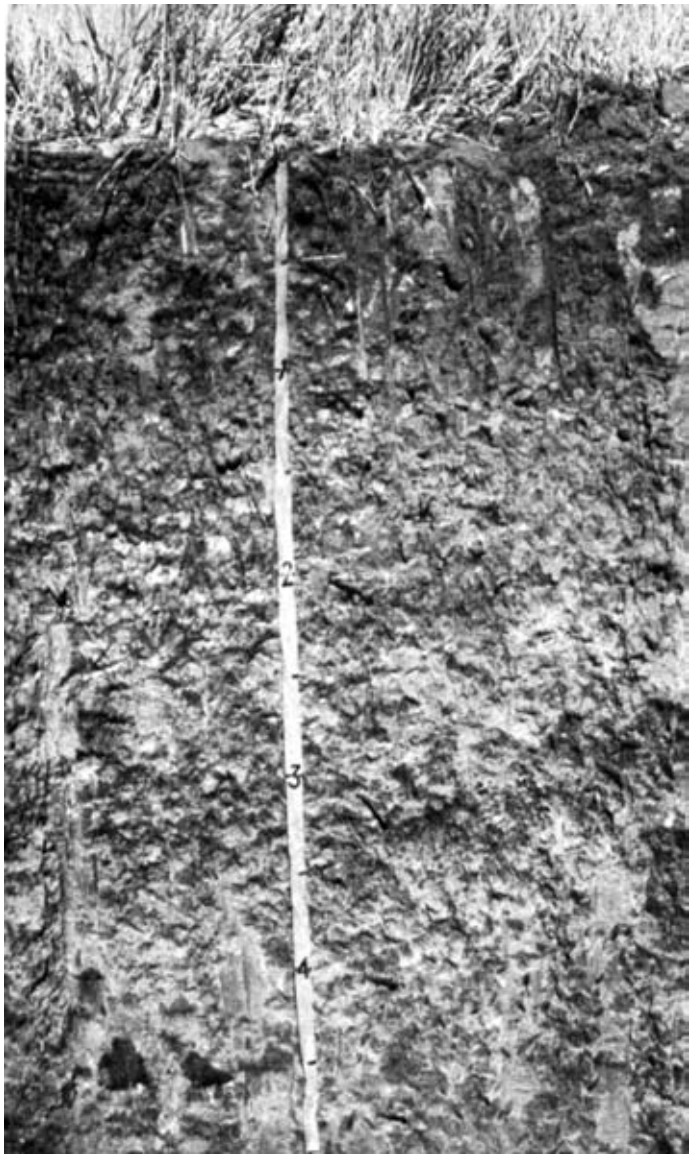

Figure 8.—**Profile of a Coolbrith silt loam.**

moderate, medium, prismatic structure that parts to strong, medium, angular blocky; hard, firm, sticky and plastic; common very fine and medium roots; many very fine and fine tubular pores; many thin clay films in pores and on faces of peds; slightly acid; gradual, slightly wavy boundary.

B31—26 to 35 inches, dark grayish-brown (10YR 4/2) gravelly sandy clay loam, dark brown (10YR 4/3) when moist; few, fine, distinct mottles of dark yellowish brown (10YR 4/4) when moist; massive; very hard, very firm, sticky and slightly plastic; few fine and medium roots; many fine interstitial pores and common very fine tubular pores; many thin clay films in pores and bridging mineral grains; slightly acid; gradual, slightly wavy boundary.

B32—35 to 43 inches, dark grayish-brown (10YR 4/2) gravelly sandy clay loam, dark brown (10YR 4/3) when moist; few, fine, distinct mottles of dark yellowish-brown (10YR 4/4) when moist; very hard, firm, slightly sticky and nonplastic; common fine and medium roots; many fine interstitial pores and common very fine tubular pores; common thin clay films in pores and as bridges; slightly acid; clear, smooth boundary.

IIC—43 to 68 inches, light olive-brown (2.5Y 5/4) coarse gravelly sand, dark grayish-brown (2.5Y 4/2) when moist; common, medium, distinct mottles of light olive brown (2.5Y 5/6) when moist; massive; hard, firm, nonsticky and nonplastic; few fine roots; very few fine pores; slightly acid.

The A horizon ranges from loam to silty clay loam. The Bt horizon ranges from clay loam to sandy clay loam, and it is gravelly in places; its structure is generally blocky or prismatic. Mottles occur in the lower part of it and in the stratified gravelly and sandy IIC horizon. Depth to the sandy IIC horizon ranges from 36 to 48 inches. In the IIC horizon reaction is slightly acid to neutral.

Coolbrith silt loam, 0 to 2 percent slopes (CnA).—This nearly level soil is on alluvial fans. It has the profile described as representative for the Coolbrith series. Included in mapping are small areas of Bidwell and Dotta soils. Runoff is very slow, and the hazard of erosion is none to slight.

This soil is commonly used for barley and oats, hay, improved pasture, alfalfa, and cereal rye. Wheatgrass is also grown for seed. Few areas are irrigated. Some areas are used for native pasture or range. Capability unit IIIc–1.

Coolbrith silt loam, 2 to 5 percent slopes (CnB).—This gently sloping soil is on alluvial fans. It is similar to the soil that has the profile described as representative for the Coolbrith series, but this soil has steeper slopes. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are areas of Bidwell and Dotta soils. Also included are areas of a soil that is similar to this soil except for a slightly higher content of clay in the subsoil.

This soil is used for range pasture, grains, improved pasture, and some alfalfa. Capability unit IIIe–1.

Correco Series

This Correco series consists of well-drained soils that formed in alluvium from various sources. These soils are on terraces near the rim of Sierra Valley. Slopes range from 2 to 30 percent. Elevation ranges from 4,500 to 5,200 feet. Annual precipitation is 10 to 20 inches, and the average annual temperature is 48° to 50° F. The frost-free period is about 80 to 90 days. The natural vegetation is big sagebrush, bitterbrush, annual grasses, and forbs. Correco soils are associated mainly with Bieber and Dotta soils.

In a representative profile the surface layer is dark-brown, medium acid and slightly acid sandy loam about 11 inches thick. The upper part of the subsoil is dark grayish-brown, slightly acid heavy sandy loam about 4 inches thick. This material grades abruptly to brown, slightly acid clay about 24 inches thick. The lower part of the subsoil, to a depth of 60 inches, is pale-brown and very pale brown, slightly acid and medium acid sandy clay loam. Below a depth of 60 inches is very pale brown, slightly acid loam that contains thin, silica-cemented lenses.

Permeability is slow. Available water capacity is 7 to 10 inches. The effective rooting depth for most plants is more than 60 inches, but some plant roots are restricted by the clay subsoil.

These soils are used for range pasture. A small acreage has been cleared of sagebrush and planted to grass or grass-alfalfa mixtures.

Representative profile of Correco sandy loam in an area facing northwest where slope is 3 percent; on an old terrace under sagebrush, bitterbrush, and grass (800 feet east of the center of sec. 29, T. 22 N., R. 16 E.; 0.25 mile east of State Highway 49) :

A11—0 to 2 inches, dark-brown (10YR 3/3) sandy loam, very dark brown (10YR 2/2) when moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; medium acid; clear, smooth boundary.

A12—2 to 11 inches, dark-brown (10YR 3/3) sandy loam, very dark brown (10YR 2/2) when moist; weak, thick, platy structure and weak, very fine, granular; soft, very friable, nonsticky and nonplastic; many very fine roots and common fine, medium, and coarse roots; many fine tubular and interstitial pores and few medium and coarse tubular pores; slightly acid; clear, smooth boundary.

B1—11 to 15 inches, dark grayish-brown (10YR 4/2) heavy sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and nonplastic; many very fine roots and common fine, medium, and coarse roots; common very fine tubular pores; common thin clay films in pores; slightly acid; abrupt, smooth boundary.

B21t—15 to 28 inches, brown (10YR 5/3) clay, dark yellowish brown (10YR 3/4) when moist; strong, coarse, prismatic structure; extremely hard, very firm, sticky and very plastic; common fine roots and few very fine, medium, and coarse roots; few very fine tubular pores; continuous, moderately thick clay films on faces of peds; slightly acid; gradual, smooth boundary.

B22t—28 to 39 inches, brown (10YR 5/3) clay, dark yellowish brown (10YR 3/4) when moist; moderate, coarse, prismatic structure; extremely hard, very firm, sticky and very plastic; common fine roots and few very fine, medium, and coarse roots; few very fine tubular pores; continuous moderately thick clay films on faces of peds; slightly acid; gradual, smooth boundary.

B31—39 to 51 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) when moist; weak, coarse, prismatic structure; extremely hard, very firm, sticky and plastic; few very fine and fine roots; common very fine tubular pores; common moderately thick clay films in pores and on faces of peds; slightly acid; clear, smooth boundary.

B32—51 to 60 inches, very pale brown (10YR 7/4) sandy clay loam, brown (10YR 4/3) when moist; massive; very hard, very firm, sticky and plastic; very few very fine roots; common very fine tubular pores; common moderately thick clay films in pores; medium acid; abrupt, smooth boundary.

C—60 to 69 inches, very pale brown (10YR 7/3) loam, dark yellowish brown (10YR 4/4) when moist; massive; slightly acid. This horizon contains thin bands of silica-cemented lenses. (Consistence, roots, pores, clay films, and boundary for this horizon could not be determined because sampling was done by auger and sample was disturbed).

Color of the A horizon ranges from brown or grayish brown to dark brown or dark grayish brown. Texture is sandy loam, but this horizon is cobbly or very cobbly in places. The B2t horizon is brown to light yellowish brown. A few pebbles are present throughout some profiles.

Correco sandy loam, 2 to 5 percent slopes (CoB).—This soil is on terraces. It has the profile described as representative for the Correco series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are areas where a gravel pavement of andesitic rock fragments is on the surface. Also included are areas where bedded, waterworn gravel and sand are below a depth of 40 inches.

This soil is used mainly for range. A small acreage is planted to grain hay, cereal grains, and improved pasture. Capability unit IIIe–3.

Correco sandy loam, 5 to 15 percent slopes (CoD).—This moderately sloping to strongly sloping soil is on higher terraces. It is similar to the soil that has the profile described as representative for the Correco series, but this soil has steeper slopes. Included in mapping are areas where the surface is cobbly and areas of Bieber and Dotta soils. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for range. Some areas are used for hay, grains, or pasture. Capability unit IVe–3.

Correco very cobbly sandy loam, 2 to 30 percent slopes (CpE).—This gently sloping to moderately steep soil is on secondary terraces. It is similar to the soil that has the profile described as representative for the Correco series, but this soil has steeper slopes. Cobbles make up 30 to 50 percent, by volume, of the material in the soil profile. Runoff is slow to rapid, and the hazard of erosion is slight to high.

Included with this soil in mapping are small areas of a soil that is similar to this one but has a clay loam subsoil. Also included are areas where this same included soil has a surface layer only a few inches thick and areas of Martineck soils.

This soil is used for range. Capability unit VIs–1; range site 1.

Delleker Series

The Delleker series consists of well-drained soils that are underlain by volcanic tuffaceous sediment at a depth of 40 to 60 inches or more. These soils are on mountainous uplands, mainly in the northwest corner of the Area, that extend southward from the village of Beckwourth to the Calpine resort area. Slopes range from 2 to 30 percent. Elevation ranges from 4,800 to 5,800 feet. Annual precipitation is 14 to 24 inches, and the average annual temperature is 45° to 47° F. The frost-free period is about 50 to 60 days. The natural vegetation is Jeffrey pine, ponderosa pine, white fir, and cedar; some black oak and manzanita; and associated brush, grass, and forbs. Big sagebrush bitterbrush predominate in open areas near the valley floor. Delleker soils are associated mainly with Portola soils.

In a representative profile 3 inches of pine needles and leaves cover the surface. The surface layer is brown, slightly acid and cobbly sandy loam and pale-brown, slightly acid to medium acid loam about 13 inches thick. The subsoil is pale-brown and light yellowish-brown, medium acid sandy clay loam and clay loam. It extends to a depth of more than 60 inches.

Permeability is moderate. The effective rooting depth is 40 to 60 inches or more.

These soils are used mainly for producing timber. The trees are young, and most of the old growth has been harvested.

Representative profile of Delleker cobbly sandy loam in an area facing south where slope is 10 percent; on an upland in an area of Jeffrey pine, ponderosa pine, and perennial and annual grasses (1,260 feet east of the west quarter corner of sec. 21, T. 23 N., R. 14 E.; 3 miles northeast of Portola on Grizzly Road) :

O1 and O2—3 to 0 inches, organic mat of pine needles, decomposing with depth; abrupt, smooth boundary.

A1—0 to 3 inches, brown (10YR 5/3) cobbly sandy loam, dark brown (10YR 3/3) when moist; strong, fine, granular structure; soft, friable, nonsticky and nonplastic; common fine and medium roots; many very fine, fine, and medium interstitial pores; slightly acid; clear, slightly wavy boundary.

A3—3 to 13 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; moderate, medium and fine, angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many very fine and fine tubular pores; medium acid; gradual, smooth boundary.

B1t—13 to 26 inches, pale-brown (10YR 6/3) sandy clay loam, brown (7.5YR 4/4) when moist; moderate, medium and fine, angular blocky structure; very hard, firm, slightly sticky and slightly plastic; common fine and medium roots; many very fine and fine tubular and interstitial pores; common thin clay films in pores; medium acid; gradual, wavy boundary.

B2t—26 to 46 inches, light yellowish-brown (10YR 6/4) clay loam, dark yellowish-brown (10YR 4/4) with dark yellowish-brown (10YR 3/4) coatings on faces of peds when moist; moderate, medium and fine, angular blocky structure; very hard, firm, sticky and plastic; few fine and medium roots; many very fine and fine tubular pores; many thin clay films in pores and on faces of peds; medium acid; gradual, wavy boundary.

B3t—46 to 60 inches, light yellowish-brown (10YR 6/4) sandy clay loam, dark yellowish-brown (10YR 4/4) when moist; moderate, medium and fine, angular blocky structure; very hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular pores; many thin clay films in pores and on faces of peds; medium acid.

The A horizon ranges from light sandy loam to cobbly loam. The Bt horizon ranges from cobbly sandy clay loam to clay loam. It is massive in some areas, but in most areas it has weak to moderate, blocky structure. The B horizon rests abruptly on hard, firm, pale tuffaceous sediment, which is at a depth of 40 to 60 or more inches. This material is variably consolidated, but in places it is very hard in areas where there are outcroppings of low rock or conglomerate.

The cobble and stone content in these soils ranges from 0 to 25 percent of the soil volume. The gravel content ranges from 0 to 15 percent by volume.

Delleker sandy loam, 2 to 15 percent slopes, eroded (DdD2).—This gently sloping to strongly sloping soil is on terraces near the valley floor. It is similar to the soil that has the profile described as representative for the Delleker series, but this soil lacks cobbles and stones throughout the profile. The available water capacity is 6 to 9 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. As a result of past erosion, as much as 25 percent of the surface layer has been removed, and rills and gullies are present in some areas.

Included with this soil in mapping are some wet Delleker-like soils that have a silica-cemented indurated hardpan at a depth of more than 40 inches. Portola soils are included in some areas.

Areas of this soil that have fair stands of Jeffrey and ponderosa pine are cut for timber. Areas that have open sagebrush and grass are grazed by livestock. Cleared areas are used for hay, grains, or pasture. Capability unit IVe–1; woodland suitability group 1.

Delleker cobbly sandy loam, 2 to 30 percent slopes (DeE).—This gently sloping to moderately steep soil is on terraces around the valley rim. It has the profile described as representative for the Delleker series. The material is 10 to 40 percent gravel, cobbles, and stones throughout the profile. The available water capacity is 4 to 7 inches. Runoff is slow to rapid, and the hazard of erosion is slight to high.

Included with this soil in mapping are some areas of Rock land that were too small to be mapped separately. Small scattered areas of soil that has a subsoil of reddish-brown sandy loam are also included.

This soil is used almost exclusively for growing trees, but a small acreage north of Beckwourth is planted to dryland pasture. Capability unit VIe–1; woodland suitability group 1.

Dotta Series

The Dotta series consists of well-drained soils that are forming in predominantly basic alluvium. Slopes are 0 to 30 percent. These soils are on lake terraces around the rim of the Sierra Valley basin, on fans and foot slopes, and in the hilly landscape that rises from the valley floor to the surrounding volcanic uplands. Elevation ranges from 4,800 to 5,200 feet. Annual precipitation is about 8 to 18 inches, and the average annual temperature is about 48° to 49° F. The frost-free period is about 80 to 90 days. The natural vegetation is mostly sagebrush and grass and a few scattered pine. A few areas have scattered thickets of juniper. Dotta soils are associated mainly with Badenbaugh, Bidwell, and Lovejoy soils.

In a representative profile (fig. 9) the surface layer is gray, slightly acid sandy loam about 13 inches thick. The upper part of the subsoil is gray, medium acid heavy loam 8 inches thick. The lower part is grayish-brown, medium acid and slightly acid sandy clay loam and heavy sandy clay loam 20 inches thick. The substratum is light brownish-gray, slightly acid sandy loam and pale-brown neutral coarse sandy loam. It extends to a depth of more than 60 inches.

Permeability is moderately slow in the more than 60 inches of effective rooting depth.

These soils are used mainly for sagebrush pasture. Some areas are cropped to wheatgrass, alfalfa-grass mixtures, or grains (fig. 10).

Representative profile of Dotta sandy loam in an area facing west where slope is 3 percent; on an alluvial fan under sagebrush and grass (750 feet south and

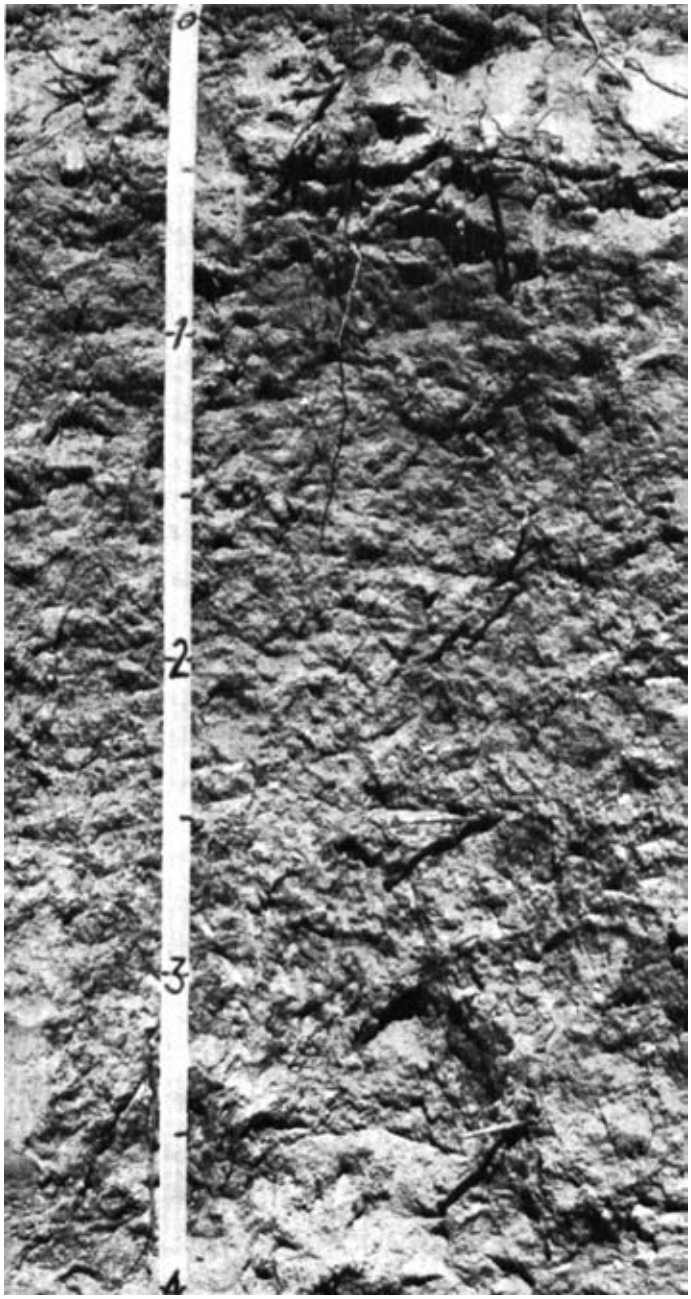

Figure 9.—**Profile of a Dotta sandy loam.**

750 feet west of the northeast corner of sec. 29, T. 22 N., R. 16 E.; 0.375 mile east of State Highway 49 and 4.5 miles northeast of Loyalton) :

A11—0 to 6 inches, gray (10YR 5/1) sandy loam, very dark brown (10YR 2/2) when moist; moderate, medium and thick, platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

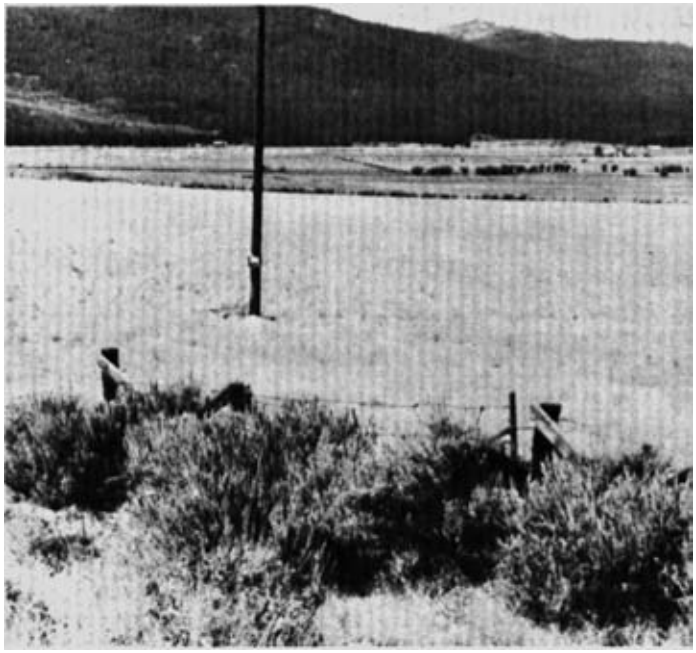

Figure 10.—**Wheatgrass on Dotta sandy loam. In foreground is sagebrush and grass pasture.**

A12—6 to 13 inches, gray (10YR 5/1) sandy loam, very dark brown (10YR 2/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; slightly acid; gradual, smooth boundary.

B1t—13 to 21 inches, gray (10YR 5/1) heavy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, subangular blocky structure; hard, friable, sticky and slightly plastic; many very fine and fine roots and common medium roots; many very fine and fine tubular and interstitial pores and common medium tubular and interstitial pores; common thin clay films in pores and on faces of peds; medium acid; gradual, smooth boundary.

B21t—21 to 30 inches, grayish-brown (10YR 5/2) sandy clay loam, dark brown (10YR 3/3) when moist; moderate, fine and medium, subangular blocky structure; hard, slightly firm, sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular and interstitial pores; many thin clay films in pores and on faces of peds; medium acid; clear, slightly wavy boundary.

B22t—30 to 41 inches, grayish-brown (2.5Y 5/2) heavy sandy clay loam, very dark grayish brown (2.5Y 3/2) when moist; weak, medium, prismatic structure that parts to strong, fine and medium, angular blocky; very hard, firm, sticky and plastic; common very fine and fine roots, mostly exped; many very fine and fine tubular and interstitial pores; many thin clay films in pores and on faces of peds; slightly acid; clear, smooth boundary.

C1—41 to 59 inches, light brownish-gray (10YR 6/2) sandy loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, abrupt boundary.

C2—59 to 68 inches, pale-brown (10YR 6/3) coarse sandy loam, dark brown (10YR 3/3) when moist; mas-

sive; hard, slightly firm, nonsticky and nonplastic; few very fine and fine roots; common very fine and fine tubular and interstitial pores; neutral.

The A horizon is gray to dark grayish brown sandy loam or loam. It is gravelly or cobbly in places. The B2t horizon is sandy clay loam or clay loam. The C horizon ranges from sandy loam to coarse sand and contains some gravel and silt lenses. Mottles are present in places in this horizon. These soils, particularly in areas on the west side of the valley, have detectable ash and volcanic glass aggregates throughout their profile.

Dotta sandy loam, 0 to 2 percent slopes (DfA).—This nearly level soil is on the foot slopes where terraces and alluvial fans merge with the valley floor. It is similar to the soil that has the profile described as representative for the Dotta series, but this soil is less sloping. This Dotta soil contains essentially no gravel or cobbles throughout its profile. Included in mapping are areas where a gravelly sand substratum is below a depth of 40 inches. Also included are areas of Badenaugh, Bidwell, and Lovejoy soils.

The available water capacity is 8 to 10 inches. Runoff is very slow, and the hazard of erosion is none to slight.

This soil is used for dryland small grains, improved grass-legume pasture, alfalfa, and wheatgrass. Capability unit IIIc-1.

Dotta sandy loam, 2 to 9 percent slopes (DfC).—This gently sloping to moderately sloping soil is on alluvial fans and terraces surrounding Sierra Valley. It has the profile described as representative for the Dotta series. Gravel makes up less than 10 percent, by volume, of the material in the profile. Included in mapping are areas where the substratum is sand and gravel. Also included are areas of Badenaugh, Bidwell, and Lovejoy soils.

The available water capacity is 8 to 10 inches. Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for range. It is also used for dryland small grains, improved pasture, and wheatgrass. Capability unit IIIe–1.

Dotta gravelly sandy loam, 9 to 30 percent slopes (DgE).—This strongly sloping to moderately steep soil is on the upper fans and terraces that adjoin the residual soils of the uplands.

Included with this soil in mapping are small areas where the soil is underlain by andesitic tuff and breccia at a depth of 36 to 48 inches. Also included are areas of Badenaugh soils.

The surface layer is 10 to 35 percent gravel, by volume, but the profile is otherwise similar to the one described as representative for the Dotta series. Also, cobbles and stones make up as much as 10 percent of the material throughout the profile.

The available water capacity is 7 to 10 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used mainly for range pasture. Capability unit VIe–1; range site 1.

Dotta cobbly sandy loam, 2 to 30 percent slopes (DhE).—This gently sloping to moderately steep soil is on terraces and fans. Included in mapping are areas of soils that are underlain at a depth of 40 to 50 inches by moderately silica- and iron-cemented gravelly or cobbly sediment that resembles gravelly sandstone or a cobbly conglomerate.

The material in this soil is 5 to 25 percent cobbles and 5 to 10 percent gravel, by volume, throughout the profile. The profile, however, is otherwise similar to the one described as representative for the Dotta series.

The available water capacity is 6 to 8 inches. Runoff is slow to rapid, and the hazard of erosion is slight to high.

This soil is used for range. Capability unit VIe–1; range site 1.

Dotta-Lovejoy complex, 0 to 9 percent slopes (DmC).—These nearly level to moderately sloping soils on terraces are so intermingled that it was not feasible to map them separately. Each soil makes up about 45 percent of this complex. The remaining 10 percent is areas of Badenaugh and Ramelli soils.

Both soils have profiles similar to the ones described as representative for their respective series. The Dotta soil in this complex lacks any significant amount of gravel or cobbles in the profile. It has an available water capacity of 8 to 10 inches. Runoff is slow to medium on soils in this complex, and the hazard of erosion is slight to moderate.

The soils in this complex are used almost exclusively for range. Capability unit IVe–3; Dotta soil in range site 1, Lovejoy soil in range site 5.

Galeppi Series

The Galeppi series consists of well-drained soils that formed in granitic alluvium. This material is interbedded with ash and stony detritus sediment laid down as lake terraces, mainly in Long Valley. A small acreage is also in the northeastern corner of Sierra Valley. Small hummocks or dunes are present in places, but the landscape is mostly smooth except where it is cut by drainageways and ravines. Slopes range from 5 to 30 percent. Elevation ranges from 4,500 to 5,500 feet. Annual rainfall is about 6 to 12 inches, and the average annual temperature is 48° to 50° F. The frost-free period is about 60 to 90 days. The natural vegetation is dominantly big sagebrush and cheatgrass and some bitterbrush, rabbitbrush, and desert peach. Junipers are present in places in Long Valley. Galeppi soils are in the same general area as Reba, Reno, and Saralegui soils.

In a representative profile the surface layer is dark grayish-brown and grayish-brown, slightly acid or neutral loamy coarse sand and sandy loam 9 inches thick. The subsoil is 27 inches thick. It is brown and dark yellowish-brown sandy clay loam that is neutral in reaction. The substratum is light yellowish-brown, mildly alkaline sandy loam and pale-brown neutral loamy sand. These soils are micaceous throughout their profile.

Permeability is moderately slow in the effective rooting depth of more than 60 inches.

These soils are used mainly for range.

Representative profile of Galeppi loamy coarse sand in an area facing northwest where slope is 4 percent; on a terrace under sagebrush, forbs, and perennial and

annual grasses at an elevation of 5,130 feet (100 feet east of the northwest corner of sec. 1, T. 22 N., R. 17 E.; 1 mile north of Hallelujah Junction and 0.25 mile east of U.S. Highway 395) :

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) loamy coarse sand, very dark grayish brown (10YR 3/2) when moist; weak, very thick, platy structure that parts to strong, medium and coarse, granular; soft, very friable, nonsticky and nonplastic; many very fine roots, common fine roots, and very few medium roots; many very fine and fine interstitial pores; slightly acid; abrupt, wavy boundary.

A3—4 to 9 inches, grayish-brown (10YR 5/2) sandy loam, dark brown (10YR 3/3) when moist; medium, coarse and very coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots, few fine roots, and very few medium roots; common very fine pores; neutral; clear, wavy boundary.

B2t—9 to 20 inches, brown (10YR 4/3) sandy clay loam, dark yellowish brown (10YR 3/4) when moist; moderate, medium, prismatic structure; hard, firm, sticky and plastic; common very fine roots and very few fine roots; common very fine and fine tubular and interstitial pores; many moderately thick clay films on faces of peds and in pores; neutral; gradual, wavy boundary.

B3t—20 to 36 inches, dark yellowish-brown (10YR 4/4) light sandy clay loam, dark brown (10YR 4/3) when moist; weak, medium, prismatic structure; hard, firm, sticky and slightly plastic; few very fine roots; common very fine tubular and interstitial pores; many moderately thick clay films on faces of peds and in pores; neutral; gradual, wavy boundary.

C1—36 to 52 inches, light yellowish-brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) when moist; weak, coarse and very coarse, angular blocky structure; hard, very firm, slightly sticky and slightly plastic; very few very fine roots; common very fine tubular and interstitial pores; common thin clay films as bridges and as colloidal stains on sand grains; mildly alkaline; clear, wavy boundary.

C2—52 to 60 inches, pale-brown (10YR 6/3) loamy sand, dark yellowish brown (10YR 4/4) when moist; massive; hard, very firm, nonsticky and nonplastic; common very fine and fine tubular and interstitial pores; neutral.

The A1 horizon is grayish-brown or dark grayish-brown loamy coarse sand to coarse sandy loam. It is cobbly in places. The B2t horizon ranges from sandy clay loam to clay loam and is also cobbly in places. Cobbles make up essentially none to about 40 percent of the soil volume.

Galeppi loamy coarse sand, 2 to 5 percent slopes (GaB).—This gently sloping soil is in concave swales, on low fans, and on stream terraces. It has the profile described as representative for the Galeppi series. The available water capacity is 7.5 to 9 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

Included with this soil in mapping are areas of seeps and springs along terrace breaks or areas where the substratum is weakly cemented by lime. On flat areas north of Highway 70 along Long Valley Creek, the subsoil is sandy clay that restricts permeability and growth of plant roots. These areas are mostly near the valley trough.

This soil is used for irrigated truck crops, dryland small grains (in areas of seeps), and for range. Capability unit IVe–1.

Galeppi loamy coarse sand, 5 to 30 percent slopes (GaE).—This moderately sloping to moderately steep soil is on rolling to hilly terraces. It is similar to the soil that has the profile described as representative for the Galeppi series, but this soil is steeper. Included in mapping are some areas in Sierra Valley of soils that have a reddish-brown clay subsoil but are otherwise similar to this soil.

The available water capacity is 7.5 to 9 inches. Runoff is slow to rapid, and the hazard of water erosion is slight to high. The hazard of wind erosion is moderate.

This soil is used for range. Capability unit VIe–1; range site 2.

Galeppi cobbly loamy coarse sand, 5 to 30 percent slopes (GdE).—This moderately sloping to moderately steep soil is mainly on terraces that face to the east. It is similar to the soil that has the profile described as representative for the Galeppi series, but this soil has steeper slopes. Also, the material is 20 to 40 percent cobbles, by volume, throughout the profile. Included in mapping are small areas of Reba, Reno, and Saralegui soils. Runoff is slow to rapid, and the hazard of water erosion is slow to high. The hazard of wind erosion is moderate. The available water capacity is 6 to 8 inches.

This soil is used for range. It is one of the favored habitats for chukar. The birds apparently take advantage of the clumps of juniper that dot the landscape, using them for cover. Capability unit VIe–1; range site 2.

Glean Series

The Glean series consists of extremely stony, well-drained soils that are forming in stony debris gravitating from the steep mountainous uplands. The parent material is colluvium derived from such mixed metamorphic rocks as quartzite, slate, and metamorphosed andesite and rhyolite. These soils are on the steep sides and strongly sloping bases of the west side of Long Valley, south of Beckwourth Pass. Slopes range from 9 to 50 percent. Elevation ranges from 4,500 to 6,000 feet. Annual precipitation is about 8 to 16 inches, and the average annual temperature is 45° to 47° F. The frost-free period is about 30 to 45 days. The natural vegetation is dominantly thick stands of big sagebrush and an understory of cheatgrass. Bitterbrush, rabbitbrush, Mormon tea, and miscellaneous grasses and forbs also grow in places. A few stands of Jeffrey pine are in the highlands. Glean soils are associated with Aldax and Trosi soils and areas of Rock land.

In a representative profile the surface layer is 17 inches of dark grayish-brown, extremely stony, gravelly, cobbly, and very gravelly sandy loam. This material gradually grades to very cobbly or very gravelly sandy loam that is grayish brown and slightly acid and extends to a depth of 51 inches. Below this is andesite bedrock. The stone-sized and smaller rock fragments are mostly angular pieces of metamorphosed andesite, but a few are rhyolite and quartzite.

Permeability is moderately rapid in these soils. Available water capacity is 3 to 5 inches in the 40 to more than 60 inches of effective rooting depth.

These soils are used for range. The few areas of steep soil have low grazing value. The soils provide some food and cover for deer, rabbits, and other wildlife.

Representative profile of Glean extremely stony sandy loam in an area facing north where slope is 50 percent; under sagebrush, bitterbrush, forbs, and perennial grasses at an elevation of 5,600 feet (1,430 feet south and 660 feet west of the center of sec. 29, T. 22 N., R. 17 E., 0.3 mile west of Coulee Canyon Road and 4.5 miles southwest of Hallelujah Junction) :

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) extremely stony light sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and common medium and coarse roots; many very fine interstitial pores; slightly acid; clear, slightly wavy boundary.

A12—3 to 6 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and common medium and coarse roots; many very fine interstitial pores; slightly acid; clear, slightly wavy boundary.

A13—6 to 17 inches, dark grayish-brown (10YR 4/2) very gravelly and cobbly heavy sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine, medium, and coarse roots; many very fine interstitial pores; slightly acid; clear, wavy boundary.

AC—17 to 29 inches, grayish-brown (10YR 5/2) very gravelly and cobbly heavy sandy loam, dark brown (10YR 3/3) when moist; weak, medium and coarse, granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine, medium, and coarse roots; common very fine tubular and interstitial pores; few thin colloid stains on mineral grains; slightly acid; gradual, wavy boundary.

C1—29 to 39 inches, grayish-brown (2.5Y 5/2) very gravelly and cobbly heavy sandy loam, olive brown (2.5Y 4/4) when moist; very coarse granular structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine and few medium and coarse roots; common very fine tubular and interstitial pores; very few thin colloid stains on sand grains and cobbles; slightly acid; gradual, wavy boundary.

C2—39 to 51 inches, grayish-brown (2.5Y 5/2) very cobbly and gravelly light sandy loam, olive brown (2.5Y 4/4) when moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine and fine and few medium and coarse roots; few very fine and fine tubular and interstitial pores; slightly acid.

R—51 to 54 inches, andesite that is fractured in places.

The A horizon ranges from gravelly sandy loam to extremely stony loamy coarse sand. Range in the C horizon is about the same, except that slightly more clay is mixed with many pebbles, cobbles, and stones. The content of stones generally increases with depth. Loose, angular rock fragments make up 40 to 70 percent, by volume, of the soil material. Depth to andesite bedrock is 40 to 70 inches.

Glean extremely stony sandy loam, 9 to 50 percent slopes (GpF).—This strongly sloping to steep soil is on side slopes and foot slopes. It has the profile described as representative for the series. Included in mapping are areas of Aldax and Trosi soils and areas of rock outcrops. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is of little value for farming because of steep slopes and stoniness. It is suitable for light grazing. Capability unit VIIs–1; range site 1.

Glenbrook Series

The Glenbrook series consists of somewhat excessively drained soils that are forming in place, at a depth of 6 to 20 inches, in material weathered from granitic rock. The parent material is mainly granite and granodiorite. Mapped areas include numerous granitic outcroppings. They are around the Beckwourth Pass and extend into Long Valley. The landscape varies from abruptly rising mountainous areas and rather rounded, rolling hills to gradational flats that merge with the valley bottoms. Slopes range from 5 to 50 percent. Elevation ranges from 4,000 to 6,500 feet. Annual precipitation is 6 to 14 inches, and the average annual temperature is about 48° to 50° F. The frost-free period is about 30 to 90 days. The natural vegetation is dominantly big sagebrush and cheatgrass and lesser populations of bitterbrush, desert peach, rabbitbrush, mule-ears, and various grasses and forbs. Glenbrook soils are in the same general areas as Galeppi and Reno soils.

In a representative profile 20 inches of dark grayish-brown and brown, slightly acid and neutral gravelly loamy coarse sand is underlain by decomposing granodiorite.

Permeability is rapid. The available water capacity is 0.5 to 1.5 inches. The effective rooting depth is 6 to 20 inches.

These soils are used for range, watershed, and wildlife habitat. At Beckwourth Pass the decomposed granitic substratum material is used by the State Division of Highways to build roads.

Representative profile of Glenbrook gravelly loamy coarse sand in an area facing south where slope is 10 percent; under big sagebrush and cheatgrass at an elevation of 5,230 feet (500 feet southwest of the northwest corner of sec. 6, T. 22 N., R. 17 E., 100 yards north of the rest stop at Beckwourth Pass on State Highway 70) :

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) and many very pale brown and mixed gravel colors, gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) when moist; single grained; loose, nonsticky and nonplastic; many very fine roots and few fine and coarse roots; many very fine and fine interstitial pores; about 15 percent fragments larger than 2 mm and 35 percent coarse or very coarse sand; slightly acid; clear, smooth boundary.

AC—4 to 20 inches, brown (10YR 5/3) and mixed gravel colors, gravelly loamy coarse sand, dark brown (10YR 3/3) when moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots and few fine and coarse roots; common very fine and fine interstitial and tubular pores; neutral; abrupt, very wavy boundary.

C—20 to 30 inches, light-gray and white decomposing granodiorite that can be dug with a spade; dark grains

of mica; neutral; weathering extends to a depth of 20 to 25 feet.

The A horizon is coarse sand or loamy coarse sand. This horizon is 10 to 20 percent gravel, by volume. The AC horizon is brown or dark brown. Depth to the granodiorite C horizon ranges from 6 to 20 inches.

Glenbrook-Rock outcrop complex, 5 to 50 percent slopes (GrF).—The Glenbrook part of this complex is a moderately sloping to steep soil on mountainous uplands. It is the only Glenbrook soil mapped in the Sierra Valley Area. Rock outcrops make up 10 to 40 percent of the surface area. They are more numerous on the steeper slopes (fig. 11). Runoff is slow to rapid, and the hazard of erosion is slight to high.

Included with this soil in mapping are areas near Long Valley that have been down-faulted and have a 6- to 10-inch overburden of sandy lake sediment. Also included are areas of Acidic rock land.

This soil is used for watershed and spring range, and it provides some food and cover for mule deer, chukar, rabbits, dove, quail, and sage hen. Several quartz mining claims have been staked in areas north of Hallelujah Junction and east of Long Valley Creek. Capability unit VIIs–1. Glenbrook part in range site 3.

Figure 11.—**Area of Glenbrook-Rock outcrop complex, 5 to 50 percent slopes. Acidic rock land is in the background.**

Haypress Series

The Haypress series consists of somewhat excessively drained soils that are forming in place in material weathered from granitic rock, mainly granite, granodiorite, or quartz diorite, at depths of 40 to more than 60 inches. These soils are on foot slopes and hills or on very steep mountainous saddles and side hills. Slopes range from 2 to 75 percent. Elevation ranges from 5,000 to 8,000 feet. Annual precipitation is 14 to 24 inches, and the average annual temperature is about 45° to 47° F. The frost-free period is about 30 to 65 days. The natural vegetation is open stands of Jeffrey and ponderosa pine and mixed forest species such as black oak, manzanita, serviceberry, ceanothus, and some annual and perennial grasses and forbs. Also, some lower foot slopes near the valley floor have scattered big sagebrush and bitterbrush. Haypress soils are associated with Toiyabe, Bonta, and Delleker soils.

In a representative profile in a wooded area, a thin litter of pine needles, leaves, and litter covers the surface. The mineral surface layer is grayish-brown, medium acid loamy coarse sand 14 inches thick. This layer is underlain by brown, medium acid loamy coarse sand about 14 inches thick. This material gradually grades to pale-brown, medium acid loamy sand. The loamy sand grades to weathered granite at a depth of 49 inches.

Permeability is rapid. The available water capacity is 3 to 5 inches. The effective rooting depth ranges from 40 to more than 60 inches.

These soils are used for producing timber. Open areas are used for grazing by livestock and wildlife.

Representative profile of Haypress loamy coarse sand in an area facing southwest where slope is 5 percent; on uplands under ponderosa and Jeffrey pine and annual and perennial grasses at an elevation of 5,000 feet (1,100 feet southwest of the east quarter corner of sec. 4, T. 21 N., R. 14 E.; 1,100 feet west of County Road A23 and 25 feet north of the dirt road to Folchi Meadows, 2.5 miles northeast of Calpine) :

O1 and O2—3 inches to 0, fresh and partly decomposed litter of pine needles, twigs, and leaves; abrupt, smooth boundary.

A11—0 to 4 inches, grayish-brown (10YR 5/2) loamy coarse sand, very dark gray (10YR 3/1) when moist; weak, thick, platy structure that parts to weak, fine, granular; soft, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; common very fine tubular and interstitial pores; medium acid; clear, smooth boundary.

A12—4 to 14 inches, grayish-brown (10YR 5/2) loamy coarse sand, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; common very fine tubular and interstitial pores and few medium tubular and interstitial pores; medium acid; clear, smooth boundary.

AC—14 to 28 inches, brown (10YR 5/3) loamy coarse sand, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft, friable, nonsticky and nonplastic; many medium and coarse roots; common very fine tubular and interstitial pores; medium acid; gradual, smooth boundary.

C1—28 to 49 inches, pale-brown (10YR 6/3) loamy coarse sand, brown (10YR 4/3) when moist; massive; soft, friable, nonsticky and nonplastic; many medium and coarse roots; common very fine tubular pores, few medium tubular pores, and common very fine interstitial pores; medium acid.

C2—49 to 67 inches, weathered granite that crushes to pale-brown (10YR 6/3) loamy coarse sand, brown (10YR 4/3) when moist; massive; hard, firm, nonsticky and nonplastic; few very fine interstitial pores and few medium tubular pores; medium acid.

Depth to granitic rock ranges from 40 to more than 60 inches. Texture ranges from loamy coarse sand to gravelly loamy coarse sand. The soil material is 5 to 25 percent gravel. These soils are micaceous throughout.

Haypress soils are intricately intermingled with the Toiyabe soils. The two soils occur on similar rock formations and are mapped as a complex.

Haypress-Toiyabe loamy coarse sands, 2 to 30 percent slopes (H†E).—These gently sloping to moderately steep soils are so intermingled that it was not feasible to map them separately. They are on mountainous uplands. Haypress soils are on the more stable landscapes on side slopes and foothills or in draws and swales. Toiyabe soils are on shallow ridge crests, or "hogbacks," that are more resistant to weathering. About 45 percent of this complex is Haypress soils, and 45 percent is Toiyabe soils. The remaining 10 percent is areas of Mottsville soils in the small areas where soils are forming in alluvium; areas of deep, coarse-textured colluvium; and areas of Acidic rock land.

The Haypress soil has the profile described as representative for the Haypress series, and the Toiyabe soil has one similar to that described as representative for the Toiyabe series. Rock outcrops make up 10 to 40 percent of the surface area. Runoff is slow to medium, and the hazard of erosion is slight to moderate for both soils.

These soils are used mainly for producing timber. Open areas that have a grass cover are used for limited grazing. Capability unit VIIs–1; Haypress part in woodland suitability group 1, Toiyabe part in woodland suitability group 2.

Haypress-Toiyabe loamy coarse sands, 30 to 75 percent slopes (H†G).—These steep to very steep soils are so intermingled that it was not feasible to map them separately. They are on mountainous uplands. Haypress soils are on the deeper, more weathered rock and have more stable slopes. Toiyabe soils are on less weathered rock and have less stable slopes. About 40 percent of this complex is Haypress soils, and 40 percent is Toiyabe soils. The remaining 20 percent is areas of Mottsville soils; deep, coarse-textured colluvium; and Acidic rock land.

Both soils have profiles similar to the ones described as representative for their respective series. Rock outcrops cover 10 to 40 percent of the surface area. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

These soils are used mainly for woodland, but small, more open areas are used for grazing. The soils are also used as watershed lands and for wildlife habitat. Capability unit VIIs–1; Haypress part in woodland suitability group 1, Toiyabe part in woodland suitability group 2.

James Canyon Series

The James Canyon series consists of poorly drained soils that are forming mainly in mixed alluvium. These soils are in meadows. They are in scattered bodies throughout the Area on young fans, stream terraces, and flat bottoms. Slopes range from 0 to 5 percent. Elevation ranges from 4,500 to 5,500 feet. Annual precipitation is 10 to 20 inches, and the average annual temperature is 48° to 50° F. The frost-free period is about 80 to 90 days. The natural vegetation is mainly such meadow-type species as sedges, wire grass, tufted hairgrass, and bluegrass and such weeds and forbs as camas, dandelion, yarrow, aster, and plantain. James Canyon soils are associated mainly with Ramelli and Smithneck soils.

In a representative profile (fig. 12) the natural meadows are thickly sodded, and the surface layer has a high content of organic matter. It is dark-gray, moderately alkaline silt loam about 18 inches thick. The next layer is gray, moderately alkaline silt loam 18 inches thick. Below this is gray, moderately alkaline heavy sandy loam and grayish-brown, moderately alkaline sandy clay loam that extend to a depth of

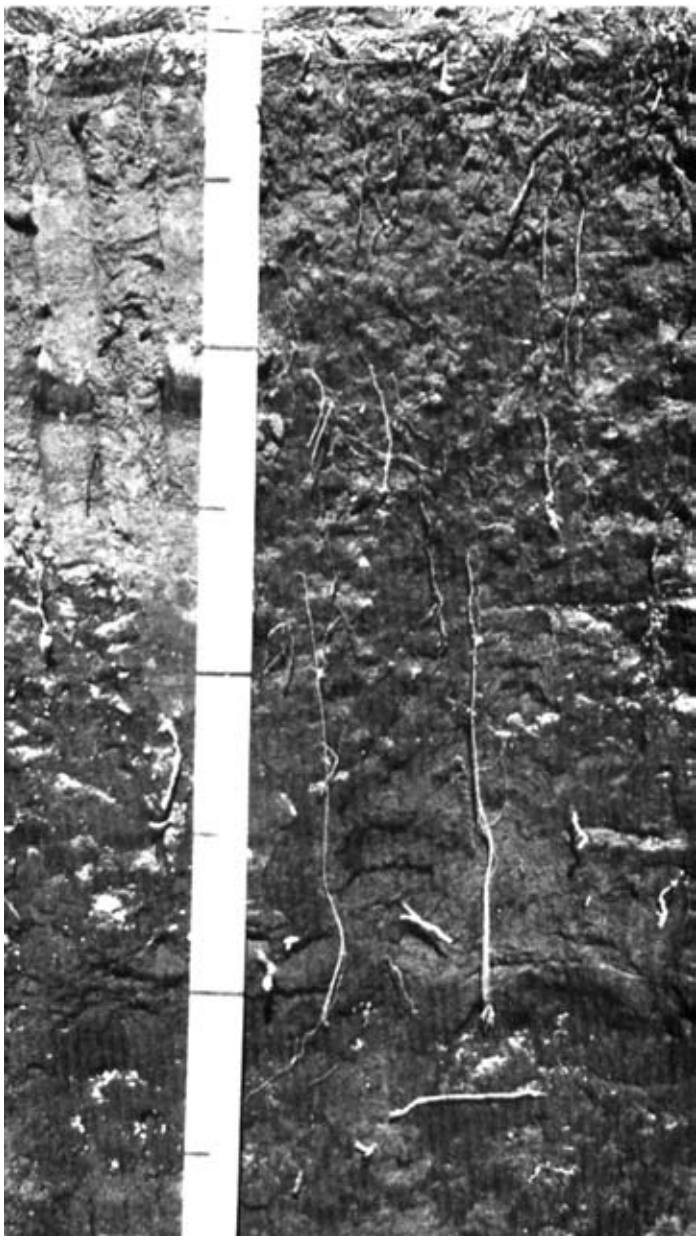

Figure 12.—**Profile of James Canyon silt loam, 0 to 2 percent slopes.**

more than 60 inches. The soil is mottled below a depth of 36 inches. Depth to the water table ranges from 2 to 5 feet.

Permeability is moderate. If these soils are drained, the rooting depth is more than 60 inches.

These soils form better natural meadowlands than most other soils in the Area. The meadows are grazed by cattle. Areas that are artificially drained are cropped to pasture, alfalfa, cereal grains, and wheatgrass. Yields are equal to those produced on the better soils in the Area.

Representative profile of nearly level James Canyon silt loam in a field planted to smooth brome and alfalfa (on the south quarter corner of sec. 12, T. 21 N., R. 15 E.; near the outskirts of the town of Loyalton, 30 feet east of Beckwith Road and 30 feet north of the old Island School building) :

O1 and O2—2 inches to 0, live roots and decaying organic matter consisting of grass and other plant remains; abrupt, smooth boundary.

Ap—0 to 6 inches, dark-gray (10YR 4/1) heavy silt loam, variegated very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) when moist; strong, medium, platy structure (in places structure is affected by compaction caused by weight of farm machinery); hard, friable, sticky and slightly plastic; many very fine and fine roots and few medium and coarse roots; many very fine and fine tubular and interstitial pores; moderately alkaline; many krotovinas; gradual, smooth boundary.

A3—6 to 18 inches, dark-gray (10YR 4/1) heavy silt loam, variegated very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) when moist; weak, medium, angular blocky structure; hard, friable, sticky and slightly plastic; many very fine and fine roots and few medium and coarse roots; many very fine and fine tubular and interstitial pores; moderately alkaline; gradual, smooth boundary.

C1—18 to 22 inches, gray (10YR 5/1) heavy silt loam, very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) when moist; weak, medium, angular blocky structure; very hard, slightly firm, very sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular and interstitial pores, common medium tubular and interstitial pores, and few coarse tubular and interstitial pores; few thin clay films in pores and as bridges; moderately alkaline; gradual, smooth boundary.

C2—22 to 30 inches, gray (10YR 5/1) heavy silt loam, very dark brown (10YR 2/2) when moist; weak, medium, angular blocky structure; very hard, firm, very sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine tubular and interstitial pores, common medium tubular and interstitial pores, and few coarse tubular and interstitial pores; few thin clay films in pores and as bridges; moderately alkaline; clear, smooth boundary.

C3—30 to 36 inches, gray (10YR 5/1) heavy silt loam, very dark brown (10YR 2/2) when moist; massive; slightly hard, firm, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and fine pores, common medium pores, and few coarse pores; moderately alkaline; clear, smooth boundary.

C4—36 to 48 inches, gray (10YR 5/1) heavy sandy loam, very dark grayish brown (10YR 3/2) when moist; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; slightly hard, friable, slightly sticky and nonplastic; common very fine, fine, and medium roots and few coarse roots; many very fine tubular and interstitial pores and few fine and medium tubular and interstitial pores; moderately alkaline; gradual, smooth boundary.

C5g—48 to 60 inches, grayish-brown (10YR 5/2) sandy clay loam that has common, medium, distinct, yellowish-brown (10YR 5/6) mottles; very dark grayish brown (10YR 3/2) and common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles when moist; massive; very hard, friable, slightly sticky and plastic; few very fine and fine roots; few very fine and fine tubular and interstitial pores.

The A horizon ranges from very dark gray to gray in color and from heavy loam to silty clay loam in texture. It is gravelly in places. The C horizon is stratified with lenses of sand and gravel in places. It is very dark gray to gray or dark brown to grayish brown. The source of some of the alluvium near Vinton is granitic rock, and the soil material in this area has a high content of mica.

James Canyon gravelly loam, 2 to 5 percent slopes (JbB).—This gently sloping soil is on fans. Material throughout the profile is about 15 to 25 percent gravel, but the profile is otherwise similar to the one described as representative for the James Canyon series.

Included with this soil in mapping are areas near Cold Stream Creek of soils that have an extremely gravelly substratum. Also included are "bog spots"—very wet areas that seem to float and are quite spongy to walk on.

The available water capacity is 6 to 8 inches, based on a drained soil. The water table is below a depth of 5 feet in most places, but it may be as shallow as 3 feet. Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for meadow pasture (fig. 13). A small acreage is planted to cereal grains, hay, or improved pasture. Capability unit IIIw–2.

James Canyon silt loam, 0 to 2 percent slopes (JcA).—This nearly level soil is on fans, stream terraces, or bottom lands that are scattered throughout parts of the Area. It has the profile described as representative for the James Canyon series. Included in mapping are areas of Ramelli and Coolbrith soils.

The available water capacity is 10 to 12 inches, based on drained soil. A water table is at a depth of 2 to 5 feet. Runoff is very slow, and the hazard of erosion is none to slight.

This soil is used mostly for meadowland. Some better drained areas near Loyalton are cropped to alfalfa-grass pastures and straight alfalfa or to hay or small grains. Capability unit IIIw–2.

Lovejoy Series

The Lovejoy series consists of moderately well drained soils that are forming in old alluvium of mixed origin. They are underlain by a hardpan at a depth of 10 to 30 inches. Slopes range from 0 to 5 percent. These soils are on hummocky flats and fan terraces on the western side of Sierra Valley. They are south of the village of Beckwourth and the Western Pacific tracks and extend to the south toward the village of Calpine. Elevation ranges from 4,500 to 5,000 feet. Annual precipitation is 14 to 20 inches, and the average annual temperature is 48° to 50° F. The frost-free

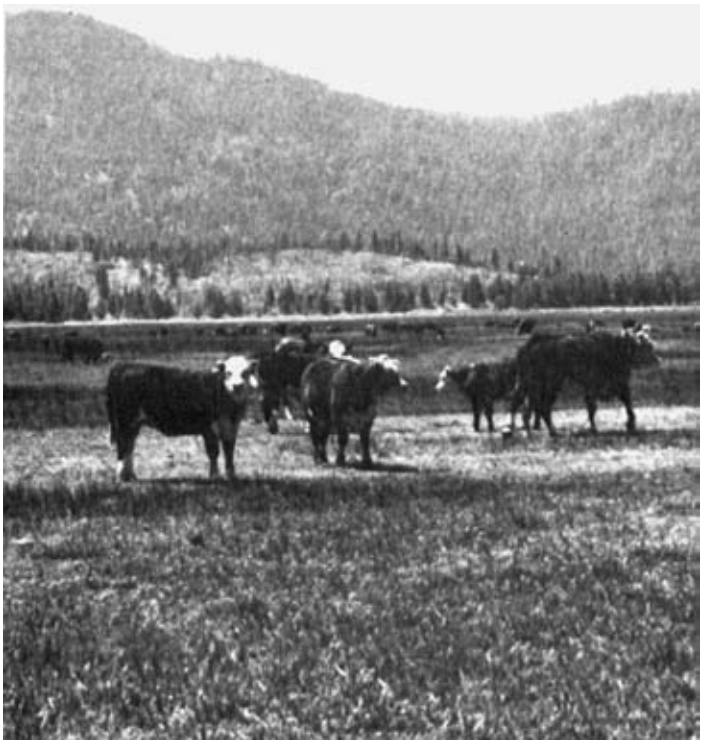

Figure 13.—**Beef cattle in a typical area of James Canyon gravelly loam, 2 to 5 percent slopes, near Sierraville.**

period is about 50 to 90 days. The natural vegetation is a spotty cover of low sagebrush, cheatgrass and some saltgrass, weeds, and forbs. Areas of Lovejoy soils adjoin areas of Calpine and Ramelli soils.

In a representative profile the surface layer is light-gray and light brownish-gray strongly acid and medium acid loam and clay loam 16 inches thick. The subsoil is pale-brown, medium acid clay about 5 inches thick. It is underlain by an indurated, massive, light-gray hardpan about 20 inches thick. The hardpan is underlain, at a depth of 41 inches, by pale-yellow, moderately alkaline clay loam that extends to a depth of more than 60 inches.

Permeability is very slow. The available water capacity is 1 to 3 inches. The effective rooting depth is 8 to 20 inches. It is limited by the clay subsoil.

Most areas of Lovejoy soils are used for range.

Representative profile of a nearly level Lovejoy loam on a low terrace under scattered low sage and annual grass (0.6 mile north and 0.1 mile west of the southeast corner of sec. 14, T. 22 N., R. 14 E., 500 feet west of the Beckwourth-Calpine Road) :

A1—0 to 2½ inches, light-gray (10YR 6/1) loam, dark grayish brown (10YR 4/2) when moist; strong, very thin, platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots and few fine roots; many very fine interstitial pores and common fine interstitial and tubular pores; strongly acid; clear, smooth boundary.

A21—2½ to 10 inches, light brownish-gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, prismatic and moderate, thin, platy structure; hard, friable, slightly sticky and plastic; common very fine roots and few fine and medium roots; many very fine tubular pores and common very fine interstitial pores; common thin clay films in pores; strongly acid; clear, smooth boundary.

A22—10 to 16 inches, light-gray (10YR 7/1) loam, dark grayish brown (10YR 4/2) when moist; moderate, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots, mostly exped; common very fine tubular and interstitial pores; common thin clay films in pores; few black shot; medium acid; abrupt, smooth boundary.

B2t—16 to 21 inches, pale-brown (10YR 6/3) clay, dark grayish brown (10YR 4/2) when moist; strong, coarse, columnar structure; extremely hard, extremely firm, very sticky and very plastic; few very fine, fine, and medium exped roots; few very fine tubular pores; continuous moderately thick clay films in pores and on faces of peds; few black shot; medium acid; abrupt, smooth boundary.

C1m—21 to 41 inches, light-gray (2.5Y 7/2) indurated hardpan, olive brown (2.5Y 4/4) and pale yellow (2.5Y 7/4) when moist; massive; no roots, except for a thin mat below the B2t horizon; moderately alkaline; strongly effervescent, lime in distinct horizontal seams, matrix is noncalcareous, horizon does not slake in water; clear, smooth boundary.

C2—41 to 60 inches, pale-yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) when moist; massive; very hard, firm, sticky and plastic; common very fine tubular pores, few fine tubular pores, and few very fine interstitial pores; common moderately thick clay films in pores; moderately alkaline.

A ½- to 2-inch mantle of windblown sand is on the surface in places. In most areas, the A1 horizon is gray or light-gray fine sandy loam or loam. The A2 horizon is light brownish gray, light gray, or nearly white. It is highly leached. In places this horizon is just a thin lens or coating that caps the columns of the upper part of the B2t horizon. The B2t horizon is a heavy clay loam or clay. It averages about 5 to 12 inches in thickness. Some of the interiors of the peds are coated with whitish silica or small amounts of lime. The C1m horizon is siltstone in places. It is mottled with reddish-brown streaks and is cemented with silica and some lime. It grades into variably stratified, loose sediment with depth.

This soil appears to be affected by salts and alkali, but this is not substantiated by laboratory data. In most profiles the A horizon is strongly acid to medium acid, and the B2t and C horizons are medium acid to moderately alkaline.

Lovejoy loam, 0 to 5 percent slopes (LaB).—This nearly level to gently sloping soil is on hummocky flats and fan terraces. It has the profile described as representative for the Lovejoy series. Included in mapping are small areas of Calpine and Ramelli soils. Runoff is slow, and the hazard of erosion is slight.

This soil is used mostly for unimproved range. Small areas have been seeded to wheatgrass or cereal rye. Capability unit IVe–3; range site 5.

Loyalton Series

The Loyalton series consists of moderately well drained soils that are moderately affected by salts and alkali. They are forming in mixed loamy alluvium. These soils are on slightly depressional and hummocky positions on the valley floor, mainly in the central part of Sierra Valley. Slopes range from 0 to 2 percent. Elevation ranges from 4,500 to 5,000 feet. Annual precipitation is about 14 to 20 inches, and the average an-

nual temperature is 48° to 50° F. The frost-free period is about 50 to 90 days. The natural vegetation is a spotty cover of silver sagebrush, saltgrass, cheatgrass, wire grass, and various other forbs and grasses. Loyalton soils are associated mainly with Beckwourth, Ormsby, and Beiber soils.

In a representative profile (fig. 14) the surface layer is light brownish-gray, neutral loamy sand and gray, neutral fine sandy loam about 5 inches thick. The subsurface layer is light-gray, strongly alkaline sandy loam 3 inches thick. The subsoil is variegated grayish-brown and light-gray, very strongly alkaline sandy clay loam in the upper 9 inches. It is variegated white and pale-yellow, very strongly alkaline sandy clay loam in the lower 16 inches. The substratum is pale-yellow, strongly alkaline gravelly loamy coarse sand and gravelly coarse sand. It extends to a depth of more than 60 inches.

Permeability is very slow in these soils. Available water capacity is 1.5 to 4.5 inches. The effective rooting depth is 10 to 30 inches. It is limited by the sandy clay loam subsoil.

Most areas of the Loyalton series are unimproved and used for range pasture. Some acreage is planted to improved pasture or cereal rye.

Representative profile of nearly level Loyalton fine sandy loam on the valley basin under sagebrush, saltgrass and cheat grass (200 feet west and 200 feet north of the south quarter corner of sec. 24, T. 22 N., R. 15 E., 200 feet west of Sierra Valley Road) :

A11—0 to ¼ inch, light brownish-gray (10YR 6/2) loamy sand, very dark grayish brown (10YR 3/2) when moist; single grained; loose, nonsticky and nonplastic; neutral; abrupt, smooth boundary.

A12—¼ to 5 inches, gray (10YR 6/1) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, thick, platy structure; soft, very friable, nonsticky and nonplastic; many very fine roots and common fine, medium, and coarse roots; many very fine interstitial pores; common very fine and few fine and medium tubular and vesicular pores; neutral; clear, smooth boundary.

A2—5 to 8 inches, light-gray (10YR 7/1) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, very thin, platy structure; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; common very fine tubular and interstitial pores; few thin clay films in pores; strongly alkaline; abrupt, smooth boundary.

B21t—8 to 12 inches, variegated grayish-brown (10YR 5/2) and light-gray (10YR 7/2) sandy clay loam, very dark grayish brown (10YR 3/2) when moist; strong, medium, columnar structure; extremely hard, very firm, sticky and very plastic; many very fine roots and few fine and medium exped roots; common very fine tubular pores and few fine tubular pores; continuous thick clay films on faces of peds; very strongly alkaline; very slightly effervescent; lime concentrated in soft masses; clear, smooth boundary.

B22tca—12 to 17 inches, variegated grayish-brown (10YR 5/2) and light-gray (10YR 7/2) sandy clay loam, variegated very dark grayish brown (10YR 3/2) and brown (10YR 5/3) when moist; strong, medium, prismatic structure; extremely hard, very firm, sticky and very plastic; very few very fine inped roots and few fine exped roots; common very fine tubular pores; continuous thick clay films on faces of peds; very strongly alkaline; strongly effervescent; lime in soft masses; clear, slightly wavy boundary.

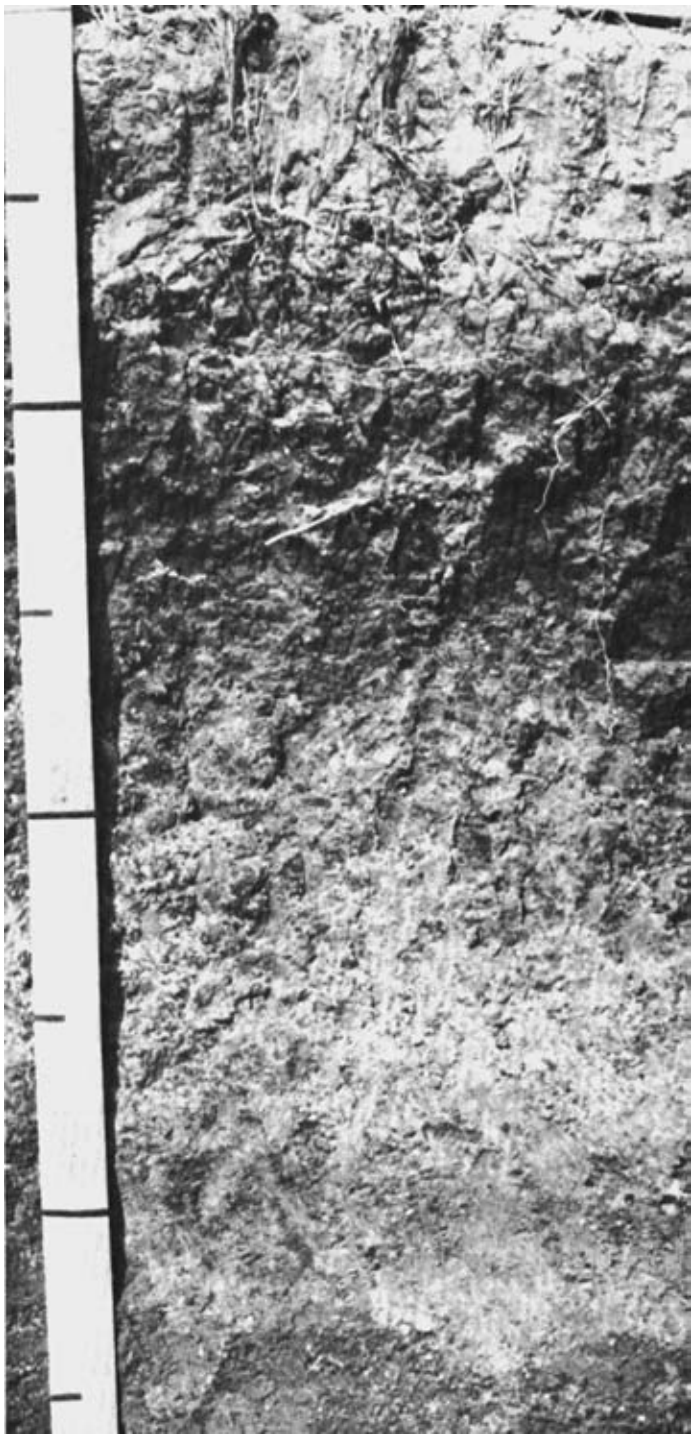

Figure 14.—**Profile of Loyalton fine sandy loam. Claypan, at a depth of 6 to 8 inches, has strong columnar structure.**

B31ca—17 to 23 inches, variegated light-gray (10YR 7/2) and pale-brown (10YR 6/3) heavy sandy clay loam, variegated dark grayish brown (10YR 4/2), brown (10YR 5/3), and light gray (10YR 7/2) when moist; moderate, medium, prismatic structure; hard, firm, sticky and plastic; few very fine and fine exped roots; few very fine tubular pores

and common very fine interstitial pores; many thick clay films in pores and on faces of peds; very strongly alkaline; violently effervescent; lime in soft masses; clear, slightly wavy boundary.

B32ca—23 to 33 inches, variegated white (2.5Y 8/2) and pale-yellow (2.5Y 7/4) sandy clay loam, variegated light gray (2.5Y 7/2) and olive brown (2.5Y 4/4) when moist; weak, medium, prismatic structure; hard, firm, sticky and plastic; very few very fine exped roots; few very fine tubular pores and common very fine interstitial pores; common thick clay films in pores and on faces of peds; very strongly alkaline; violently effervescent; lime in soft masses; abrupt, wavy boundary.

IIC1—33 to 53 inches, pale-yellow (2.5Y 7/4) gravelly loamy coarse sand, variegated very dark grayish brown (2.5Y 3/2) and olive brown (2.5Y 4/4) when moist; massive; slightly hard, friable, nonsticky and nonplastic; no roots; many very fine interstitial pores and few fine interstitial pores; strongly alkaline; noncalcareous; abrupt, smooth boundary.

IIC2—53 to 63 inches, pale-yellow (2.5Y 7/4) gravelly coarse sand, olive-brown (2.5Y 4/4) and many medium, distinct, very dark grayish-brown (10YR 2/2) mottles when moist; massive; slightly hard, firm, nonsticky and nonplastic; no roots; common very fine interstitial pores; strongly alkaline; noncalcareous.

In some areas a thin layer of sand is on the surface. Otherwise, A horizons range from sandy loam to silt loam, and Bt horizons range from sandy clay loam to silty clay loam. Reaction of the A horizon ranges from slightly acid to strongly alkaline. Reaction of the B2t and C horizons varies from moderately alkaline to very strongly alkaline.

The salt and alkali content of these soils is quite variable, even within the same field. In hummocky areas soils in the mound positions generally have a deeper B2t horizon and are less affected by salt and alkali. In areas of swales, drainageways, and depressional flats, the soils are generally more affected by salt and alkali and the B2t horizon is at a shallower depth.

Loyalton fine sandy loam (Lo).—This nearly level soil has hummocky micro-relief. Unimproved areas have "biscuits" or mounds, 15 to 100 feet in diameter. These are interspaced with weakly indented swales, depressional basins, and relatively smooth flats. This soil has the profile described as representative for the Loyalton series. Included in mapping are small areas of Balman, Bellavista, Beckwourth, and Bieber soils. Runoff is very slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate, especially in cleared and disturbed areas. Salinity and content of alkali in this soil are slight to moderate.

The subsoil is shallow in this soil. The soil is low in fertility, commonly affected by sodium and salts, and has rather a low potential for the production of crops. A sizable acreage of one ranch that was formerly hummocky, however, has been smoothed, border checked, planted to salt-tolerant grass and legume mixtures, and used for pasture. These areas are irrigated by flooding and are moderately suitable for pasture (fig. 15). Unleveled areas are sometimes planted to rye or small grains and hay. This soil is used mainly for sagebrush range. Capability unit IVs–6.

Loyalton silt loam (Lp).—Areas of this nearly level, moderately saline-alkali soil are of minor extent. Included in mapping are small areas of Balman and Bidwell soils.

This soil is similar to the one that has the profile described as representative of the series, except it has a surface layer of loam or silt loam, a subsoil of columnar or prismatic silty clay or silty clay loam, and a substratum of loamy coarse sand or coarse sand that contains indurated lime in places. Runoff is very slow, and the hazard of erosion is slight.

Figure 15.—**Improved irrigated pasture on Loyalton fine sandy loam. Ponding of irrigation water is partly the result of very slow permeability in the subsoil and of the high content of alkali.**

This soil is used mainly for native range. Attempts have been made to seed some areas to an alfalfa-grass mixture. These attempts have met with little success, however, because weak stands of the grass component commonly become established on the higher knolls only, and the alfalfa dies out in a few years. Other small areas are used for hay or grains. Capability unit IVs–6.

Martineck Series

The Martineck series consists of well-drained, very stony soils that are forming in old material that is predominantly basic alluvium. The well-rounded stones in the profile are mostly andesitic. These soils are underlain by a hardpan at a depth of 10 to 20 inches. They are on terraces, mainly on the western and southern rim of Sierra Valley. Slopes range from 2 to 30 percent. Elevation ranges from 4,500 to 5,200 feet. Annual precipitation is 12 to 18 inches, and the average annual temperature is about 48° or 49° F. The frost-free period is about 30 to 90 days. The natural vegetation is mainly low sagebrush and thin areas of cheat grass and forbs. A few sentinel Jeffrey pines are on higher terraces. Martineck soils are associated mainly with Bieber and Correco soils.

In a representative profile the surface is studded with stones or is a gravelly pavement (fig. 16). The surface layer is grayish-brown and gray, medium acid very stony sandy loam about 6 inches thick. The upper

Figure 16.—**Stones on the surface of Martineck very stony sandy loam, 2 to 30 percent slopes.**

part of the subsoil is 6 inches thick and is dark grayish-brown, slightly acid very stony sandy clay loam. The lower part of the subsoil is brown, medium acid very stony clay. It is underlain, at a depth of 19 inches, by a pale-yellow, indurated hardpan.

Permeability is very slow. Available water capacity is 1.0 to 2.0 inches. The effective rooting depth, limited by the very stony clay subsoil, is 10 to 20 inches.

These soils provide some scant grazing for livestock and wildlife, but they are too stony and shallow for reseeding.

Representative profile of Martineck very stony sandy loam on an old terrace in an area facing northwest where slope is 5 percent; under low sagebrush, bitterbrush, and annual and perennial grasses (1,320 feet south and 300 feet west of the north quarter corner of sec. 29, T. 21 N., R. 16 E.; 2.5 miles southeast of Loyalton on the Smithneck Road and 600 feet east of the road) :

A11—0 to 2 inches, grayish-brown (10YR 5/2) very stony sandy loam, very dark brown (10YR 2/2) when moist; weak, thick, platy structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine tubular and interstitial pores and common vesicular pores; medium acid; abrupt, slightly wavy boundary.

A12—2 to 6 inches, gray (10YR 5/1) very stony sandy loam, very dark brown (10YR 2/2) when moist; weak, thick, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular and interstitial pores; medium acid; clear, slightly wavy boundary.

B1t—6 to 12 inches, dark grayish-brown (10YR 4/2) very stony sandy clay loam, very dark grayish-brown (10YR 3/2) when moist; moderate, fine, subangular blocky structure and moderate, fine, granular; very hard, very firm, sticky and plastic; many very fine and fine roots and common medium roots; common very fine and fine tubular and interstitial pores; common thin clay colloids in pores and as bridges between mineral grains; slightly acid; abrupt, slightly wavy boundary.

B2t—12 to 19 inches, brown (10YR 4/3) very stony clay that has yellowish-brown (10YR 5/6) stains, dark brown (10YR 3/3) with lighter and darker mineral colors when moist; strong, medium, prismatic structure; extremely hard, extremely firm, sticky and very plastic; few fine and very fine exped roots; common fine and very fine tubular pores; continuous moderately thick clay films in pores and on faces of peds; some nearly black manganese stains on faces of peds; medium acid; abrupt, wavy boundary.

IIC1m—19 to 24 inches, pale-yellow (2.5Y 7/4), indurated, nonstony hardpan, dark yellowish brown (10YR 4/4) when moist; massive; extremely hard when dry and extremely firm when moist; dark-gray (10YR 4/1) stains on fracture planes; medium acid.

IIC2—24 to 60 inches, stratified lake sediment, becoming less cemented with depth.

The B2t horizon has many dark manganese stains and some mottles. The C1m horizon is extremely hard. It is cemented, mostly with silica, but also with iron. The silica coatings in the pan are thick and sometimes in seams. They resemble lime deposits in color, but they are mostly noneffervescent with dilute acid. The cemented layer is generally nonstony, except in the bedded gravel lenses. The texture and color of all horizons is greatly influenced by the many rock fragments. The mostly rounded stones make up 40 to 60 percent, by volume, of the material in the profile.

Martineck very stony sandy loam, 2 to 30 percent slopes (MaE).—This gently sloping to moderately steep soil is on terraces and their escarpments. Slopes are mainly 2 to 15 percent but range to 30 percent. This is the only Martineck soil in the Sierra Valley Area, and it has the profile described as representative for the Martineck series. Included in mapping are small areas of Bieber, Dotta, and Correco soils. Runoff is slow to rapid, and the hazard of erosion is slight to high.

This soil is used chiefly for range. A small acreage has been sprayed by airplane to control sagebrush. The spraying slightly increases forage yields of grasses on the gentler slopes. Capability unit VIIs–1; range site 6.

Millich Series

The Millich series consists of well-drained, very stony soils that are forming in place, at depths of 12 to 20 inches, over basic rock that is mainly cobbly andesitic and basaltic tuffs, breccia, and conglomerate. These soils are on hills and mountainous uplands surrounding the valley basins. Slopes range from 5 to 75 percent. Elevation ranges from 4,900 to 6,000 feet. Annual precipitation is 10 to 18 inches, and the average annual temperature is 45° to 47° F. The frost-free period is about 60 to 90 days. The natural vegetation is mixed big sagebrush and low sagebrush, some bitterbrush, and a sparse understory of grasses and forbs. Millich soils are associated mainly with Aldax and Bieber soils.

In a representative profile the surface layer is grayish-brown, neutral very stony loam about 3 inches

thick. The upper part of the subsoil is dark grayish-brown, slightly acid cobbly clay loam about 5 inches thick. The lower part is grayish-brown, slightly acid clay that rests abruptly, at a depth of 16 inches, on vesicular andesite.

Permeability is slow. Available water capacity is 1 to 2 inches in the 12 to 20 inches of effective rooting depth.

These soils are used for unimproved range. They serve as part of the wildlife habitat for deer and upland birds such as quail and chukar. They also form a sizable part of the watershed that contributes to the drainge of the Area.

Representative profile of Millich very stony loam on uplands in an area facing west where slope is 10 percent; under big sagebrush, bitterbrush, and annual and perennial grasses (2,000 feet south and 500 feet west of the northeast corner of sec. 9, T. 22 N., R. 16 E., 2 miles south of Vinton) :

A1—0 to 3 inches, grayish-brown (10YR 5/2) very stony loam, dark brown (10YR 3/3) when moist; moderate, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common very fine vesicular pores; neutral; abrupt, slightly wavy boundary.

B1t—3 to 8 inches, dark grayish-brown (10YR 4/2) cobbly light clay loam, dark brown (10YR 3/3) when moist; moderate, fine, subangular blocky structure; hard, friable, sticky and plastic; common fine and medium roots; common very fine and fine interstitial and tubular pores; many thin clay coatings on faces of peds and in pores; slightly acid; abrupt, slightly wavy boundary.

B2t—8 to 12 inches, grayish-brown (10YR 5/2) clay, dark brown (10YR 4/3) when moist; strong, moderate, prismatic and strong, medium and coarse, angular blocky structure; extremely hard, extremely firm, sticky and very plastic; common very fine exped roots; few very fine and fine tubular pores; continuous moderately thick clay films on faces of peds and filling pores; slightly acid; gradual, smooth boundary.

B22t—12 to 16 inches, grayish-brown (10YR 5/2) clay, dark brown (10YR 4/3) when moist; strong, fine and medium, angular blocky structure; extremely hard, extremely firm, sticky and very plastic; common very fine exped roots; few fine and very fine tubular pores; continuous moderately thick clay films on faces of peds and filling pores; slightly acid; abrupt, wavy boundary.

R—16 inches, gray vesicular andesite, very hard but slightly weathered; some clay films in fracture planes.

In places the A horizon is without vegetation and is weakly rilled. The A horizon ranges from dark grayish brown to brown. The Bt horizon ranges from dark grayish brown to grayish brown or brown and is dark reddish brown in places. Texture ranges from heavy clay loam to clay. Reaction ranges from slightly acid to neutral in the A horizon and from slightly acid to medium acid in the Bt horizon.

Depth to bedrock ranges from 12 to 20 inches. In places loose stone fragments ranging from 1 to 12 inches diameter make up 5 to 40 percent, by volume, of the material in the profile. Millich soils are mapped only in complex with Aldax soils. For individual mapping units, see the Aldax series.

Mixed Alluvial Land

Mixed alluvial land (MdB) is a land type that consists of nearly level, mixed alluvium. This material has been laid down as stringers on widened terraces or levees in or near stream channels. The material is variable, generally stratified or mixed with sands, and contains many pebbles and some cobbles and stones. Generally, enough fine material is present in the alluvium to sustain a good cover of grass and other plants. Drainage is highly variable, but these lands are generally wet enough to support sedges and wire grass and other water-tolerant plants. Willow, cottonwood, alder, and some aspen commonly line the drainageways. This land type is subject to annual overflow and flooding during the winter months, except in areas on some of the broader terraces.

In some areas this land consists of good, deep, medium-textured soil. In these areas the soil material is comparable to that of the better bottom lands in the valley, but the areas are small, inaccessible, or difficult to handle as a farming unit because of the depth of the gulleys or channels that isolate them. Most areas are used for range. Capability unit VIw–1; range site 8.

Mottsville Series

The Mottsville series consists of excessively drained soils that are forming in coarse granitic alluvium. They are on lake terraces in the northeastern Sierra Valley near the village of Chilcoot and extend eastward into Long Valley. Slopes range from 2 to 9 percent. Elevation ranges from 4,800 to 5,200 feet. Annual precipitation is 8 to 16 inches, and the average annual temperature is about 48° to 50° F. The frost-free period is 60 to 90 days. The natural vegetation is mostly big sagebrush, cheat grass, Indian ricegrass, scattered bitterbrush, and a few forbs and other grasses. Mottsville soils are associated mainly with Ormsby and Quincy soils.

In a representative profile the surface layer is brown and dark-brown, medium acid loamy sand and loamy coarse sand about 10 inches thick. The next layer is brown, slightly acid loamy sand 24 inches thick. The underlying material is yellowish-brown, medium acid loamy sand that extends to a depth of more than 60 inches.

Permeability is rapid. Available water capacity is 3.5 to 5 inches. The effective rooting depth is more than 60 inches.

These soils are used mainly for range.

Representative profile of gently sloping Mottsville loamy sand on a beach terrace; under sagebrush-grass (1,500 feet northwest of the southeast corner of sec. 35, T. 23 N., R. 16 E., 0.5 mile west of Chilcoot, 100 feet south of State Highway 70) :

A11—0 to 4 inches, dark-brown (10YR 4/3) loamy sand, very dark grayish-brown (10YR 3/2) when moist; single grained; loose, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; medium acid; clear, smooth boundary.

A12—4 to 10 inches, brown (10YR 4/3) loamy coarse sand, dark brown (10YR 3/3) when moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; medium acid; clear, smooth boundary.

AC—10 to 34 inches, brown (10YR 4/3) loamy sand, dark brown (10YR 3/3) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots and few fine roots; many very

fine interstitial pores, common fine interstitial pores, and few medium and coarse interstitial pores; slightly acid; gradual, smooth boundary.

C—34 to 60 inches, yellowish-brown (10YR 5/4) loamy sand, dark brown (10YR 4/3) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine interstitial pores and common fine interstitial pores; medium acid.

The A horizon ranges from brown to dark brown and dark grayish brown. It is most commonly sand to loamy sand. A thin winnowed layer of coarse sand is at the surface in some places. The A horizon has weak, platy structure or is single grained or massive. The AC horizons are generally yellowish-brown or brown loamy sand or sand. In some areas these horizons are brown or light brown and have a reddish hue of 7.5YR. Below a depth of 25 to 30 inches, in some profiles, these horizons are flecked and stained with many, hard, reddish-brown concretions of iron and manganese. These concretions vary in diameter from ¼ to 4 inches. They occur at random in the substratum and gradually become less abundant with depth. Below a depth of 4 to 5 feet the C horizon is yellowish-brown or very pale brown sand or loamy sand. In some areas the sands extend to a depth of 17 feet or more. Very coarse, stratified lake sediment is generally at a depth of more than 6 to 8 feet in these soils.

Mottsville loamy sand, 2 to 9 percent slopes (MrC).—This gently sloping to moderately sloping soil is on terraces adjacent to the granitic uplands. It is the only Mottsville soil in the Area, and it has the profile described as representative for the Mottsville series. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of wind erosion is moderate.

Included with this soil in mapping are areas of Ormsby and Quincy soils and areas of soils that are similar to Mottsville soils except they are underlain by granitic rock at a depth of 20 to 40 inches. These soils have slopes of 9 to 30 percent and grade into the steep uplands.

No areas of this soil are cropped. Most areas are used mainly for range. A source of irrigation water has not been developed. This soil provides some food and cover for wildlife, such as rabbits, quail, and deer. Capability unit IVe–4.

Newlands Series

The Newlands series consists of well-drained soils that are forming in material weathered from old metamorphic rock at a depth of 30 to 50 inches. The soils are on foot slopes, rolling hills, and mountainous uplands mainly on the mountain range that divides Sierra Valley and Long Valley. Slopes range from 2 to 30 percent. Elevation ranges from 4,800 to 6,000 feet. Annual precipitation is 8 to 16 inches, and the average annual temperature is 48° to 49° F. The frost-free period is 50 to 90 days. The natural vegetation is big sagebrush, cheatgrass, and other miscellaneous forbs and grasses. Newlands soils are mainly in the same general area as Aldax and Glean soils.

In a representative profile the surface layer is dark grayish-brown and dark-brown, neutral sandy loam about 11 inches thick. The upper part of the subsoil is yellowish-brown and light yellowish-brown, neutral heavy sandy loam about 3 inches thick. The lower part is yellowish-brown and light yellowish-brown, neutral light clay loam about 7 inches thick. It is underlain by yellow and yellowish-brown silt loam about 4 inches thick. Below this is brownish-yellow and reddish-brown neutral silt loam that is underlain, at a depth of 45 inches, by reddish-yellow and light reddish-brown, slightly acid, moderately weathered rock.

Permeability is moderately slow. The available water capacity is 4 to 8 inches. The effective rooting depth is 30 to 50 inches.

These soils are used for range by livestock and wildlife.

Representative profile of Newlands sandy loam on moderately sloping upland in an area where slope is 7 percent; under big sagebrush, lupine, shoestring, mule ears, and cheatgrass (1,650 feet south and 1,320 feet east of the northwest corner of sec. 36, T. 23 N., R. 16 E.; 2,000 feet north of Chilcoot and 50 feet west of Frenchman Lake Road):

A11—0 to 6 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, thin, platy structure; soft, friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine, fine, and medium tubular and interstitial pores; neutral; abrupt, smooth boundary.

A12—6 to 11 inches, dark-brown (10YR 4/3) heavy sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and common medium roots; many very fine, fine, and medium tubular and interstitial pores; few thin clay films in pores and as bridges; neutral; gradual, smooth boundary.

B1—11 to 14 inches, yellowish-brown (10YR 5/4) and light yellowish-brown (10YR 6/4) heavy sandy loam, variegated dark brown (10YR 3/3) and brown (7.5YR 5/4) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine exped roots; common very fine and fine tubular and interstitial pores and few medium tubular and interstitial pores; few thin clay films in pores and as bridges; neutral; clear, smooth boundary.

B2t—14 to 21 inches, yellowish-brown (10YR 5/4) and light yellowish-brown (10YR 6/4) light clay loam, dark brown (7.5YR 4/4) and strong brown (7.5YR 5/6) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and plastic; few very fine and fine exped roots; common very fine pores and few fine pores; common moderately thick clay films in pores and on faces of peds; neutral; clear, wavy boundary.

C1—21 to 25 inches, yellow (10YR 7/6) and yellowish-brown (10YR 5/6) silt loam, yellowish brown (10YR 5/6 and 10YR 5/4) when moist; massive; hard, slightly firm, slightly sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores and few fine tubular pores; few thin clay films in pores; neutral; discontinuous but abrupt, wavy boundary.

C2—25 to 45 inches, brownish-yellow (10YR 6/6) and reddish-brown (5YR 5/3) silt loam, mixed strong brown (7.5YR 5/8), yellowish brown (10YR 5/4), and light reddish brown (5YR 6/4) when moist; platy schistose structure; extremely hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; common very fine tubular pores and few fine tubular pores; neutral; clear, wavy boundary.

R—45 inches, reddish-yellow (10YR 6/8) and light reddish-brown (2.5YR 6/4), somewhat weathered, metamorphosed basic rock; yellowish brown (10YR 5/6) mixed with red and green when moist; hard, extremely firm; slightly acid.

Because the Newlands soils are forming in material weathered from a variety of rocks, they range somewhat in color, depth, and rockiness. In areas where the soils are forming in quartzite or pale-colored metarhyolite, the A horizon is gray or dark gray. In other areas it is dark grayish brown to dark brown. Texture of the A horizon ranges from loam to sandy loam. The Bt horizon is sandy clay loam or clay loam. Depth to rock ranges from 30 to 50 inches.

Newlands-Rock outcrop complex, 2 to 30 percent slopes (NaE).—This complex consists of 65 to 80 percent Newlands sandy loam, 10 to 25 percent Rock outcrop, and about 10 percent inclusions of a soil near Chilcoot that has a pale-yellow or white gravelly substratum over weathered igneous rock. Also included are areas where bedrock is at a depth of 15 to 30 inches.

The Newlands soil has the profile described as representative for the Newlands series. Runoff is slow to rapid, and the hazard of erosion is slight to high.

This soil is used mainly for livestock grazing. Most areas are used for habitat by mule deer and other game animals and birds. Capability unit VIs–1; Newlands soil is in range site 1.

Ormsby Series

The Ormsby series consists of somewhat poorly drained and poorly drained soils that are forming in mixed, but dominantly granitic, alluvium. The nearly level Ormsby soils are on the floor of Sierra Valley and the gently sloping ones are on fan terraces, mainly in the northern areas. Slopes range from 0 to 5 percent. Elevation ranges from 4,000 to 5,200 feet. Annual precipitation is between 12 and 18 inches, and the average annual temperature is about 48° F. The frost-free period is about 50 to 90 days. The natural vegetation is chiefly silver sagebrush and cheatgrass. Meadow species, such as wiregrass, sedges, and forbs, are in wetter areas. Ormsby soils are in the same general areas as Beckwourth and Loyalton soils.

In a representative profile the surface layer is dark grayish-brown and dark-gray, medium-acid loamy coarse sand and loamy sand about 14 inches thick. The next layer is dark-gray, slightly acid loamy sand about 8 inches thick. The substratum is brown and pale-brown, neutral and moderately alkaline loamy sand to gravelly coarse sand that extends to a depth of more than 60 inches.

Permeability is moderately rapid. The available water capacity, based on a drained soil, is 3.5 to 5 inches. A water table is at a depth of 2 to 6 feet. The rooting depth is more than 60 inches.

The Ormsby soils are used mainly for unimproved pasture. Poorly drained areas are used for meadow pasture. A small acreage is planted to alfalfa.

Representative profile of nearly level Ormsby loamy coarse sand on a flood plain; under sagebrush and grass (1,200 feet east-northeast of the center of sec. 21, T. 22 N., R. 15 E.; 0.4 mile southeast of the intersection of Dyson and Heriot Lane) :

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) loamy coarse sand, very dark brown (10YR 2/2) when moist; moderate, very thin, platy structure; soft, very friable, nonsticky and nonplastic; many very fine roots and few fine and medium roots; many very fine tubular and interstitial pores and common fine and medium tubular pores; medium acid; clear, smooth boundary.

A12—2 to 14 inches, dark-gray (10YR 4/1) loamy coarse sand and loamy sand, very dark brown (10YR 2/2) when moist; massive; soft, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; common very fine tubular and interstitial pores, common fine tubular pores, and few medium tubular pores; medium acid; gradual, slightly wavy boundary.

AC—14 to 22 inches, dark-gray (10YR 4/1) loamy sand, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; common very fine tubular and interstitial pores and few fine and medium tubular pores; slightly acid; clear, smooth boundary.

C1—22 to 33 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 4/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; very few fine and medium roots; many very fine interstitial pores and few fine and medium tubular pores; neutral; gradual, smooth boundary.

C2—33 to 45 inches, pale-brown (10YR 6/3) loamy sand and loamy coarse sand, dark brown (10YR 4/3) when moist; massive; hard, friable, nonsticky and nonplastic; very few fine and medium roots; many very fine interstitial pores and few fine and medium tubular pores; moderately alkaline; slightly effervescent; lime disseminated; clear, smooth boundary.

C3—45 to 60 inches, pale-brown (10YR 6/3) gravelly coarse sand, dark brown (10YR 4/3) when moist; massive; soft, friable, nonsticky and nonplastic; no roots; many very fine, fine, and medium interstitial pores; moderately alkaline; noncalcareous.

The content of organic matter content in the A horizon is generally more than 1 percent and in places ranges as high as 8 percent in the upper few inches. The content of organic matter decreases appreciably with depth. The C horizon ranges from loamy sand to gravelly coarse sand. It is neutral to moderately alkaline in reaction. The greatest accumulations of lime are near the highest level reached by the fluctuating water table. In this zone the dry consistence is hard in places or is weakly cemented.

The sand grains are rounded and often mottled. The mottles are partly obscured by the multicolored sand minerals. They are red to yellowish brown. Depth to olive-yellow or bluish-gray clay ranges from 48 to 60 inches to as deep as 10 feet. This clay restricts downward movement of water and contributes to the presence of the water table.

Ormsby loamy coarse sand, 0 to 2 percent slopes (OrA).—This nearly level soil is on the valley floor. It has the profile described as representative for the Ormsby series.

Included with this soil in mapping are small areas of Beckwourth soils. Also included are areas in old, weakly indented drainageways where a dense clay subsoil is at a depth of 5 to 20 inches. A small acreage, south of Highway 70 between Vinton and Beckwourth, of soils that have a reddish-brown subsoil is also included.

This soil is somewhat poorly drained and has a seasonal water table at a depth of 4 to 6 feet. Runoff is very slow. The hazard of water erosion is none to slight. The hazard of wind erosion is moderate.

This soil is used mainly for range. Some areas are sprayed with an herbicide to kill the sagebrush and allow grass species to increase. A sizable acreage on one ranch has been leveled and seeded to improved pasture and hay. This area is irrigated with water from Last Chance Creek. Forage production is moder-

ate, but it is much improved compared to production when the soil was used for dry range. Capability unit IVw–4.

Ormsby loamy coarse sand, 2 to 5 percent slopes (OrB).—This gently sloping soil is on fan terraces and on the valley floor. It has a profile similar to that of the soil described as representative for the Ormsby series, but this soil is steeper. Included in mapping are areas of Beckwourth soils.

This soil is somewhat poorly drained. It has a seasonal water table at a depth of 4 to 6 feet. Runoff is slow, and the hazard of water erosion is moderate. The hazard of wind erosion is moderate.

This soil is used mainly for dryland range, but a small acreage is used for improved pasture or hay. Capability unit IVw–4.

Ormsby coarse sandy loam, poorly drained, 0 to 2 percent slopes (OtA).—This nearly level soil is on valley floors. The surface layer is dark-gray coarse sandy loam, but the profile is otherwise similar to the one described as representative for the Ormsby series. Included in mapping are small areas of very deep, well-drained, sandy soils that are similar to the Mottsville soils.

Free ground water fluctuates between depths of 2 and 4 feet. Runoff is slow, and the hazard of water erosion is slight. The hazard of wind erosion is moderate.

This soil is used mainly for meadow pasture. The natural vegetation is mostly wet meadow species such as wire grass, sedges, bluegrass, creeping wildrye, camas, and aster. A small acreage has been leveled. The subsurface drainage has been improved by ditches, and the area has been seeded to alfalfa, hay, and pasture. Initial production is good but may not be long lived if water control and management are not closely controlled. Capability unit IVw–4.

Ormsby coarse sandy loam, poorly drained, 2 to 5 percent slopes (OtB).—This gently sloping soil is on fan terraces. It is affected by seepage from the adjoining higher uplands. It has a dark-gray coarse sandy loam or sandy loam surface layer, but the profile is otherwise similar to the one described as representative for the Ormsby series. Included in mapping are areas of a very deep, well-drained, sandy soil similar to those in the Mottsville series. Runoff is slow, but the hazards of erosion by wind and water are moderate.

This soil is used mainly for dryland range, but small areas are used for hay or pasture. Capability unit IVw–4.

Ormsby Series, Hardpan Variant

This variant of the Ormsby series consists of somewhat poorly drained, saline-alkaline soils that are underlain by indurated sediment at a depth of 15 to 37 inches. They are in valley basins. Slopes range from 0 to 2 percent. Elevation ranges from 4,600 to 5,000 feet. Annual rainfall is 16 to 22 inches, and the average annual temperature is 48° to 50° F. The frost-free period is 50 to 90 days. Vegetation is sparse, and bare spots encrusted with salt are common. The spotty vegetation is mostly saltgrass, wire grass, and pickleweed. The higher mound positions of the landscape have some silver sagebrush and rabbitbrush. Ormsby, hardpan variant, soils are associated mainly with Lovejoy, Beckwourth, Balman, and Ramelli soils.

In a representative profile the surface layer is gray, slightly acid loamy sand about 13 inches thick. The subsoil is grayish-brown, mildly alkaline loam about 7 inches thick. The substratum is an indurated hardpan and stratified loam, sandy loam, and loamy sand sediment.

Permeability is moderately slow above the very slowly permeable hardpan. Available water capacity is 2 to 3.5 inches. The effective rooting depth is 15 to 37 inches. It is restricted by the hardpan. A water table is at a depth of 30 to 60 inches.

These soils are used for meadow pasture.

Representative profile of Ormsby loamy sand, hardpan variant, in meadow pasture (1,500 feet northwest of the southeast corner of sec. 13, T. 22 N., R. 14 E.; 100 feet north of Marble Lane) :

A11—0 to 6 inches, gray (10YR 6/1) loamy sand, dark gray (10YR 4/1) when moist; weak, thin, platy structure; slightly hard, friable, nonsticky and nonplastic; many very fine, fine, and medium roots; common very fine tubular and interstitial pores; slightly acid; gradual, smooth boundary.

A12—6 to 13 inches, gray (10YR 6/1) loamy sand, dark gray (10YR 4/1) moist; massive; hard, firm, nonsticky and nonplastic; common very fine, fine, and medium roots; few very fine tubular pores and common very fine interstitial pores; slightly acid; clear, smooth boundary.

B2t—13 to 20 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1) coatings on faces of peds when moist; weak, medium, prismatic structure; very hard, slightly firm, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; roots are matted at a depth of 20 inches and a few penetrate into lower horizons; common very fine tubular pores; common thin clay films on faces of peds and in pores; mildly alkaline; clear, smooth boundary.

C1m—20 to 26 inches, light brownish-gray (10YR 6/2) indurated hardpan, very dark grayish brown (10YR 3/2) when moist; massive; extremely hard, very firm; few very fine roots in fractures; few very fine tubular pores; pores filled with clay; mildly alkaline; clear, slightly wavy boundary.

C2—26 to 45 inches, light yellowish-brown (10YR 6/4) loam, dark-brown (10YR 3/3), very dark gray (10YR 3/1) coatings of clay when moist; weak, coarse, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; very few very fine exped roots; few very fine tubular pores; continuous thick clay films on faces of peds; mildly alkaline; abrupt, smooth boundary.

C3—45 to 57 inches, black and white mineral grains that have olive (5Y 4/4) coatings and loamy sand, dark yellowish brown (10YR 4/4 and 3/4) when moist; massive; hard, slightly firm, slightly sticky and slightly plastic; common very fine pores; all sand grains coated with clay films; mildly alkaline; clear, smooth boundary.

C4m—57 to 66 inches, black and white mineral grains that have yellowish-brown (10YR 5/8) coatings and weakly cemented loamy sand; yellowish brown (10YR 5/6) and have greenish-gray (5BG 5/1) coatings, dark yellowish brown (10YR 4/4) and have greenish-gray (5BG 5/1) coatings when moist; massive; extremely hard, extremely firm, nonsticky and nonplastic; some sand grains coated with clay films; mildly alkaline.

The A horizon ranges from gray or light gray to light brownish gray in color. Texture ranges from sand or loamy sand to coarse sandy loam. In the upper few inches of the A horizon, structure is platy or granular. Vesicular porosity is common in some areas. Reaction ranges from slightly acid to mildly alkaline in the A horizon. Strongly saline- and sodium-affected spots are common in some areas. In places the lower parts of the A horizon are calcareous. Reaction ranges from slightly acid to strongly alkaline in the A horizon. The B horizon ranges from gray or grayish brown to pale brown. In some areas mottles and manganese stains are common in this horizon. Texture ranges from sandy loam or loam to sandy clay loam. Structure is blocky or prismatic in the B horizon, and reaction ranges from neutral to strongly alkaline. In places lime is present in seams or filaments, but in some areas the lime is disseminated or is absent. The C horizon consists of stratified loam, sandy loam, and loamy sand, which are generally weakly cemented or indurated with lime and alkaline salts, particularly in the upper part. The C horizon has many manganese stains and some mottling. Roots tend to "pan out" near the upper part of the boundary.

Depth to sediment that is cemented by silica or lime ranges from 15 to 37 inches. Few roots extend below a depth of 15 to 37 inches. The salt and sodium content of these soils varies with their position on the landscape, the height that the fluctuating ground waters rise, and the frequency of flooding. Generally, the greatest concentration of salts is just below the surface. The salts accumulate when the upper horizons dry out and the salts "wick up" or move by capillarity. In some areas periods of flooding will leach them down to the vicinity of the water table. In most cases the concentration is strong enough that only the more salt-tolerant plant species survive. Lime is often the prime cementing agent in the C horizon. Sodium tends to deflocculate the soil, making it tight and slowly permeable.

Ormsby loamy sand, hardpan variant, 0 to 2 percent slopes (OuA).—This nearly level soil is in valley basins. It is the only Ormsby variant soil in the Sierra Valley Area, and it has the profile described as representative for the series. Runoff is very slow, or the surface layer is ponded. The hazard of erosion is none to slight.

Included with this soil in mapping are areas of Lovejoy soil. The area near the dry lake in Long Valley has been hummocked by wind and in places is studded with large granitic boulders. In this area deep, sandy, well-drained soils were included in some mapped areas.

This soil is used for saltgrass meadow pasture. Forage production is low. Capability unit VIw–1; range site 8.

Pasquetti Series

The Pasquetti series consists of poorly drained and very poorly drained soils that are forming in ashy lake sediment. They are in basins. Slopes range from 0 to 2 percent. Elevation ranges from 4,500 to 5,000 feet. Annual precipitation is 12 to 20 inches, and the average annual temperature is 48° to 50° F. The frost-free period is about 80 to 90 days. The natural vegetation is dominantly wet meadow species such as wire grass, sedges, moss, grasses, and forbs. Pasquetti soils are associated with Ramelli and James Canyon soils.

In a representative profile (fig. 17) the surface layer is very dark gray and dark-gray, moderately alkaline mucky silty clay and silty clay to a depth of about 20 inches. Below this it is 9 inches of dark-gray, moderately alkaline clay loam. The next layer is light-gray, moderately alkaline clay loam about 24 inches thick. Below this is white or grayish-brown, moderately alkaline very fine sandy loam and sandy loam that extends to a depth of more than 60 inches. The water table ranges from the surface to a depth of about 30 inches.

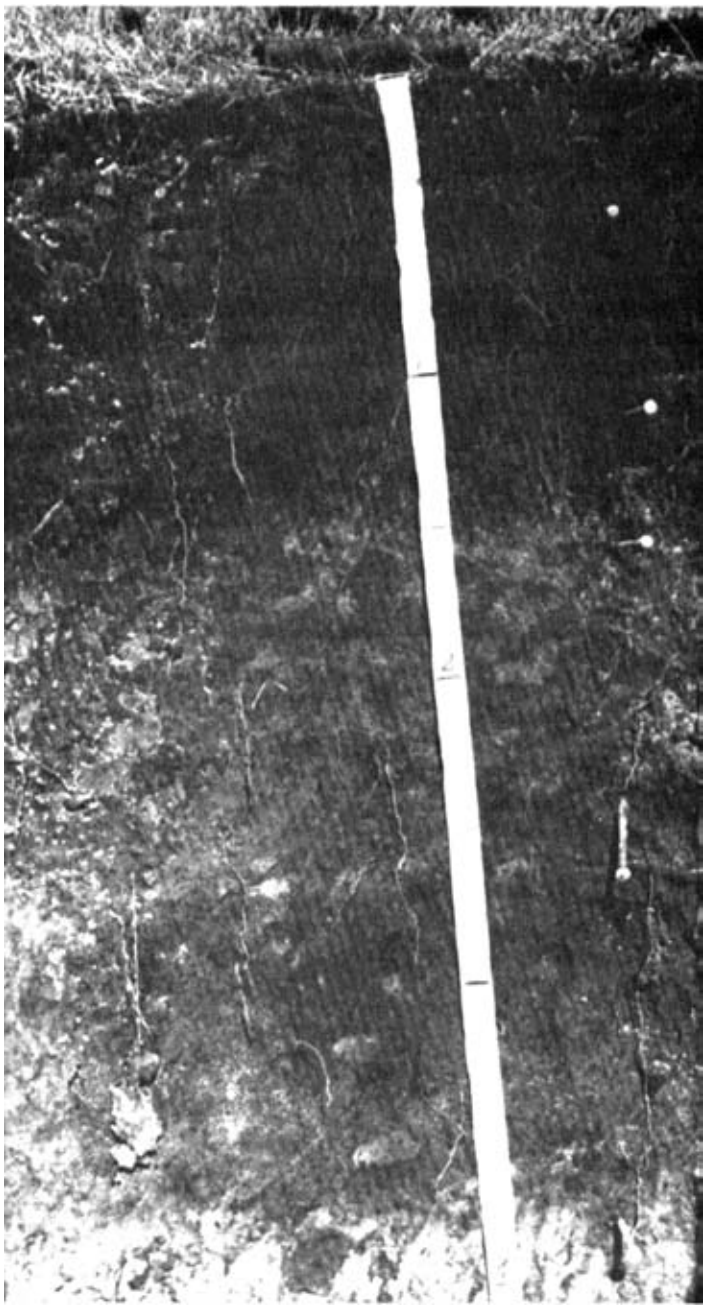

Figure 17.—**Profile of Pasquetti mucky silty clay. A banded layer of ash is at a depth of about 4 feet.**

Pasquetti soils are used mainly for wet meadow pasture.

Representative profile of nearly level Pasquetti mucky silty clay in a valley basin under sedges and wire grass (1,500 feet northeast of the southeast cen-

ter of sec. 12, T. 20 N., R. 14 E.; 1.25 miles north of Sierraville):

A11—0 to 6 inches, very dark gray (10YR 3/1) mucky silty clay, very dark brown (10YR 2/2) when moist; strong, very fine and fine, granular structure; slightly hard, slightly firm, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine and fine interstitial pores; moderately alkaline; clear, smooth boundary.

A12—6 to 13 inches, very dark gray (10YR 3/1) silty clay, black (10YR 2/1) when moist; moderate, fine, granular structure; slightly hard, slightly firm, slightly sticky and plastic; common very fine, fine, and medium roots; common very fine and fine tubular and interstitial pores; moderately alkaline; clear, slightly wavy boundary.

A13—13 to 20 inches, dark-gray (10YR 4/1) silty clay, black (10YR 2/1) when moist; strong, fine and medium, subangular and angular blocky structure; hard, slightly firm, sticky and plastic; common very fine, fine, and medium roots; common very fine and fine tubular and interstitial pores; thin continuous organic coatings on faces of peds; moderately alkaline; gradual, smooth boundary.

A14—20 to 29 inches, dark-gray (10YR 4/1) clay loam, very dark brown (10YR 2/2) when moist; moderate, fine and medium, subangular and angular blocky structure; hard, slightly firm, sticky and plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores and common medium tubular pores; many thin clay films and organic stains on faces of peds and in pores; moderately alkaline; gradual, smooth boundary.

C1g—29 to 43 inches, light-gray (10YR 6/1) clay loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; black (10YR 2/1) with common, medium, distinct, dark-brown (10YR 3/3) mottles when moist; moderate, fine and medium, subangular and angular blocky structure; slightly hard, friable, sticky and plastic; few fine and medium roots; few fine and medium pores; moderately alkaline; abrupt, smooth boundary.

IIC2—43 to 50 inches, white (10YR 8/1) very fine sandy loam that has yellowish-brown (10YR 5/6) mottles, light brownish gray (10YR 6/2) and has common medium, prominent, brown (7.5YR 5/4) mottles when moist; massive; slightly hard, slightly firm, slightly sticky and slightly plastic; few fine roots; few fine and medium tubular pores; moderately alkaline; abrupt, smooth boundary.

IIIC3—50 to 60 inches, grayish-brown (10YR 5/2) sandy loam that has white (10YR 8/1) flecks, very dark gray (10YR 3/1) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; very few fine roots; many very fine and fine interstitial pores; moderately alkaline.

These soils have a covering of thick organic sod. The ashy C horizon is gray to white or grayish brown. It is low in content of organic matter, high in content of silica, and low in content of plant nutrients. The ashy C horizon serves as an aquifer that carries ground water. Mottles are between depths of 15 and 30 inches. None to about 5 percent cobbles and gravel are present throughout the profile.

Pasquetti mucky silty clay (Pa).—This nearly level soil is in basins. It has the profile described as representative for the Pasquetti series.

The water table is at a depth of 20 to 30 inches. This soil is poorly drained. Permeability is slow. The available water capacity is 9 to 10 inches, based on drained soil. The effective rooting depth is more than 60 inches in drained areas. Many plant roots are restricted by the water table. Runoff water ponds on the surface. The hazard of erosion is none to slight.

This soil merges with the better drained, higher alluvial fans. In places, small areas of loamy soils that have ashy or gravelly layers below the surface are included in mapping.

This soil is used mainly for meadow pasture. Where surface water is controlled by ditching, some areas are cut for hay. This soil is a suitable habitat for ducks and geese. Trout thrive in the major meadow waterways. Capability unit VIw–1; range site 8.

Pasquetti mucky silty clay, thick surface (Pd).—This nearly level soil is in basins. It has a profile similar to that of the soil described as representative for the Pasquetti series, but this soil has a surface mat of plant roots, plant remains, and moss 6 to 14 inches thick. Mottles are at a depth of about 15 inches. Included in mapping are small areas of better drained, sandy soils.

The ashy substratum is underlain by very slowly permeable clay lake deposits at a depth of 30 to 60 inches. These deposits tend to restrict the movement of water and roots. This soil is very poorly drained. The available water capacity is 4.5 to 8 inches. The water table is at or near the surface, and surface water tends to pond on this soil. The hazard of erosion is slight to none.

This soil is used mainly for meadow pasture. The grazing period is quite limited because of wetness. Hay cutting is rare except in areas that are drained by open ditches. Capability unit VIw–1; range site 8.

Portola Series

The Portola series consists of well-drained soils that are forming, at a depth of 30 to 40 inches, in mixed, ashy material on the volcanic uplands. These soils are mainly on mountainous uplands and rolling hills on the northwestern and western rims of Sierra Valley. Slopes range from 9 to 50 percent. Elevation ranges from 4,800 to 6,000 feet. Annual precipitation is 14 to 24 inches, and the average annual temperature is 46° to 47° F. The frost-free period is 50 to 60 days. The natural vegetation is moderately dense to open stands of ponderosa and Jeffrey pine mixed with some cedar, sugar pine, white fir, and black oak. Bitterbrush, big sagebrush, manzanita, perennial and annual grasses, and forbs are in the understory, or in open, treeless areas. Portola soils are in the same general areas as Delleker and Trojan soils.

In a representative profile the surface layer is light-gray and light brownish-gray, medium acid cobbly coarse sandy loam about 9 inches thick. The upper part of the subsoil is very pale brown, medium acid coarse sandy loam about 8 inches thick. The lower part of the subsoil is light-brown, medium acid coarse sandy loam. This is underlain, at a depth of 30 inches, by reddish-yellow, softly consolidated, tuffaceous material.

Permeability is rapid. Available water capacity is 2 to 3.5 inches. The effective rooting depth is 30 to 40 inches.

The Portola soils are used mainly for producing timber. Some open areas afford fair grazing for livestock and wildlife.

Representative profile of Portola cobbly coarse sandy loam in an area facing west where slope is 10 percent; under mixed conifers, manzanita, annual and perennial grasses on strongly sloping upland (1,320 feet north of the southwest corner of sec. 3, T. 22 N., R. 14 E.; 3.5 miles southeast of Portola) :

A11—0 to 3 inches, light-gray (10YR 6/1) cobbly coarse sandy loam, dark brown (10YR 3/3) when moist; weak, thick, platy and moderate, fine, granular structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; medium acid; clear, smooth boundary.

A12—3 to 9 inches, light brownish-gray (10YR 6/2) cobbly coarse sandy loam, brown (7.5YR 4/2) when moist; weak, fine, subangular blocky structure; soft, friable, nonsticky and nonplastic; many fine and medium roots; many very fine and fine tubular and interstitial pores; medium acid; gradual, smooth boundary.

B1—9 to 17 inches, very pale brown (10YR 7/3) coarse sandy loam, brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many fine and medium roots and common coarse roots; common fine and medium tubular pores and many very fine and fine interstitial pores; medium acid; gradual, smooth boundary.

B2—17 to 30 inches, light-brown (7.5YR 6/4) coarse sandy loam, brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine and medium roots and few coarse roots; common fine and medium tubular pores and many very fine and fine interstitial pores; few thin clay films in pores and as bridges; medium acid; abrupt, wavy boundary.

C—30 to 35 inches, reddish-yellow (7.5YR 7/6) matrix that has varicolored sand and gravel; partly consolidated tuffaceous material; moderately thick clay films along fractures.

The A horizon ranges from cobbly sandy loam to cobbly coarse sandy loam. The B horizon is slightly finer textured sandy loam or loam. Some areas near the valley floor have variably stratified, gravelly C horizons.

The amount of loose rock fragments in the soil ranges from 10 to 35 percent, and the fragments range in size from gravel to stone. Stones and cobbles cover 5 to 20 percent of the surface in some areas. Depth to tuffaceous sediment or weathered rock ranges from 30 to 50 inches.

Portola cobbly coarse sandy loam, 9 to 30 percent slopes (PrE).—This rolling to hilly soil is on the hills and mountainous uplands. It has the profile described as representative for the Portola series. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

Included with this soil in mapping are areas of Delleker soils. Also included, in some of the areas that adjoin the higher uplands, are areas of shallow soils that are similar to the Aldax soils. Other areas have exposed rock outcroppings of granodiorite, basalt, andesite, or rhyolite. These rocks underlie the tuffaceous material.

This soil is used for producing timber. Also, it provides some pasture for livestock and deer. Capability unit VIe–1; woodland suitability group 1.

Portola cobbly coarse sandy loam, 30 to 50 percent slopes (PrF).—This soil is on the mountainous uplands. It has a profile similar to that of the soil described as representative for the Portola series, but this soil is much steeper. Runoff is rapid, and the hazard of erosion is high.

Included with this soil in mapping are small areas of a shallow soil that is similar to Aldax soils. Also included are outcroppings of the basement rocks that underlie the tuffaceous material. Areas of soils that are less than 30 inches deep to the tuffaceous materials are also included.

This soil is used almost exclusively to grow trees for timber. Most timber stands are young and growing at moderate rates. Capability unit VIIe–1; woodland suitability group 1.

Portola Series, Moderately Well Drained Variant

These variants of the Portola series consists of moderately well drained soils that are underlain by variably stratified lake deposits. These soils are on alluvial fans and valley bottoms. Slopes range from 0 to 2 percent. Elevation ranges from 4,900 to 5,200 feet. Annual rainfall is 16 to 22 inches, and the average annual temperature is 48° to 50° F. The frost-free period is 50 to 60 days. The natural vegetation is low sagebrush, silver sagebrush, annual and perennial grasses, and forbs. These variants are associated mainly with Pasquetti, Ramelli, and Calpine soils.

In a representative profile (fig. 18) the surface layer is grayish-brown, medium acid loam about 10 inches thick. The next layers are light brownish-gray or light-gray, slightly acid or medium acid ashy sandy loam, loam, and gravelly loamy coarse sand. This material is underlain, at a depth of 37 inches, by light brownish-gray, neutral gravelly sandy clay loam and pale-olive, mildly alkaline clay that extends to a depth of more than 60 inches.

Permeability is slow. Available water capacity is 6 to 8 inches. The effective rooting depth is 48 to 60 inches. Both are restricted by the clayey substratum. A water table is at a depth of 48 to 60 inches.

These soils are used for growing hay and for pasture.

Representative profile of Portola loam, moderately well drained variant (100 feet east of County Road A23, 100 feet east of the center of sec. 28, T. 21 N., R. 14 E.; about 0.5 mile south of the current Calpine dump) :

A11—0 to 3 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, thick, platy structure; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine roots and common medium and coarse roots; many very fine tubular and interstitial pores; medium acid; clear, smooth boundary.

A12—3 to 10 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, thick, platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium and coarse roots; many very fine tubular and interstitial pores; medium acid; gradual, smooth boundary.

C1—10 to 19 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure: slightly hard, friable, slightly sticky and nonplastic; common very fine and fine roots; common very fine, fine, and medium tubular and interstitial pores and

Figure 18.—**Profile of Portola loam, moderately well drained variant.**

few coarse tubular and interstitial pores; medium acid; clear, smooth boundary.

IIC2—19 to 29 inches, light-gray (2.5Y 7/2) and light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine, fine, and medium and few coarse tubular pores; slightly acid; abrupt, slightly wavy boundary.

IIIC3—29 to 37 inches, light brownish-gray (2.5Y 6/2) gravelly loamy coarse sand that has many varicolored pebbles, grayish brown (2.5Y 5/2) and has varicolored pebbles when moist; massive; soft, very friable, nonsticky and nonplastic; 30 percent gravel, dominantly rounded rhyolitic pebbles; very few very fine roots; common fine tubular and common very fine interstitial pores; medium acid; abrupt, smooth boundary.

IIIC4—37 to 51 inches, light brownish-gray (10YR 6/2) gravelly sandy clay loam, dark grayish brown (10YR 4/2) when moist; massive; hard, firm, slightly sticky and slightly plastic; varicolored gravel that has dark grayish-brown (10YR 4/2) clay coatings; some black manganese shot; no roots; common very fine tubular and interstitial pores; many moderately thick clay films in pores and bridging sand grains and gravel fragments; neutral; abrupt, slightly wavy boundary.

IVC5—51 to 64 inches, pale-olive (5Y 6/3) clay, light olive brown (2.5Y 5/4) when moist; moderate, medium, prismatic structure; hard, firm, sticky and plastic; few white (N 9/0) gravel fragments; no roots; few very fine tubular pores; continuous moderately thick clay films on faces of peds (may be pressure faces); mildly alkaline.

The A horizon is grayish brown, gray, light gray or light brownish gray in hues of 10YR and 2.5Y. It ranges in texture from loam to sandy loam, and in some areas it is gravelly. The A11 horizon, when undisturbed, has platy structure, but is often granular when cultivated. Reaction of the A horizon is slightly acid or medium acid. The C horizon down to a depth of about 30 inches is similar to the A horizons in texture and reaction. Colors range to light gray, light brownish gray, or nearly white and are generally paler than those of the surface layer. Below a depth of about 30 inches, the unrelated C horizons are stratified and variable in color, texture, and thickness. These horizons are light gray, light brownish gray, or bands of white. In places rhyolitic gravel and cobbles constitute 10 to 25 percent, by volume, of these horizons. Textures include loamy coarse sand, loam, and sandy clay loam. Total thickness of these gravelly horizons varies from 20 to 30 inches. Pale-olive, gleyed gravelly clay or clay lake deposits occur at a depth of 48 to 60 inches.

Depth to the gravelly loamy coarse sand IIIC horizon ranges from 23 to 35 inches, and depth to the IVC horizon of clayey lake sediment is generally more than 50 inches. Some areas have the appearance of "alkali ground" because of the spotty appearance of the vegetation and the pale color of the A11 horizon, but reaction is medium or slightly acid. Under the microscope the upper soil material has a high content of devitrified glass and diatoms (small fossils of former marine life). This material has a high content of silica, which contributes little in the way of plant nutrients.

Portola loam, moderately well drained variant (Ps).—This nearly level soil is on alluvial fans and valley bottoms. It is the only Portola variant soil mapped in the Area and has the profile described as representative for the series. Included in mapping are areas of Ramelli and Pasquetti soils. Runoff is slow, and the hazard of erosion is slight.

This soil is easy to work and cultivate, but only a small acreage is cropped. A few acres are planted to grain; yields are poor and spotty, and young stands are commonly grazed as pasture. Most areas are unimproved and used as sagebrush range. Capability unit VIe–1; range site 1.

Quincy Series

The Quincy series consists of excessively drained, windblown sands. These soils formed in granitic alluvium that has been extensively modified by wind action. They are on dunelike terraces and areas where the sandy material has been blown up against hillsides. These inextensive soils are in only one area.

This area is about 1½ miles north of the village of Chilcoot, on either side of the road to the Frenchman Reservoir. Slopes range from 2 to 15 percent. Elevation ranges from 4,900 to 5,500 feet. Annual precipitation is 8 to 12 inches, and the average annual temperature is about 48° to 50° F. The frost-free period is about 60 to 90 days. The natural vegetation is sparse. It consists of an open stand of big sagebrush and a few forbs and grasses. Quincy soils are associated with Galeppi and Mottsville soils.

In a representative profile the upper part of the surface layer has not been stabilized by vegetation and consists of pale-brown, slightly acid, winnowed sand about 2 inches thick. It commonly collects as a pedestal at the base of the sagebrush. The lower part of the surface layer is about 8 inches of brown, slightly acid sand that contains a little organic matter. The next layer is pale-brown, slightly acid sand about 10 inches thick. This is underlain by very pale brown, slightly acid sand that extends to a depth of more than 60 inches.

Permeability is rapid. Available water capacity is 3 to 5 inches. The effective rooting depth is more than 60 inches.

These soils are used mainly for unimproved range.

Representative profile of gently sloping Quincy sand on a northwest-facing beach terrace; under big sagebrush, bitterbrush, silver sagebrush, and rabbitbrush (1,000 feet west of the north quarter corner of sec. 25, T. 23 N., R. 16 E.; 1.75 miles north of Chilcoot and 150 feet west of the Frenchman Lake Road) :

A11—0 to 2 inches, pale-brown (10YR 6/3) sand, brown (10YR 5/3) when moist; single grained; loose, nonsticky and nonplastic; no roots; many very fine interstitial pores; slightly acid; clear, smooth boundary.

A12—2 to 10 inches, brown (10YR 5/3) sand, dark brown (10YR 3/3) when moist; single grained; loose, nonsticky and nonplastic; common fine and coarse roots; many fine interstitial pores; slightly acid; clear, smooth boundary.

AC—10 to 20 inches, pale-brown (10YR 6/3) sand, yellowish brown (10YR 5/4) when moist; single grained; loose, nonsticky and nonplastic; common fine and coarse roots; many fine interstitial pores; slightly acid; clear, smooth boundary.

C—20 to 78 inches, very pale brown (10YR 7/3, 7/4) sand, light yellowish brown (10YR 6/4) when moist; single grained; loose, nonsticky and nonplastic; few fine roots; many fine interstitial pores; slightly acid.

The depth of these soils is more than 10 feet in most areas, except where the mantle becomes thin and feathered on the upper slopes of rocky knolls. The grain size of the sand is fairly uniform, mostly medium sand. Soil reaction is slightly acid or neutral throughout the profile.

Quincy sand, 2 to 15 percent slopes (QuD).—This is the only Quincy soil mapped in the Area. Most areas are hummocky and gently sloping, and a small acreage on side hills is moderately steep. Drifts or dunes range from 1 to 3 feet in height. The landscape is unstabilized and drifting. Runoff is slow, and the hazard of erosion by water is moderate. The hazard of wind erosion is high to very high.

Included with this soil in mapping are areas of Mottsville and Galeppi soils. Also included are areas of very deep sand that has a dark-brown surface layer, especially on long, smooth slopes.

This soil has little value for farming aside from providing a little light grazing for livestock and wildlife. It is a good source of sand for building material. The content of organic matter is very low, particularly in the layer below the surface layer, and the sand has little or no silt or clay mixed with it. Capability unit VIIe–1; range site 7.

Ramelli Series

The Ramelli series consists of poorly drained and very poorly drained soils that are forming in fine-textured alluvium from various sources. They are commonly in meadowlands of the Sierra Valley. Slopes range from 0 to 2 percent on the valley floor, in swales, and in drainageways. Elevation ranges from 4,500 to 5,000 feet. Annual precipitation is 12 to 18 inches, and the average annual temperature is 48° to 50° F. The frost-free period is about 80 to 90 days. The natural vegetation consists of wet meadow grasses and forbs, including sedges and wire grass. Ramelli soils are associated mainly with Balman and Loyalton soils.

In a representative profile (fig. 19) the surface layer is dark-gray and dark grayish-brown, slightly acid silty clay and clay about 7 inches thick. The subsoil is dark-gray and gray, slightly acid to mildly alkaline clay and sandy clay loam about 19 inches thick. This is underlain by light brownish-gray or gray, moderately alkaline to slightly acid, stratified sandy loam to gravelly coarse sand. This layer extends to a depth of more than 77 inches. Below this is pale-olive and pale-yellow, slightly acid clay.

Permeability is slow. When drained, the Ramelli soils have an effective rooting depth of more than 60 inches and an available water capacity of 6 to 8 inches.

Ramelli soils are used mainly for meadow pasture. Some drained areas are planted to oats, barley, or improved pasture.

Representative profile of nearly level Ramelli clay in valley basin; under wire grass, sedges, bluegrass, and annual grasses (100 feet south and 300 feet east of the center of sec. 28, T. 22 N., R. 15 E.; 600 feet east of Heriot Lane) :

A11—0 to 2 inches, dark-gray (10YR 4/1) silty clay, black (10YR 2/1) when moist; moderate, very thin, platy structure; soft, friable, sticky and slightly plastic; many very fine roots and few fine and medium roots; many very fine tubular pores and few very fine interstitial pores; slightly acid; clear, smooth boundary.

A12—2 to 7 inches, dark grayish-brown (10YR 4/2) clay, black (10YR 2/1) when moist; weak, thick, platy structure that parts to moderate, fine, granular; soft, friable, sticky and slightly plastic; many very fine roots and common fine and medium roots; many very fine tubular pores, few fine and medium tubular pores, and few very fine interstitial pores; few thin clay films in pores; slightly acid; gradual, smooth boundary.

B21g—7 to 14 inches, gray (N 5/0) clay, black (N 2/0) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine, fine, and medium roots;

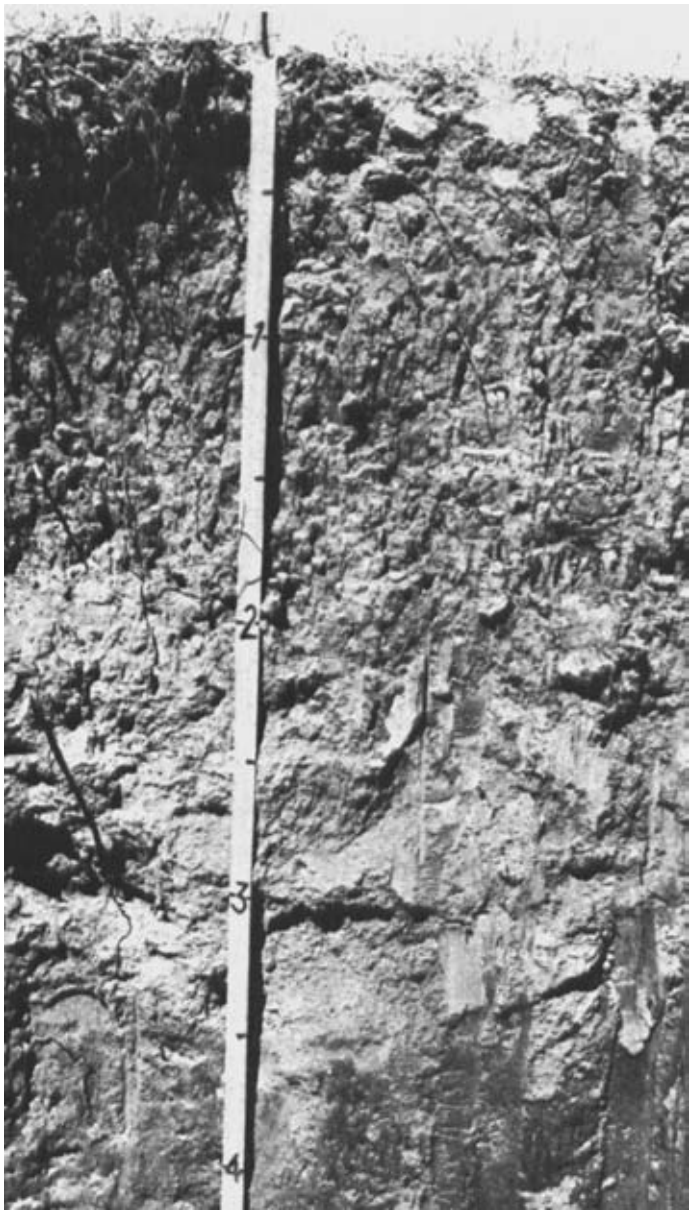

Figure 19.—**Profile of Ramelli clay. The subsoil of this soil has strong prismatic structure. The sandy substratum is at a depth of about 30 inches.**

many very fine tubular pores, few fine and medium tubular pores, and few very fine interstitial pores; few thin clay films in pores; slightly acid; clear, smooth boundary.

B22g—14 to 18 inches, dark-gray (N 4/0) clay, black (N 2/0) when moist; strong, medium, prismatic structure that parts to strong, coarse, angular blocky; very hard, firm, very sticky and plastic; common very fine roots and few fine and medium roots; mainly exped; few very fine and fine tubular pores; few thin clay films in pores and on faces of peds; many moderately thick organic stains on faces of peds; neutral; clear, slightly wavy boundary.

IIB3g—18 to 26 inches, gray (10YR 5/1) sandy clay loam, dark gray (10YR 4/1) when moist; strong, medium, prismatic structure that parts to strong, coarse, angular blocky; extremely hard, very firm, sticky and plastic; few very fine, fine, and medium exped roots; few very fine and fine tubular pores; few thin clay films in pores and on faces of peds; many moderately thick organic stains on faces of peds; mildly alkaline; strongly effervescent; lime in soft masses; clear, slightly wavy boundary.

IIIC1g—26 to 28 inches, light brownish-gray (10YR 6/2) coarse sandy loam that has common, medium, light yellowish-brown mottles, grayish brown (10YR 5/2) when moist; weak, medium, prismatic structure; extremely hard, very firm, sticky and plastic; few fine and medium roots; common very fine tubular and interstitial pores and few fine tubular pores; common thin clay films in pores and on faces of peds; moderately alkaline; strongly effervescent, lime in soft masses; gradual, smooth boundary.

IIIC2g—28 to 34 inches, light brownish-gray (2.5Y 6/2) loamy coarse sand that has common, medium, faint, light yellowish-brown (2.5Y 6/4) mottles; dark grayish-brown (2.5Y 4/2) when moist; massive; slightly hard, firm, nonsticky and nonplastic; few fine and medium roots; common very fine tubular pores, few fine tubular pores, and common very fine interstitial pores; moderately alkaline; slightly effervescent, lime in soft masses; clear, smooth boundary.

IIIC3—34 to 45 inches, light brownish-gray (2.5Y 6/2) sandy loam that has common medium, prominent, reddish-yellow (7.5YR 6/6) mottles; dark grayish-brown (2.5Y 4/2) and has common, medium, prominent, strong-brown (7.5YR 5/8) mottles when moist; massive; hard, firm, slightly sticky and slightly plastic; very few fine and medium roots; few very fine tubular and interstitial pores; moderately alkaline; noncalcareous; clear, slightly wavy boundary.

IIIC4—45 to 64 inches, light brownish-gray (2.5Y 6/2) loamy coarse sand and coarse sand that has many, coarse, prominent, reddish-yellow (7.5YR 6/6) mottles; grayish-brown (2.5Y 5/2) and has many, large, prominent, strong-brown (7.5YR 5/8) mottles when moist; massive; soft, slightly firm, nonsticky and nonplastic; very few fine and medium roots; few very fine tubular pores and common very fine interstitial pores; mildly alkaline; noncalcareous; abrupt, slightly wavy boundary.

IVC5g—64 to 77 inches, gray (N 6/0) gravelly coarse sand that has common, medium, prominent, reddish-yellow (7.5YR 6/6) mottles; dark grayish brown (2.5Y 4/2) with common, medium, prominent, strong-brown (7.5YR 5/8) mottles when moist; massive; soft, friable, nonsticky and nonplastic; very few fine and medium roots; many very fine and fine interstitial pores and few fine tubular pores; slightly acid; noncalcareous; abrupt, slightly wavy boundary.

VC6g—77 to 83 inches, variegated pale-olive (5Y 6/4) and pale-yellow (5Y 7/3) clay, pale olive (5Y 6/3) and olive brown (2.5Y 4/4) when moist; massive; hard, firm, very plastic and sticky; no roots; few very fine tubular pores; slightly acid; noncalcareous.

These soils generally have a thick sod made up of grasses, sedges, roots, and decaying organic matter. The A11 horizon is dark grayish-brown or dark-gray silty clay or clay. The A12, A13, and B21 horizons are dark gray, gray, dark grayish brown, or grayish brown and have a slightly lower content of organic matter. Characteristically, mottling occurs at depths of 18 to 28 inches. At a depth of 25 to 40 inches is a stratified, coarse-textured, unrelated C horizon of sand, gravel, and coarse sandy loam to fine sandy loam. The sand particles are relatively fresh and unweathered, although somewhat rounded, and consist of quartz, feldspar, dark minerals, and mica. This coarse sediment is commonly underlain, at a depth of 5 feet or more, by pale-brown, pale-olive, pale-yellow, olive-brown, or bluish-gray clay that restricts movement of water.

The A horizon is slightly acid to medium acid. The B horizon and upper part of the C horizon are neutral to moderately alkaline and commonly have accumulations of disseminated lime. In some areas the soils are slightly to moderately saline. Ground water moves laterally in the sandy substratum, but during the year it fluctuates between depths of 18 inches and 5 feet. Free water is on the surface for long periods in some very poorly drained areas.

Ramelli clay (Ra).—This nearly level soil is in basins. It has the profile described as representative for the Ramelli series. Included in mapping are areas of Balman soils. Also included are some areas of soils that are similar to Ramelli soils but have a loam surface layer and a compact clay subsoil.

The water table is at a depth of 18 to 60 inches or more, depending upon the season. Runoff is very slow, and the hazard of erosion is none to slight. The soil is poorly drained.

This soil is used mainly for native meadow. Some areas near Beckwourth Lane and north of Loyalton have been drained, leveled, and seeded to improved pasture and small grains (fig. 20). Forage quality and production are much improved compared to the forage produced on native meadows. Capability unit IIIw–5.

Ramelli clay, very poorly drained (Rb).—This nearly level soil is in the wettest part of the Sierra Valley along drainage channels. It has a profile similar to the one described as representative for the Ramelli series (fig. 21). Most areas of this soil are flooded during the early spring months. The water table is commonly near the surface, and free water sometimes stands on the surface for long periods. The natural vegetation is wire grass, reeds, and sedges. The sod is 6 to 14 inches thick, in places, and resembles a peat or muck. This soil has essentially no hazard of erosion.

Figure 20.—**Improved pasture after seeding on Ramelli clay.**

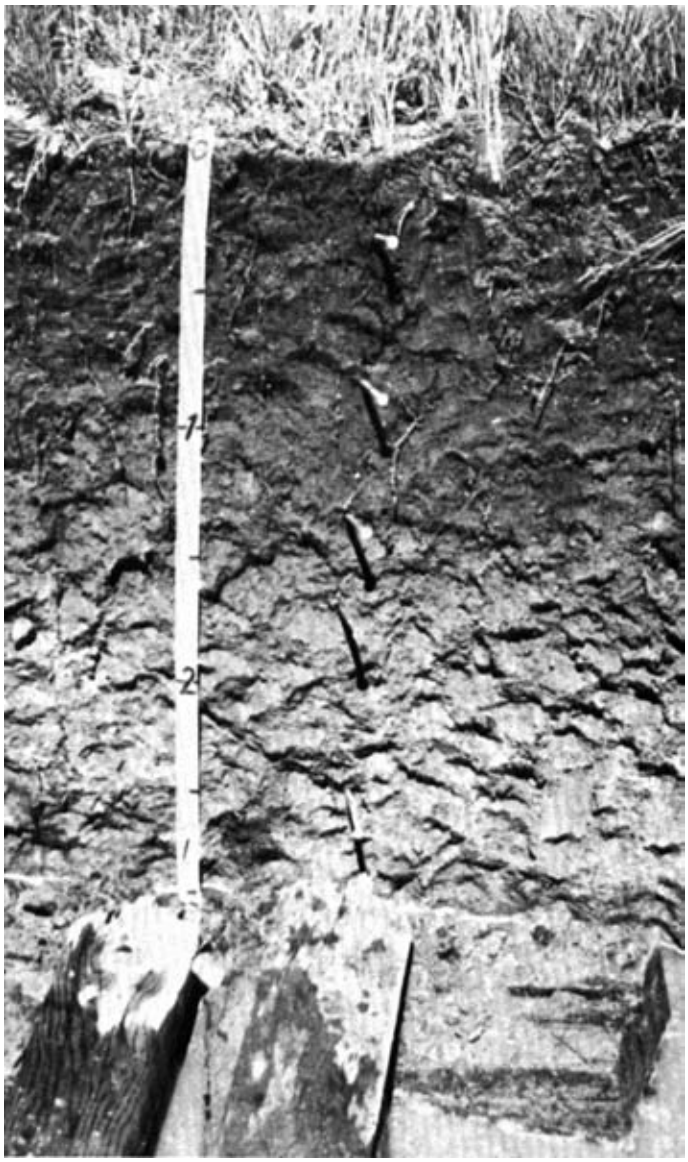

Figure 21.—**Profile on Ramelli clay, very poorly drained.**

Included with this soil in mapping are small areas of wet, loamy soils that are affected by salt and alkali. Some areas, on slightly elevated mounds, have loamy texture.

This soil is used almost exclusively for meadow pasture. Wet conditions delay haymaking. Capability unit VIw–1; range site 8.

Ramelli clay, very poorly drained, channeled (Rc).—This soil is along drainage channels and occupies some of the wettest areas in the Sierra Valley basin. Most areas are channeled by drainages from the Feather River and are subject to annual inundation and flooding. The dendritic pattern of the drainage channels isolates many areas by creating islands. Channels are too wide to be crossed by vehicles or livestock. This soil commonly has a thick, peaty surface layer, varying in thickness from 6 to 14 inches.

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Some areas are nearly without vegetation because of continual submergence. The surface layer in most areas is made up of plant remains, roots, and stems of such water-tolerant plants as sedges, wire grass, forbs, and mosses. In some areas the soil mass is unstable and seems to move underfoot. The underlying mineral soil is very dark in color, has a high content of organic matter, and consists of mucky silty clays and clays. In places, at a depth of 3 to 4 feet, the substratum consists of pale-gray ashy deposits, stratified sands and clays, or moderately fine textured lake deposits. The reaction of the mineral solum is mostly slightly acid. In places the substratum is neutral to mildly alkaline.

Included with this soil in mapping are small areas of saline-alkaline wet loam that has a subsoil of dense, compact clay.

The soil is used mainly for meadow pasture. It serves as a prime habitat for ducks, geese, and coot. Many of the streams have trout. Capability unit VIw–1; range site 8.

Reba Series

The Reba series consists of well-drained soils that are forming in old alluvial lake deposits. These soils are only in Long Valley, mainly in areas east of Long Valley Creek. They are on flats, in basins, and on foot slopes of alluvial fans. Slopes are commonly concave. They range from 2 to 30 percent. Elevation ranges from 4,500 to 5,200 feet. Annual precipitation is 6 to 12 inches, and the average annual temperature is 48° to 50° F. The frost-free period is 60 to 90 days. The natural vegetation is low-growing sagebrush, sparse grass, and a few forbs. A few juniper are on higher fans. Reba soils are associated mainly with Reno and Galeppi soils.

In a representative profile the surface layer is light brownish-gray and grayish-brown, medium acid and slightly acid sandy loam and sandy clay loam about 10 inches thick. The subsoil is grayish-brown, slightly acid to mildly alkaline silty clay and sandy clay loam about 15 inches thick. The substratum is light brownish-gray, moderately alkaline heavy sandy loam and coarse sandy loam that extends to a depth of more than 60 inches.

Permeability is slow. Available water capacity is 5 to 8 inches. The effective rooting depth is more than 60 inches, but some plant roots are restricted by the silty clay subsoil.

These soils are used for dry range. Few areas have been improved.

Representative profile of nearly level Reba sandy loam on an alluvial fan under stunted sagebrush, cheatgrass, and perennial grasses (1,200 feet north-northwest of the south quarter corner of sec. 11, T. 22 N., R. 17 E.; 0.63 mile southeast of Hallelujah Junction):

A11—0 to 4 inches, light brownish-gray (2.5Y 6/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium and thick, platy structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; many fine and medium vesicular pores; medium acid; abrupt, smooth boundary.

A12—4 to 7 inches, grayish-brown (2.5Y 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) when moist; massive and weak, thin, platy structure; slightly hard, friable, sticky and slightly plastic; common fine roots and many medium and coarse roots; common fine and medium tubular pores and common very fine interstitial pores; slightly acid; abrupt, wavy boundary.

A3—7 to 10 inches, grayish-brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard, friable, sticky and slightly plastic; common fine roots and many medium and coarse roots; common fine and medium tubular pores and common very fine interstitial pores; few thin clay films in pores and bridging sand grains; slightly acid; abrupt, smooth boundary.

B21t—10 to 15 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) when moist; strong, fine and medium, columnar structure; extremely hard, very firm, sticky and very plastic; common fine and medium, mostly exped roots; few fine tubular pores; continuous moderately thick clay films on faces of peds and in pores; white coatings on tops of columns; slightly acid; clear, smooth boundary.

B22t—15 to 21 inches, grayish-brown (2.5Y 5/2) silty clay; very dark grayish brown (2.5Y 3/2) when moist; strong, medium, angular blocky structure; extremely hard, very firm, sticky and very plastic; common fine and medium exped roots; very few fine tubular pores; many moderately thick clay films on faces of peds and in pores; neutral; clear, smooth boundary.

B3—21 to 25 inches, grayish-brown (2.5Y 5/2) sandy clay loam, very dark grayish brown (2.5Y 3/2) when moist; moderate, medium, angular blocky structure; very hard, firm, sticky and slightly plastic; few fine roots; few fine tubular pores; common thin clay films in pores and bridging sand grains; mildly alkaline; gradual, smooth boundary.

C1ca—25 to 40 inches, light brownish-gray (2.5Y 6/2) heavy sandy loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, angular blocky structure; very hard, firm, slightly sticky and slightly plastic; very few fine roots; few fine tubular and interstitial pores; common thin clay films in pores and bridging sand grains; strongly effervescent; lime segregated in white filaments, threads, and seams; intermittently cemented with lime; moderately alkaline; 5 percent small gravel; gradual, smooth boundary.

C2ca—40 to 49 inches, light brownish-gray (2.5Y 6/2) coarse sandy loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, angular blocky structure; very hard, firm, slightly sticky and nonplastic; very few fine roots; few fine tubular and interstitial pores; few thin clay films in pores and as bridges; strongly effervescent; lime segregated in white filaments, threads, and seams; intermittently cemented with lime; moderately alkaline; gradual, smooth boundary.

C3—49 to 66 inches, light brownish-gray (2.5Y 6/2) coarse sandy loam, dark grayish brown (2.5Y 4/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; 17 to 30 percent gravel below a depth of 56 inches; very few fine roots; few fine tubular and interstitial pores; strongly effervescent; lime disseminated; moderately alkaline.

The A horizon is weatherbeaten, weakly rilled, light brownish-gray or grayish-brown sandy loam, loam, or sandy clay loam. Reaction of the A horizon is medium acid to slightly acid. In some profiles a thin, indistinct, bleached, transitional A2 horizon of sandy clay loam is present. In places the A2 horizon is only a thin whitish capping that coats the columns of the underlying B2t horizon. The B2t horizon is grayish-brown or light olive-brown clay or silty clay. It is commonly at a depth of 7 to 15

inches and is 10 to 15 inches thick. The C horizon is light brownish-gray or light yellowish-brown heavy sandy loam, coarse sandy loam, or loamy sand. It ranges from 0 to 30 percent gravel. In places the C horizon is weakly cemented and is restrictive to roots. A few loose cobbles or stones are in some profiles.

Reba sandy loam, 2 to 30 percent slopes (ReE). This gently sloping to moderately steep soil has the profile described as representative for the Reba series. Included in mapping are small areas of Reno and Galeppi soils. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is used mainly for range. Precipitation is generally insufficient for improved dryland pasture. Capability unit VIe–1; range site 5.

Reno Series

The Reno series consists of well-drained soils that are forming in alluvium or lake sediment mixed with ashy sediments that is stratified mostly with lenses of sand, gravel, hard calichelike material, and some clay. These soils are underlain, at a depth of 20 to 36 inches, by a hardpan. They are on old lake terraces in Long Valley. The terraces are tabular or gently sloping (depending somewhat on the tilt or dip of the ancient lake sediment) and have side slopes that are strongly sloping. Slopes range from 2 to 15 percent. Elevation ranges from 4,500 to 5,500 feet. Annual precipitation is 6 to 12 inches, and the average annual temperature is 48° to 50° F. The frost-free period is 60 to 90 days. The natural vegetation is big sagebrush and cheatgrass and minor populations of other plants. Reno soils are associated mainly with Reba and Galeppi soils.

In a representative profile the surface layer is light brownish-gray, light-gray, and grayish-brown gravelly loamy coarse sand and sandy loam about 10 inches thick. It is medium acid and slightly acid. The subsoil is brown, light olive-brown, and light brownish-gray, neutral to moderately alkaline clay and silty clay about 16 inches thick. It is abruptly underlain by a lime- and silica-cemented hardpan.

Permeability is very slow. Available water capacity is 2 to 3.5 inches. The effective rooting depth is 20 to 36 inches, but growth of some plant roots is limited by the clay subsoil.

These soils are used mainly for range.

Representative profile of Reno sandy loam in an area facing northwest where slope is 11 percent; on an old terrace under sagebrush and perennial and annual grasses at an elevation of 5,040 feet (1,320 feet east and 1,320 feet south of the north quarter corner of sec. 14, T. 22 N., R. 17 E.; ¾ mile south of Hallelujah Junction and 100 feet west of U.S. Highway 395) :

A11—0 to 2 inches, light brownish-gray (10YR 6/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) when moist; single grained; loose, nonsticky and nonplastic; many very fine interstitial pores; medium acid; abrupt, smooth boundary.

A12—2 to 6 inches, light-gray (10YR 6/1) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, thick, platy structure; soft, friable, nonsticky and nonplastic; many very fine roots and common fine roots; many very fine and fine vesicular pores; slightly acid; clear, smooth boundary.

A&B—6 to 10 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, thick, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; common fine tubular pores and few medium tubular pores; few thin clay films in pores and as bridges on sand grains; slightly acid; abrupt, smooth boundary.

B21t—10 to 15 inches, brown (10YR 5/3) clay, dark yellowish brown (10YR 4/4) when moist; brown (10YR 4/3) and dark-brown (10YR 3/3) coatings on faces of peds when moist; strong, medium, columnar structure; very hard, firm, sticky and plastic; few very fine and fine exped roots; common fine tubular pores and few medium tubular pores; continuous, moderately thick clay films in pores and on faces of peds; neutral; clear, smooth boundary.

B22t—15 to 21 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) when moist; dark yellowish-brown (10YR 4/4) coatings on faces of peds, very dark grayish brown (2.5Y 3/2) when moist; moderate, medium, prismatic structure; very hard, firm, sticky and plastic; few very fine and fine exped roots; common very fine tubular pores; continuous, moderately thick clay films in pores and on faces of peds; mildly alkaline; clear, smooth boundary.

B3—21 to 26 inches, light brownish-gray (2.5Y 6/2) silty clay, brown (10YR 4/3) when moist; brown (10YR 4/3) clay films in pores, dark brown (10YR 3/3) when moist; weak, fine and medium, angular blocky structure; hard, slightly firm, slightly sticky and plastic; few very fine and fine exped roots; few fine tubular pores; many thin clay films in pores and on faces of peds; moderately alkaline; no effervescence when treated with dilute HCl; abrupt, smooth boundary.

C1m—26 to 40 inches, pale-olive (5Y 6/3) indurated hardpan, olive brown (2.5Y 3/4) when moist; brown (10YR 4/3) clay films in pores, olive brown (2.5Y 4/4) when moist; massive; no roots; few very fine tubular pores; strongly alkaline; strongly effervescent; lime disseminated; gradual, irregular boundary.

C2—40 to 60 inches, pale-olive (5Y 6/3) very gravelly loamy sand, olive brown (2.5Y 3/4) when moist; massive; slightly hard and hard, friable, nonsticky and nonplastic; no roots; many very fine interstitial pores; moderately alkaline; strongly effervescent, lime disseminated.

Some scattered stones, rounded cobbles, and pebbles are on the surface and a few cobbles and pebbles are in the soil material. A sizable acreage north of Highway 70 and Hallelujah Junction is comparatively free of stones. The B2t horizon may be 5 to 18 inches thick. The C1m horizon differs in composition and texture from place to place. Most commonly it is indurated sand, but in places it consists of sand, gravel and cobbles cemented as in a conglomerate. Below the C1m horizon these soils grade into loosely consolidated, mostly coarse-textured, stratified sediment. The color of the B2t horizon ranges from grayish brown to brown to yellowish brown or light olive brown. This horizon is at a depth of 10 to 15 inches, and it is not easily penetrated by roots.

Reno sandy loam, 2 to 15 percent slopes (RtD).—This gently sloping to strongly sloping soil has the profile described as representative for the Reno series. Runoff is slow, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Rough broken land, especially along terrace breaks. Also included are areas in adjoining swales and fans where the soil is deep and has no clay subsoil or hardpan. In some areas near fault or terrace scarps, slopes

are as much as 30 percent. Also, the soil is cobbly or stony in some areas.

This soil is used almost exclusively for dry range for sheep and cattle. The range condition class is poor. Capability unit VIs–1; range site 4.

Riverwash

Riverwash (Rw) consists of stony, cobbly, gravelly, and sandy stringers of waterworn material that is carried along and deposited in waterways and drainage channels. This land type is throughout the survey area in drainageways extending to the Sierra Valley floor and along Long Valley Creek in Long Valley. The stone fragments generally range from ½ inch to more than 10 inches in diameter. Most of this material is deposited during periods of flooding. Profiles and bank cuts indicate that 40 to 90 percent of the material consists of stone and gravel with very few fines.

Scant brush and grass cover is in some areas, but it has little or no grazing value. Most areas are subject to flooding during the rainy season. Capability unit VIIIw–1.

Rough Broken Land

Rough broken land (RyF) is a land type that consists of steep terrace escarpments, very shallow ridge crests, and eroded flats on the east slope of Long Valley. It is on old, tilted lake terraces of Pliocene age. The material is generally less than 10 inches deep and gravelly. It is underlain by hardpanlike strata similar to siltstone or sandstone. Some areas of deeper soils are included on foot slopes of hills. Vegetation is sparse. It consists mostly of big sagebrush, cheat grass, open stands of juniper, and lesser populations of Indian ricegrass, Stipa species, turkey mullein, cutleaf balsam root, and other forbs. Eroded, bare escarpment faces are quite evident. Slopes are dominantly more than 30 percent; but in some areas of foot slopes and ridges, slopes are only 5 to 10 percent.

This land type has very little value for farming other than serving as a part of the wildlife habitat for deer, rabbits, chukar, and sage hens. It is a part of the watershed that contributes to the Long Valley Creek drainage. Capability unit VIIIs–1.

Saralegui Series

The Saralegui series consists of well-drained soils that are forming in ashy lake deposits. They are on gentle swales and foot slopes or on terraces, mostly east of Long Valley Creek and south of Hallelujah Junction along U.S. Highway 395. Slopes range from 2 to 15 percent. Elevation ranges from 4,500 to 5,200 feet. Annual precipitation is 6 to 12 inches, and the average annual temperature is 48° to 50° F. The frost-free period is 60 to 90 days. The natural vegetation is big sagebrush, cheatgrass, Sandberg bluegrass, Indian ricegrass, squirreltail, and some scattered bitterbrush and forbs. Saralegui soils are associated mainly with Trosi, Reno, and Reba soils.

In a representative profile the surface layer is light-gray, medium acid sandy loam about 4 inches thick. The subsoil is light brownish-gray, neutral heavy loam, sandy clay loam, and gravelly sandy clay loam about 47 inches thick. This is underlain by light-gray, mildly alkaline light sandy loam that extends to a depth of more than 60 inches.

Permeability is moderately slow. Available water capacity is 7.5 to 9 inches. The effective rooting depth is more than 60 inches.

These soils are mostly unimproved and are used for sagebrush range.

Representative profile of Saralegui sandy loam on an alluvial fan in an area facing west where slope is 5 percent; under sagebrush and grass (0.25 mile west-northwest of the center of sec. 1, T. 21 N., R. 17 E.; 1.25 miles northwest of the plant quarantine station and 600 feet east of U.S. Highway 395) :

A1—0 to 4 inches, light-gray (10YR 6/1) sandy loam, dark gray (10YR 4/1) when moist; moderate, thin, platy structure; soft, friable, slightly sticky and nonplastic; many very fine, fine, and medium roots; common very fine and fine vesicular pores; medium acid; abrupt, smooth boundary.

B11t—4 to 12 inches, light brownish-gray (10YR 6/2) heavy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine, fine, and medium tubular and interstitial pores; few thin clay films in pores and bridging mineral grains; neutral; gradual, smooth boundary.

B12t—12 to 22 inches, light brownish-gray (10YR 6/2) light sandy clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; hard, slightly firm, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; common very fine, fine, and medium tubular and interstitial pores; few thin clay films in pores and bridging mineral grains; neutral; clear, smooth boundary.

B2t—22 to 36 inches, variegated light brownish-gray (10YR 6/2) and light-gray (10YR 7/2) sandy clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, angular blocky structure; very hard, firm, sticky and slightly plastic; common very fine and fine roots and few medium roots; few very fine and fine tubular and interstitial pores; common thin clay films in pores and bridging mineral grains; neutral; clear, wavy boundary.

B3t—36 to 51 inches, variegated light brownish-gray (10YR 6/2) and light-gray (10YR 7/2) gravelly sandy clay loam, brown (10YR 4/3) when moist; massive; very hard, firm, sticky and plastic; few very fine, fine, and medium roots; common very fine and fine tubular and interstitial pores; few thin clay films in pores and bridging mineral grains; neutral; clear, wavy boundary.

C—51 to 61 inches, light-gray (10YR 7/2) light sandy loam, dark grayish brown (2.5Y 4/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine interstitial pores and few very fine tubular pores; slightly effervescent; lime disseminated; mildly alkaline.

The A horizon ranges from gravelly loamy coarse sand to sandy loam. Color ranges from gray to light gray. Reaction ranges from slightly acid to medium acid. The B2t horizon has weak to strong blocky structure. In places it is tilted or inclined because of faulting. Reaction is slightly acid to neutral. Laboratory studies indicate a large amount of volcanic glass throughout the profile.

Saralegui sandy loam, 2 to 15 percent slopes (SaD). —This gently sloping to strongly sloping soil has the

profile described as representative for the Saralegui series. Most areas of this soil are concave to gently sloping and are on alluvial fans between higher tabular terraces. Some areas are on the sides of terraces. Included in mapping are small areas of Reno and Reba soils and areas of soils that have slopes in excess of 15 percent. Runoff is medium, and the hazard of erosion is moderate.

This soil is used for dry range. Most areas are not cropped because of the scarcity of irrigation water. Annual rainfall is generally insufficient for highly productive dryland grain or pasture. The soils provide a suitable habitat for chukar, sage hen, and other wildlife. Capability unit IVe–1; range site 2.

Sattley Series

The Sattley series consists of well-drained soils that are forming at a depth of 40 to 60 inches or more in very stony volcanic debris, including andesitic conglomerate, basaltic flow rock, or colluvium from these sources. These soils are on foot slopes and knolls adjacent to the valley floor and on mountainous slopes to the south. Slopes range from 2 to 50 percent. Elevation ranges from 5,000 to 8,000 feet. Annual precipitation is 14 to 22 inches, and the average annual temperature is 45° to 47° F. The frost-free period is about 30 to 60 days. The natural vegetation is ponderosa and Jeffrey pine; scattered white fir, cedar, and black oak; and an understory of brush, grass, and forbs. Sattley soils are closely associated with Trojan soils.

In a representative profile the surface layer is grayish-brown, slightly acid and medium acid extremely stony sandy loam about 15 inches thick. The subsoil is light brownish-gray, medium acid extremely stony sandy clay loam and extremely stony clay loam that extends to a depth of about 46 inches. It is underlain by cemented andesitic conglomerate.

Permeability is moderate. The available water capacity is 3 to 5 inches, and the effective rooting depth is 40 to more than 60 inches.

The Sattley soils are used almost exclusively for producing timber. Some areas are brushy and provide cover for wildlife.

Representative profile of Sattley extremely stony sandy loam on uplands in an area facing north where slope is 10 percent; under Jeffrey pine, incense cedar, and mountain-mahogany at an elevation of 5,120 feet (2,000 feet southwest of the northeast corner of sec. 24, T. 21 N., R. 15 E., 1.5 miles south of Loyalton):

O1&O2—4 inches to 0, fresh pine needles, twigs, and litter and decomposed forest litter, duff, and humus.

A1—0 to 10 inches, grayish-brown (10YR 5/2) extremely stony sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine, fine, and medium roots; common very fine tubular and interstitial pores and few fine tubular and interstitial pores; about 25 percent stones, cobbles, and gravel by volume; slightly acid; gradual, smooth boundary.

A3—10 to 15 inches, grayish-brown (10YR 5/2) extremely stony heavy sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; common very fine tubular and interstitial pores and few fine tubular and interstitial pores; 30 percent stones, cobbles, and gravel by volume; medium acid; gradual, smooth boundary.

B1t—15 to 22 inches, light brownish-gray (10YR 6/2) extremely stony sandy clay loam, dark yellowish brown (10YR 3/4) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and coarse roots; common very fine and few fine tubular and interstitial pores; few thin clay films in pores; few colloid stains on mineral grains and stones; about 35 percent stones, cobbles, and gravel by volume; medium acid; clear, smooth boundary.

B2t—22 to 40 inches, light brownish-gray (10YR 6/2) extremely stony light clay loam, dark yellowish brown (10YR 3/4) when moist; moderate, fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and coarse roots; common very fine tubular and interstitial pores and few fine tubular and interstitial pores; common thin clay films in pores, on faces of peds, and on stones; 65 percent stones, cobbles, and gravel by volume; medium acid; gradual, smooth boundary.

B3—40 to 46 inches, light brownish-gray (10YR 6/2) extremely stony sandy clay loam, dark yellowish brown (10YR 3/4) when moist; massive; hard, firm, slightly sticky and slightly plastic; common fine and medium roots; common very fine tubular and interstitial pores and few fine tubular and interstitial pores; common thin clay films in pores; 65 percent stones, cobbles, and gravel by volume; medium acid.

R—46 to 50 inches, cemented andesitic conglomerate.

A litter of needles, twigs, and leaves is generally present on the surface in wooded areas, depending on the prevalence of fires. The texture of the A1 horizon ranges from very gravelly sandy loam or loam to extremely stony sandy loam or loam. In places this horizon is 10 to 50 percent stones, by volume. Reaction ranges from slightly acid to medium acid and the structure from granular to weakly blocky. The B2t horizon consists of extremely stony or cobbly sandy clay loam or clay loam. The B2t horizon ranges from 50 to 80 percent stones, by volume, and content of stones generally increases with increasing depth into the C horizon. Reaction of the B2t horizon is medium acid to strongly acid.

In areas where the soils are forming in material weathered from hard pyroclastic rock, stone fragments are angular and brecciated. Most of the rock material is rounded andesitic cobbles and stone. In most areas quantities of ash or volcanic glass aggregates are mixed in the fine-earth fraction of the soil. Tuff-cemented conglomerate generally is at a depth of 40 to 60 inches.

Sattley extremely stony sandy loam, 2 to 50 percent slopes (S†F).—This gently sloping to steep soil has slopes of predominantly 20 to 40 percent. It is the only Sattley soil in the Sierra Valley Area, and it has the profile described as representative for the Sattley series. Included in mapping are small areas of Trojan soils and areas of Basic rock land. Runoff is mostly medium to rapid, and the hazard of erosion is moderate to high.

These soils are used for commercial timber production. They also provide food and cover for wildlife. Capability unit VIIs–1; woodland suitability group 2.

Sierraville Series

The Sierraville series consists of well-drained, conifer-covered soils that are forming in weathered vol-

canic rock, mainly andesite, at a depth of 48 to more than 60 inches. They are on the wooded uplands just south of Beckwourth Peak on the western rim of Sierra Valley. Slopes range from 2 to 30 percent. Elevation ranges from 5,200 to 6,500 feet. Annual precipitation is 14 to 28 inches, and the average annual temperature is 45° to 47° F. The frost-free period is 50 to 60 days. The natural vegetation is ponderosa pine, Jeffrey pine, other conifers, black oak, brush, grass, and forbs. Sierraville soils are in the same area as Delleker and Trojan soils.

In a representative profile the surface layer is reddish-brown, slightly acid stony sandy loam and stony loam about 9 inches thick. The upper 15 inches of the subsoil is reddish-brown, slightly acid stony clay loam. The remaining 51 inches of the subsoil is weak-red, slightly acid heavy clay loam and medium acid light clay. The parent material is light-gray, porous and vesicular, slightly weathered andesite.

Permeability is moderately slow. Available water capacity is 6 to 9 inches. The effective rooting depth is 48 to more than 60 inches.

These soils are used almost exclusively for producing timber. They serve as part of the habitat for wildlife such as deer, bear, fox, and quail.

Representative profile of Sierraville stony sandy loam on uplands in area facing southeast where slope is 25 percent; under ponderosa and Jeffrey pine, white fir, squaw carpet, and manzanita at an elevation of 5,250 feet (0.375 mile southeast of the northwest corner of sec. 21, T. 22 N., R. 14 E.; 10 feet west of a Forest Service road running from Portola to Carmen Valley and about 1.75 miles south-southeast of Beckwourth Peak):

O1&O2—2 inches to 0, pine needles, duff, and stones; 20 to 50 percent cobble-sized angular, brecciated rock fragments, mostly fine-grained basalt.

A1—0 to 3 inches, reddish-brown (5YR 5/3) stony sandy loam, dark reddish brown (5YR 3/3) when moist; moderate, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine interstitial pores; slightly acid; clear, smooth boundary.

A3—3 to 9 inches, reddish-brown (2.5YR 4/4) stony loam, dark reddish brown (2.5YR 3/4) when moist; weak, fine, subangular blocky structure and moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine and fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

B1t—9 to 24 inches, reddish-brown (2.5YR 4/4) stony clay loam, dusky red (10R 3/4) when moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common fine roots and many medium and coarse roots; many very fine and fine tubular and interstitial pores; common thin clay films in pores; slightly acid; clear, wavy boundary.

B21t—24 to 48 inches, weak-red (10R 5/3) heavy clay loam, dusky red (10R 3/4) when moist; moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots and common medium and coarse roots; many very fine and fine tubular and interstitial pores; many thin clay films in pores and few clay films on faces of peds; slightly acid; gradual, smooth boundary.

B22t—48 to 75 inches, weak-red (10R 4/3) light clay, dark red (10R 3/6) when moist; moderate, fine, angular blocky structure; hard, firm, very sticky and plastic; few fine and coarse roots and common medium roots; common very fine and fine tubular pores and many very fine interstitial pores; many thin clay films in pores and on faces of peds; medium acid; abrupt, irregular boundary.

R—75 inches, light-gray, porous and vesicular, slightly weathered andesite; roots in pores and fissures.

Most wooded areas have a litter of pine needles, leaves, and twigs on the surface, unless such litter has been destroyed by fire. In places the surface is littered with many angular, fine-grained, cobble-sized fragments of rock that are unlike the underlying vesicular bedrock. Various sizes of angular rock fragments are present throughout the profile and make up 10 to 50 percent of the total volume of the soil material. Rock outcrops are common in some areas. Depth to the R horizon ranges from 48 to more than 60 inches.

Sierraville stony sandy loam, 2 to 30 percent slopes (SvE).—This gently sloping to hilly soil is on mountainous areas just above the valley floor. It stands out distinctly in the landscape because of its reddish colors. This soil has the profile described as representative for the Sierraville series. Included in mapping are small areas of Delleker and Trojan soils. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for producing timber. Growth rates for pine are moderate. Capability unit VIe–1; woodland suitability group 1.

Smithneck Series

The Smithneck series consists of moderately well drained soils that are forming in recent mixed alluvium. They are on flood plains, on foot slopes of young alluvial fans, or on low stream terraces. These soils are throughout the Area, generally in the vicinity of creeks or streams that drain into the valley basins. Slopes range from 0 to 2 percent. Elevation ranges from 4,500 to 5,200 feet. Annual precipitation is 10 to 20 inches, and the average annual temperature is 48° to 50° F. The frost-free period is 80 to 90 days. The natural vegetation in uncropped areas consists of scattered silver sagebrush and meadow-type vegetation, including wire grass, clover, bluegrass, ryegrass, and other grasses and forbs. Smithneck soils are associated with Coolbrith and James Canyon soils.

In a representative profile the surface layer is dark-gray, slightly acid sandy loam about 15 inches thick. The subsoil is grayish-brown and light brownish-gray, neutral heavy sandy loam. It is underlain, at a depth of 48 inches, by stratified fine gravel, gravelly loamy coarse sand, and sandy loam. This material is light brownish gray, white, and dark grayish-brown and is mottled. This layer of underlying material extends to a depth of more than 60 inches.

Permeability is moderately rapid. Available water capacity is 7 to 9 inches. The effective rooting depth is more than 60 inches, but some roots have difficulty penetrating the stratified gravelly substratum. The water table is generally below a depth of 5 feet but at times is within 3 feet of the surface for short periods on low fans adjoining the valley floor.

These soils are commonly cropped to alfalfa, improved pasture, and small grains. Wheatgrass is

grown for seed and forage. A small acreage is unimproved and used for meadow pasture.

Representative profile of Smithneck sandy loam in an area of wheatgrass and alfalfa on a nearly level flood plain (1,420 feet north and 20 feet east of the south quarter corner of sec. 18, T. 21 N., R. 16 E.; 15 feet east of the Smithneck Road):

Ap—0 to 6 inches, dark-gray (10YR 4/1) sandy loam, black (10YR 2/1) when moist; weak, fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; many very fine, fine, and medium tubular pores; slightly acid; gradual, smooth boundary.

A3—6 to 15 inches, dark-gray (10YR 4/1) heavy sandy loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; slightly acid; clear, slightly wavy boundary.

B1t—15 to 23 inches, grayish-brown (10YR 5/2) heavy sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; common thin clay films in pores and as bridges; neutral; gradual, slightly wavy boundary.

B2t—23 to 32 inches, grayish-brown (10YR 5/2) heavy sandy loam that has light yellowish-brown (10YR 6/4) mottles, grayish-brown (10YR 4/2) and has few, fine, faint, dark yellowish-brown (10YR 4/4) mottles when moist; massive; very hard, friable, sticky and slightly plastic; common very fine and fine roots; many very fine and common medium tubular and interstitial pores; many thin clay films in pores and as bridges; neutral; clear, wavy boundary.

B3—32 to 48 inches, light brownish-gray (10YR 6/2) heavy sandy loam that has light yellowish-brown (10YR 6/4) mottles, dark grayish-brown (10YR 4/2) and has common, fine, faint, dark yellowish-brown (10YR 4/4) mottles when moist; massive; hard, friable, slightly sticky and slightly plastic; many very fine roots and few medium roots; many very fine and fine and common medium tubular and interstitial pores; common thin clay films in pores and as bridges; neutral; clear, wavy boundary; free ground water at a depth of 40 inches.

C—48 to 60 inches, light brownish-gray (10YR 6/2) and has white mineral grains, dark grayish-brown (10YR 4/2) and has common fine, faint, dark yellowish-brown (10YR 4/4) mottles; stratified fine gravel, gravelly loamy coarse sand, and sandy loam.

The A horizon ranges from dark gray to very dark grayish brown. It is black or very dark brown when moist. The B horizon is grayish brown or light brownish gray, but in places it has some mixed or darker colors because of organic stains translocated from the A horizon.

These soils may be slightly gravelly (up to 10 percent, by volume) in the A horizon or throughout the profile because of periodic diversion and deposition of natural stream channels. The soil reaction throughout the profile ranges from slightly acid to neutral.

Smithneck sandy loam (Sw).—This nearly level soil is the only Smithneck soil mapped in the Sierra Valley Area. It is mostly in small delineations throughout the Area. This soil has the profile described as representative for the series. Included in mapping are areas of soil that has a clay subsoil and areas where stratified sand and gravel is below a depth of 2 feet. Runoff is slow, and the hazard of erosion is slight.

This soil is better cropland than most other soils in the Area, and it is easy to work. It is used for alfalfa and pasture and, to a lesser extent, other crops adapted to the area. Some difficulty is encountered in removing or incorporating the natural meadow sod when old pastures are being prepared for crops. Capability unit IIIc–1.

Toiyabe Series

The Toiyabe series consists of excessively drained, rocky soils that are forming in place in weathered granitic rock, principally granodiorite, quartz diorite, and granite, which are at a depth of 6 to 18 inches. These soils are on mountainous uplands, mostly on the northern and western fringe of Sierra Valley. Slopes range from 2 to 75 percent. Elevation ranges from 5,000 to 8,000 feet. Annual precipitation is 10 to 24 inches, and the average annual temperature is 45° to 47° F. The frost-free period is 30 to 60 days. The natural vegetation is open stands of ponderosa and Jeffrey pine mixed with black oak, mountainmahogany, brush, forbs, and some grasses. Big sagebrush and bitterbrush are on some of the lower foot slopes. Toiyabe soils are in the same general area as Bonta and Haypress soils.

In a representative profile the surface layer is grayish-brown and light brownish-gray, slightly acid loamy coarse sand about 12 inches thick. The underlying parent material consists of strongly weathered granodiorite.

Permeability is rapid. Available water capacity is 0.5 to 1.5 inches. The effective rooting depth is 6 to 18 inches.

These soils are used for producing timber. Open areas have some grazing value for livestock and wildlife.

Representative profile of Toiyabe loamy coarse sand on uplands in an area facing west where slope is 8 percent; under Jeffrey pine, big sagebrush, and perennial and annual grasses (1,200 feet southwest of the northeast corner of sec. 13, T. 23 N., R. 16 E., 3.5 miles north of Chilcoot and 1.5 miles east of Little Last Chance Creek):

O1—2½ inches to 1½ inches, pine needles, duff, and oak leaves.

O2—1½ inches to 0, organic matter, leaf mold, and very fine roots.

A11—0 to 5 inches, grayish-brown (10YR 5/2) loamy coarse sand, very dark grayish brown (10YR 3/2) when moist; single grained; loose, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; slightly acid; gradual, wavy boundary.

A12—5 to 12 inches, light brownish-gray (10YR 6/2) loamy coarse sand, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; slightly acid; abrupt, wavy boundary.

C—12 to 20 inches, strongly weathered black and white granodiorite; mineral orientation of rock is evident; some iron staining; few roots extend into fractures.

In wooded areas these soils have a thin litter of pine needles, leaves, and twigs on the surface. The mineral soil is highly micaceous, and material in the profile is 5 to 20

percent, by volume, gravel-sized pieces of granitic rock. Reaction ranges from slightly acid to medium acid.

Toiyabe soils in the Sierra Valley Area are mapped only in complex with Bonta and Haypress soils.

Toiyabe-Bonta loamy coarse sands, 2 to 30 percent slopes (TbE).—These gently sloping to moderately steep soils are so intermingled that it was not feasible to map them separately. About 50 percent of this complex is Toiyabe soils, and about 30 percent is Bonta soils. The remaining 20 percent is areas of Acidic rock land and areas of soils that are similar to the Haypress and Mottsville soils on fans and valleys.

Both soils in this complex have the profile described as representative for their respective series. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Rocks crop out on about 15 to 30 percent of the surface in most areas of these soils.

These soils are used for producing timber. Growth rates are slow, and the lumber quality is fair. The soils make up a sizable part of the watershed and drainage area that contributes to the Sierra Valley basin and are probably a major source of the sandy alluvium on the valley floor. Capability unit VIIe–1; Toiyabe soils in woodland suitability group 2, Bonta soils in woodland suitability group 1.

Toiyabe-Bonta loamy coarse sands, 30 to 75 percent slopes (TbG).—These steep to very steep soils are so intermingled that it was not feasible to map them separately. About 55 percent of the complex is Toiyabe soils, and about 35 percent is Bonta soils. The remaining 10 percent is small areas of Haypress soils, of Mottsville soils on fans or in valleys, and of Acidic rock land.

These soils have profiles similar to the ones described as representative for their respective series. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Rock outcrops cover 25 to 50 percent of the surface in some areas.

These soils are used mainly for growing timber. Growth rates of conifers are somewhat better than the complex that has 2 to 30 percent slopes, which are at lower elevations where the precipitation is less. Capability unit VIIe–1; Toiyabe soils are in woodland suitability group 2; Bonta soils are in woodland suitability group 1.

Trojan Series

The Trojan series consists of well-drained soils that are forming in place, at a depth of 40 to more than 60 inches, in stony residuum, predominantly from andesitic and basaltic conglomerate and breccia. These soils are on mountainous uplands surrounding the Sierra Valley basin and on the western slopes of Long Valley. Slopes range from 2 to 50 percent. Elevation ranges from 4,900 to 6,000 feet. Annual precipitation is 12 to 24 inches, and the average annual temperature is 45° to 47° F. The frost-free period is 50 to 60 days. The natural vegetation is open stands of conifers and some mixed brush, oak, grasses, and forbs. Trojan soils are in the same area as Dotta, Millich, and Sattley soils.

In a representative profile (fig. 22) in an area where stands of trees are moderately thick, a 1- to 3-inch mat of pine needles, duff, and litter covers the surface. The upper 10 inches of mineral soil is dark-brown, slightly acid stony sandy loam. The subsoil is brown, light-brown, and reddish-yellow, medium acid gravelly loam and gravelly light clay loam and extends to a depth of more than 60 inches.

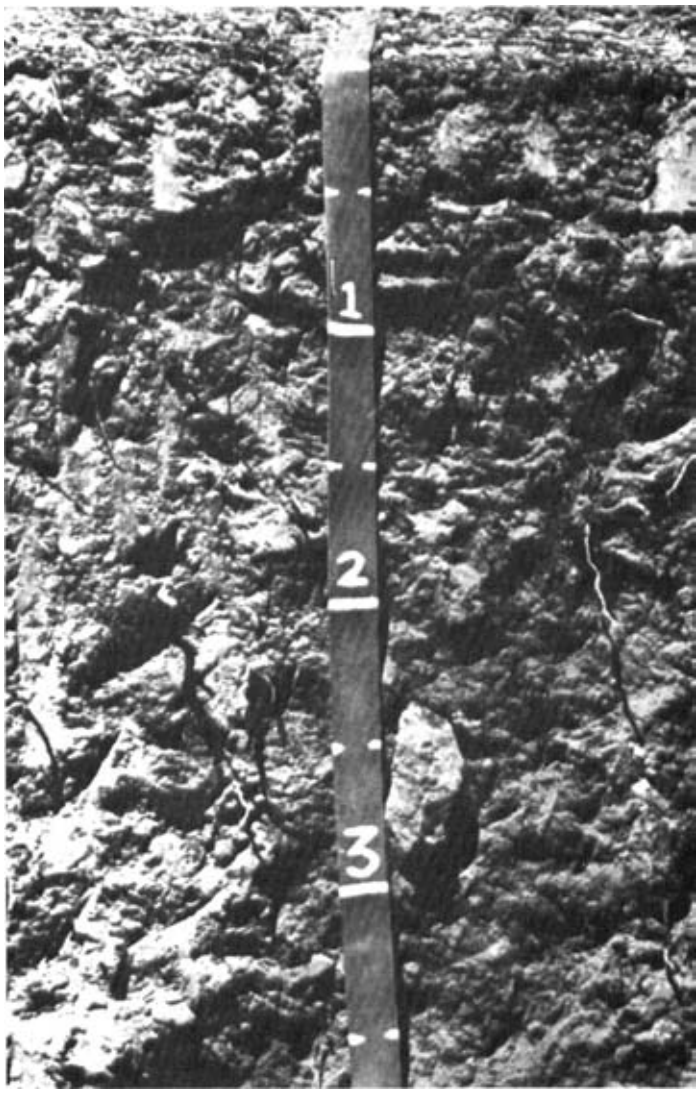

Figure 22.—**Profile of a Trojan stony sandy loam.**

Permeability is moderately slow. Available water capacity is 6 to 9 inches. The effective rooting depth is 40 to more than 60 inches.

These soils are used for producing timber. Open areas are grazed by livestock and wildlife.

Representative profile of moderately steep Trojan stony sandy loam on uplands in an area facing north where slope is 8 percent; under Jeffrey pine, big sagebrush, bitterbrush, squirreltail, and cheat grass at an elevation of 5,200 feet (1,100 feet south and 800 feet east of the north quarter corner of sec. 24, T. 21 N., R. 15 E., 1 mile south of Loyalton):

O1&O2—3 inches to 0, mat of pine needles, twigs, and leaves, etc., decomposing with depth; abrupt, smooth boundary.

A1—0 to 3 inches, dark-brown (7.5YR 4/2) stony sandy loam, dark reddish brown (5YR 3/2) when moist; weak, thick, platy structure and moderate, fine and medium, granular; soft, friable, nonsticky and nonplastic; common very fine and fine roots and few medium roots; many very fine interstitial and tubular pores; slightly acid; clear, smooth boundary.

A3—3 to 10 inches, dark-brown (7.5YR 4/2) stony sandy loam, dark reddish brown (5YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; few very fine and fine tubular pores; slightly acid; clear, smooth boundary.

B1t—10 to 21 inches, brown (7.5YR 5/4) gravelly loam, dark reddish brown (5YR 3/4) and yellowish-red (5YR 4/6) flecks when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots, common fine and coarse roots, and many medium roots; few fine and medium pores and common very fine pores; medium acid; clear, smooth boundary.

B21t—21 to 37 inches, mixed brown (7.5YR 5/4) and light-brown (7.5YR 6/4) gravelly light clay loam, reddish brown (5YR 4/4) when moist; moderate, fine and medium, angular blocky structure; hard, slightly firm, slightly sticky and slightly plastic; few fine and coarse roots and common medium roots; few very fine tubular pores; common thin clay films in pores and on faces of peds; medium acid; gradual, smooth boundary.

B22t—37 to 48 inches, mixed brown (7.5YR 5/4) and light-brown (7.5YR 6/4) gravelly light clay loam, reddish brown (5YR 4/3) when moist; moderate, fine and medium, angular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; few very fine tubular pores; many thin clay films in pores and on faces of peds; medium acid; gradual, smooth boundary.

B3t—48 to 61 inches, light-brown (7.5YR 6/4) and reddish-yellow (7.5YR 6/6) gravelly light clay loam, reddish brown (5YR 4/4) when moist; moderate, medium, angular blocky structure; hard, firm, sticky and plastic; very few fine and medium roots; common very fine tubular pores; common thin clay films in pores and as bridges holding mineral grains together; medium acid.

In some areas on the western and southern slopes of Sierra Valley, the Bt horizon is reddish brown or brown. The texture of the Bt horizon ranges from heavy loam to gravelly clay loam. The B horizons are slightly acid to medium acid.

In most areas significant amounts of ash, volcanic glass, and concretions of iron and manganese are in the soils. Loose stones make up 5 to 35 percent of the material in the profile. Fragments range in size from gravel to stones.

Hard andesite or basalt is at a depth of 40 to 80 inches.

Trojan stony sandy loam, 2 to 30 percent slopes (TrE).—This gently sloping to moderately steep soil has the profile described as representative for the Trojan series. Runoff is slow to medium, and the hazard of erosion is moderate to high.

Included with this soil in mapping are small areas of a soil similar to Trojan soils that has a thick, dark grayish-brown surface layer and a cover of big sagebrush and cheatgrass. Also included are extremely stony areas and areas of soils underlain by beds of ashy sediment.

This soil is used for producing timber. Growth rates of pine are moderate. Most areas have grazing value for livestock and wildlife. Capability unit VIe–1; woodland suitability group 1.

Trojan stony sandy loam, 30 to 50 percent slopes (TrF).—This steep soil is on the uplands and mountainous areas well above the valley floor. It is steeper than the soil described as representative for the Trojan series but has a similar profile. Runoff is rapid, and the hazard of erosion is high to very high.

Included with this soil in mapping are areas of a very deep, dark grayish-brown soil that has a cover of big sagebrush and cheatgrass but is otherwise similar to this Trojan soil. Also included are extremely stony areas, areas of rock outcrops, and areas of soils that are underlain by beds of ashy material.

This soil is used for producing timber. Growth rates are about the same as on the less sloping Trojan soil —the annual rainfall is higher in areas of this soil, but this soil is shallower. Logging these steeper slopes is somewhat more hazardous, and measures to protect the soil are necessary. Capability unit VIIe–1; woodland suitability group 1.

Trosi Series

The Trosi series consists of well-drained soils that are underlain by a hardpan at a depth of 12 to 30 inches. They are forming in old terrace alluvium on middle terraces in Long Valley, mostly on the west side of Long Valley Creek and south of Beckwourth Pass. Slopes range from 2 to 50 percent. Elevation ranges from 4,800 to 5,200 feet. Annual precipitation is 6 to 12 inches, and the average annual temperature is 48° to 50° F. The frost-free period is 60 to 90 days. The natural vegetation is stunted big sagebrush, cheatgrass, and a few perennial grasses and forbs. Trosi soils are associated with Saralegui soils.

In a representative profile (fig. 23) the surface layer is light-brown, slightly acid very stony sandy loam about 7 inches thick. The subsoil is brown, slightly acid very cobbly light sandy clay loam and very cobbly clay about 12 inches thick. It is abruptly underlain by a silica-cemented hardpan.

Permeability is very slow. Available water capacity is 1 to 2.5 inches. The effective rooting depth is 12 to 30 inches.

These soils have very little value for farming. Forage production is very low, and the landscape is not easily traversed by animals.

Representative profile of gently sloping Trosi very stony sandy loam in an area facing east where slope is 3 percent; on old terraces under big sagebrush, cheat grass, and a trace of bitterbrush at an elevation of 4,890 feet (400 feet south of the north quarter corner of sec. 16, T. 22 N., R. 17 E.; 0.75 mile south and 2.25 miles west of Hallelujah Junction) :

A11—0 to 2 inches, light-brown (7.5YR 6/4) very stony sandy loam that has brown (10YR 5/3) stains, dark-brown (7.5YR 3/4) and dark yellowish-brown (10YR 3/4) stains when moist; weak, thick, platy structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; few fine tubular pores and many very fine and fine vesicular pores; slightly acid; clear, smooth boundary.

A12—2 to 7 inches, light-brown (7.5YR 6/4) very stony sandy loam, dark brown (7.5YR 3/4) when moist; weak, thick, platy structure; slightly hard, friable, slightly sticky and nonplastic; common very fine roots and few fine and medium roots; common

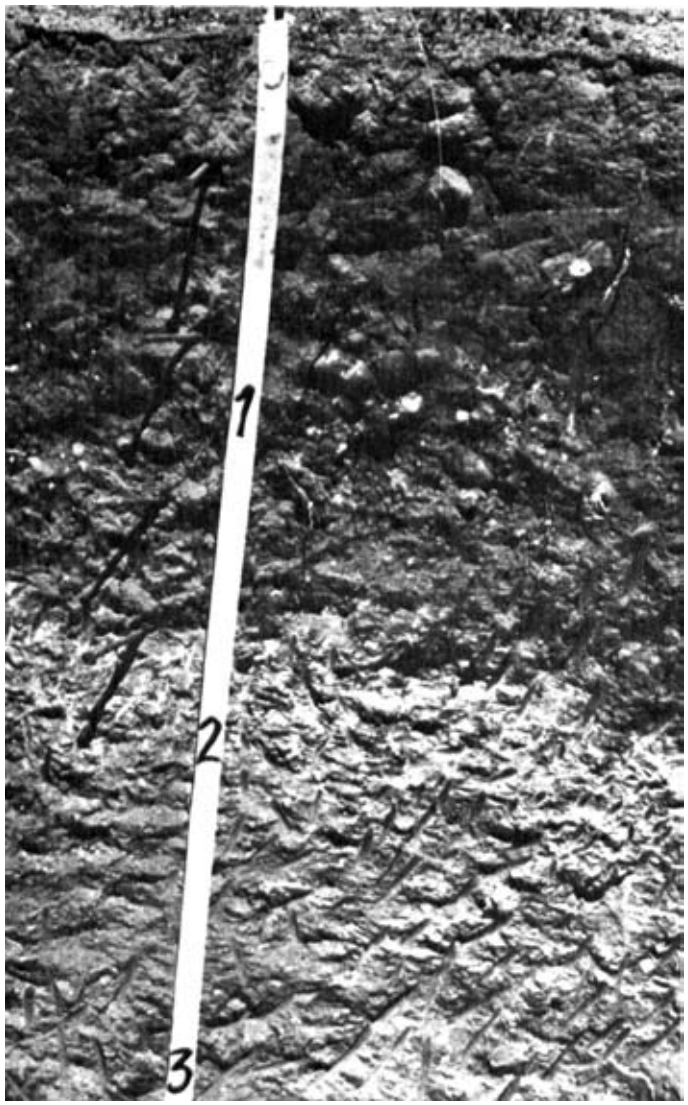

Figure 23.—**Profile of a Trosi very stony sandy loam, 2 to 15 percent slopes. At a depth of 12 inches is the cobbly clay subsoil, and at a depth of 19 inches is the silica-cemented hardpan.**

very fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

B1t—7 to 12 inches, brown (7.5YR 5/4) very cobbly light sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, medium, angular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots and few fine and medium roots; common very fine tubular and interstitial pores; common thin clay films in pores and as bridges; slightly acid; clear, smooth boundary.

B2t—12 to 19 inches, brown (7.5YR 5/4) very cobbly clay, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic structure that parts to weak, fine and medium, angular blocky; very hard, firm, sticky and plastic; common very fine roots and few fine and medium roots; few very fine tubular pores; continuous, moderately thick clay films in pores and on faces of peds; slightly acid; abrupt, smooth boundary.

C1sim—19 to 26 inches, light-brown (7.5YR 6/4) and pink (7.5YR 7/4) silica-cemented gravelly duripan that has black stains, strong brown (7.5YR 5/6) and black stains when moist; continuous, moderately thick clay films in fractures; slightly acid; weak effervescence when tested with H_2O_2 on black stains.

C2—26 to 60 inches, stratified sediment becoming less cemented with depth.

The surface in most areas is rilled, sparsely vegetated, and paved with cobbles and stones. The A horizon ranges from very stony sandy loam to gravelly light loam. The B2t horizon ranges from gravelly clay to very cobbly clay or heavy clay loam. Structure of the B2t horizon is generally prismatic, but if it is less than 6 inches thick it tends toward strong, blocky structure. The depth to the C1sim horizon ranges from 12 to 30 inches. Stones and cobbles cover about 10 to 20 percent of the surface and in places make up 20 to 60 percent of the volume of the soil.

Trosi very stony sandy loam, 2 to 15 percent slopes (TsD).—This gently sloping to strongly sloping soil is on the middle terraces above and west of Long Valley Creek. Stones and cobbles make up 20 to 40 percent, by volume, of this soil. It has the profile described as representative for the Trosi series. Runoff is medium to rapid, and the hazard of erosion is moderate.

Included with this soil in mapping are some areas of deep, very stony soils that have a clay loam subsoil, particularly near terrace breaks. Also included is a small acreage of soils that are affected by seeps and wetness and have a very dark stony loam surface layer and a calcareous clay subsoil.

This soil is used almost exclusively for range for livestock and wildlife. The stoniness of the surface and throughout the profile generally precludes farming operations. Capability unit VIs–1; range site 4.

Trosi extremely stony sandy loam, 2 to 15 percent slopes (TtD).—This gently sloping to strongly sloping soil is on broad, flat terraces in Upper Long Valley. Stones and cobbles make up about 40 to 60 percent of the material in the soil profile, by volume, and the hardpan of this soil contains more stones than the hardpan in the representative profile. This soil, however, is otherwise similar to the one described as representative for the Trosi series. Runoff is medium to rapid, and the hazard of erosion is moderate.

Included with this soil in mapping are areas where the hardpan is as shallow as 8 inches below the surface and areas of very deep, very stony soil that has a clay loam subsoil.

This soil has very little value for farming. Forage production is very low, and the landscape is not easily traversed by animals or vehicles. Capability unit VIIs–1; range site 6.

Trosi-Saralegui complex, 15 to 50 percent slopes, eroded (TuF2).—These moderately steep to steep soils are so intermingled that it was not feasible to map them separately. They are mostly on terrace breaks, canyon sides, and arroyolike ravines, mainly on the west side of Long Valley Creek in Upper Long Valley. About 45 percent of this complex is Trosi soils, and about 30 percent is Saralegui soils. The remaining 25 percent is areas, near Roberts Creek, of gravelly sand or gravelly sandy loam that is about 24 inches deep to a weakly cemented hardpan and areas of a very shal-

low, very stony soil that is forming in mixed lake sediment.

Both soils have profiles similar to the ones described as representative for their respective series. Stones and cobbles cover as much as 60 percent of the surface area, especially on the Trosi soils. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

These soils are used almost exclusively for range or watershed. Capability unit VIIs–1; Trosi soils in range site 6, Saralegui soils in range site 2.

Use and Management of the Soils

This section describes the system of capability classification commonly used by the Soil Conservation Service. The Storie index ratings are then explained, and the vegetation of the Area is described. Information about management of the soils for crops, range, woodland, and wildlife and fish is given, and engineering uses of the soils are described.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

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

Class I soils have few limitations that restrict their use. (None in Sierra Valley Area)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. (None in Sierra Valley Area)

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (None in Sierra Valley Area)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

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

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

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils.

Capability units III and IV are given Arabic numbers that suggest the chief kind of limitation responsible for placement of the soil in the capability class and subclass. For this reason, some of the units within the subclasses are not numbered consecutively, and their symbols are a partial key to some soil features. The numerals used to designate units within the classes and subclasses are:

0. A problem or limitation of a soil underlain by sand or gravel.
1. A problem or limitation caused by slope or by actual or potential erosion hazard.
2. A problem or limitation of wetness caused by poor drainage or flooding.
3. A problem or limitation of slow or very slow permeability of the subsoil or substratum caused by a clay subsoil or a semiconsolidated substratum.
4. A problem or limitation caused by low available water capacity of sandy or gravelly soils.

5. A problem or limitation caused by clay texture.
6. A problem or limitation due to saline or alkaline conditions.
7. A problem or limitation caused by rocks or cobbles.
8. A problem or limitation in the root zone, which generally is less than 36 inches over massive bedrock or hardpan and lacks moisture for plants.
9. A problem or limitation caused by low or very low fertility, acidity, or toxicity that cannot be corrected by adding normal amounts of fertilizer or soil amendments.

Soils in units V through VIII are given the single nonconnotative number 1.

Management by capability units

The productivity and responses of a soil depend on many factors, especially on the nature of the soil, the climate in which it is located, and the management it receives. Soil characteristics and climate cannot be changed readily. Management, on the other hand, is subject to control. Changes in the management of a soil can drastically change the quality and yield of the crop. Depending on their kind, recurring practices in management establish a trend toward improvement, maintenance, or depletion of the soil in a field.

A good system of soil management is likely to consist of a combination of several practices. Among these are the use of a good cropping system, application of fertilizer, and cultivating on the contour or across the slope. The effectiveness of any one practice is dependent upon other practices. For example, a diversion system for disposal of storm water may cause gullying unless the water is directed into an adequate grassed waterway or other suitable channel.

Because of the wide variety of soil and climatic factors, it is desirable to group many of these combinations of practices for ease of handling and treating the soils. Such a grouping has been made in this section. This section contains a description of each capability unit and some suggestions for the use and management of the soils. Further information about each kind of soil is given in the section "Descriptions of the Soils." Specific management of the soils in each unit for range or for woodland is discussed in the sections "Range Management" and "Woodland."

CAPABILITY UNIT IIIe-1

In this unit are moderately well drained and well drained soils in the Bidwell, Calpine, Coolbrith, and Dotta series. These soils are more than 60 inches deep. The surface layer is sandy loam or silt loam, and the subsoil is clay loam or sandy clay loam. Permeability ranges from moderately rapid to moderately slow, and available water capacity ranges from 6 to 10 inches. Most slopes range from 2 to 5 percent but are as steep as 9 percent in places. Runoff is slow, and the hazard of water erosion is slight. In places the hazard of wind erosion is moderate. Elevation is 4,500 to 5,500 feet, average annual precipitation is 8 to 20 inches, and the annual frost-free period is 80 to 90 days.

Most crops grown in the Area are also grown on or suited to these soils. Such close-growing crops as alfalfa and pasture plants are best suited to these soils and afford the best protection from accelerated water erosion and wind erosion. Irrigation water is best applied by flooding in borders and checks or by sprinklers. Good management practices include placing irrigation ditches on the contour; installing drop structures on delivery ditches that carry large volumes of water, especially on steeper slopes; and keeping cultivation to a minimum in order to maintain soil aggregation and to prevent compaction.

CAPABILITY UNIT IIIe-3

Correco sandy loam, 2 to 5 percent slopes, is the only soil in this unit. It is more than 60 inches deep and is well drained. The subsoil is slowly permeable clay. It is underlain by loam that contains lenses of silica-cemented material. The available water capacity ranges from 7 to 10 inches. Runoff is slow, and the hazard of erosion is slight. Elevation is 4,500 to 5,000 feet, average annual precipitation is 10 to 20 inches, and the annual frost-free period is 80 to 90 days.

This soil is used for range, dryland grains, and pasture. It is suited to most crops adapted to the Area, except those with roots that would be restricted by the slowly permeable subsoil.

Irrigation water is applied by sprinklers, borders, or furrows. All tillage should be across the slope. Deep cuts should be avoided in land leveling, to keep from exposing the clay subsoil. Runoff water must be controlled and put into adequate outlets to reduce the hazard of erosion. Crop residues should be returned to the soil to improve structure, tilth, and infiltration rates and to reduce the hazard of erosion. Plants respond to nitrogen and phosphorus fertilizers.

CAPABILITY UNIT IIIw-2

In this unit are soils in the Beckwourth and James Canyon series. The soils are somewhat poorly drained and poorly drained. The surface layer is sandy loam, gravelly loam, or silt loam. The subsoil is sandy loam, loam, or silt loam and contains slightly more clay than the surface layer. These soils have a fluctuating water table at a depth of about 3 to 5 feet. Permeability is moderate. The available water capacity is 5 to 12 inches, based on soil in a drained area. Slopes are 0 to 5 percent. Runoff is slow to very slow, and the hazard of erosion is none to slight. Elevation is 4,000 to 5,500 feet, average annual precipitation is 10 to 20 inches, and the annual frost-free period is 80 to 90 days.

These soils are best suited to grain crops and clover-grass pasture. Most climatically adapted crops can be grown on these soils. Stands of alfalfa may be short lived after a succession of wet years, if the water table rises above a depth of 3 feet. Some areas are used for meadow pasture.

These soils have limitations because of wetness. If irrigation water is managed well, the water table does not rise appreciably. Artificial drainage in the nearly level central valley region is not very successful because of the flat terrain and the lack of a suitable outlet for the excess water. Land leveling may be re-

quired on soils that are to be flood irrigated. Leveling cuts should be restricted to a depth of less than 2 feet because of the high water table.

CAPABILITY UNIT IIIw–5

Soils in this unit are mainly in the Ramelli series. These soils are poorly drained clay. Also in this unit is a Balman soil that is mapped with the Ramelli soils. The Balman soil is moderately well drained. A fluctuating water table is at a depth of 1½ to 5 feet. Permeability is slow. The available water capacity is 6 to 8 inches. Slopes are 0 to 2 percent. Runoff is very slow, and the hazard of erosion is none to slight. Elevation is 4,500 to 5,000 feet, average annual precipitation is 12 to 18 inches, and the annual frost-free period is 80 to 90 days.

These soils are used mainly for native meadow pasture. Some areas have been drained, leveled, and seeded to improved pasture or small grains.

These soils are capable of sustained high production but require special management treatment because of poor drainage and clay texture. Installation and maintenance of drainage ditches is difficult because of the lack of sufficient gradient on the flat valley floor and of suitable drain outlets. The soil can be worked only within a narrow range of moisture content in order to prevent "balling" and "clodding." Heavy equipment and special techniques are required to break out old sod-bound pastures for cropping. These soils are best used for legume-grass pasture in a cropping system in which small grains such as barley or oats are alternated every 3 to 5 years. Irrigation water can best be applied by flooding in checks. Care must be exercised in irrigation because of the slow permeability of the soil and the high water table.

CAPABILITY UNIT IIIs–0

Bidwell sandy loam, sandy substratum, 0 to 2 percent slopes, is the only soil in this unit. It is well drained and is underlain, at a depth of 22 to 40 inches, by stratified coarse sand and fine gravel. Permeability is rapid. The available water capacity ranges from 3 to 6 inches in the 22- to 40-inch root zone. Runoff is very slow, and the hazard of water erosion is none to slight. The hazard of wind erosion is moderate. Elevation is 4,500 to 5,000 feet, average annual precipitation is 12 to 18 inches, and the annual frost-free period is 80 to 90 days.

This soil is used for small grains, pasture, and alfalfa. It is suited to all crops adapted to the Area.

Deep cuts need to be avoided so the sand and gravel substratum will not be exposed. Irrigation water is applied by borders, furrows, or sprinklers. Small amounts of water need to be applied frequently to avoid losing excess water and nutrients through the coarse substratum. Plants respond to nitrogen and phosphorus fertilizers. Returning crop residues to the soil improves soil structure and water infiltration rates.

CAPABILITY UNIT IIIs–4

Calpine coarse sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is well drained and has a sandy clay loam subsoil. Permeability is moderately rapid. The available water capacity ranges from 6 to 8 inches in the more than 60 inches of effective rooting depth. Runoff is very slow, and the hazard of erosion is none to slight. Elevation is 4,800 to 5,500 feet, average annual precipitation is 10 to 20 inches, and the annual frost-free period is 80 to 90 days.

This soil is used for all crops grown in the Area and is suited to all climatically adapted crops.

Because of the relatively low available water capacity, this soil needs fairly light, frequent irrigations. Returning crop residues to the soil helps improve soil tilth and structure and infiltration rates. Crops respond to nitrogen and phosphorus fertilizers. All surface methods of applying irrigation water can be used on this soil.

CAPABILITY UNIT IIIs–6

In this unit are soils in the Balman series. These soils are moderately well drained and are variably affected by salts and alkali. The surface layer is loam, and the substratum is loam, sandy clay loam, sandy loam, and loamy coarse sand. Permeability is moderately slow. The available water capacity is 7 to 9 inches. The effective rooting depth is more than 60 inches, but salt- or alkali-sensitive crops do not grow well in these soils. Slopes are 0 to 5 percent. Runoff is very slow to slow, and some areas are ponded. The hazard of erosion is none to slight. Elevation is 4,000 to 5,000 feet, average annual precipitation is 10 to 20 inches, and the annual frost-free period is 80 to 90 days.

Crops grown in these soils include improved pasture, hay, and grains—particularly wheatgrasses, trefoil, alfalfa, and barley. A large area is used for native pasture. Only crops that are tolerant of slight to moderate amounts of salinity and sodium in the soil can be grown successfully.

The availability of phosphorus in the soil, and in some cases iron, is reduced by the high content of lime. Grain and grass crops respond to fertilizers containing nitrogen. Most areas need landsmoothing or leveling for flood irrigation. Newly exposed surfaces may require the addition of gypsum to help get new seedlings established. Heavy flooding and leaching with good irrigation water reduce the salt and sodium content of the soils. These soils are capable of good sustained production, but they require good management.

CAPABILITY UNIT IIIc–1

In this unit are soils in the Bidwell, Coolbrith, Dotta, and Smithneck series. The soils are all more than 60 inches deep and are well drained or moderately well drained. The surface layer is sandy loam, loam, of silt loam. The subsoil is sandy loam, sandy clay loam, or clay loam. Permeability ranges from moderately slow to moderately rapid. The available water capacity ranges from 7 to 10 inches in the more than 60 inches of effective rooting depth. Slopes are 0 to 2 percent. Runoff is slow to very slow, and the hazard of erosion is none to slight. Elevation is 4,500 to 5,200 feet, average annual precipitation is 8 to 20 inches, and the annual frost-free period is 80 to 90 days.

These soils are suited to all crops grown in the Area, including alfalfa, barley, wheat, rye, oats, pasture, and hay. Most deep-rooted crops are watered by natural subirrigation. In some areas surface water is applied to alfalfa, pasture, and hay crops. Water is diverted from streams through open ditches, and a few areas are irrigated with water pumped from wells. A few crops respond well to applications of fertilizers that contain amounts of nitrogen and phosphorus determined by laboratory tests and greenhouse studies of potted plants. Alfalfa responds well to sulfur. The value of applying fertilizer has not been firmly established, and more study and field-sized experimentation are needed. Such factors as freezing conditions (sometimes even during the months of July and August) that topple stands of Alfalfa, poor water management that greatly alters the composition and production of pasture, and choice of plant species have more influence in places than the addition of fertilizers.

These soils are capable of sustained production under a minimum of care. Good management practices are fencing pastures into a number of units for systematic alternation of grazing, allowing plants to recover, and applying water according to the needs of the crop and the intake of the soil. Care should be taken to not overirrigate and thus raise the height of the water table. Excessive wetness also encourages the growth of sedges, wire grass, and other less desirable plants in pastures and among permanent field crops. These soils are among the most productive in the Area. Grazing in wet pastures should be avoided because the weight of the animals compacts the soil and destroys the plants.

The difficulty in breaking the soil in old sod-bound meadows during preparation for planting other crops is a concern of management.

CAPABILITY UNIT IVe-1

In this unit are soils in the Calpine, Delleker, Galeppi, and Saralegui series. The soils are well drained. The surface layer is sandy loam and loamy coarse sand. The subsoil is sandy clay loam or clay loam. Permeability is moderately rapid to moderately slow. The available water capacity ranges from 6 to 10 inches in the 40 to more than 60 inches of effective rooting depth. Slopes are 2 to 15 percent. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. Galeppi soils also have a moderate hazard of wind erosion. Elevation is 4,500 to 5,800 feet, average annual precipitation is 6 to 24 inches, and the annual frost-free period is 50 to 90 days.

These soils are suited to most crops adapted to the climate. Development of water for irrigation is not extensive. The acreage in crops is small. Crops grown include such dryland pasture as alfalfa-grass, wheatgrass, or straight alfalfa. Barley, oats, wheat, and rye are grown for hay and grain. Much of the area is unimproved and used as sagebrush range. The Delleker soils are used mainly for producing timber.

Strong slopes and the susceptibility to erosion are the major concerns if these soils are cropped intensively. In addition, the lack of irrigation water and low temperatures during the year limit the choice of crops and the use of these soils. Sheet erosion can be controlled by growing crops that provide a permanent cover. All tillage and irrigation should be done across the slope. Water for irrigation can be applied by borders of furrows on gentle slopes; but on slopes steeper than 5 percent, sprinkler irrigation should be used.

CAPABILITY UNIT IVe-3

In this unit are soils in the Bieber, Correco, Lovejoy, and Calpine, variant, series. Also in this unit are areas of Calpine and Dotta soils that are mapped with Lovejoy soils. The dominant soils are well drained and moderately well drained. They have a surface layer of coarse sandy loam to loam and a subsoil of sandy clay loam to clay. Some of the soils are underlain by hardpans or cemented lenses. Permeability is moderately slow to very slow. The effective rooting depth for many plants is 8 to 28 inches, except in Correco soils. They have a rooting depth of more than 60 inches. The available water capacity is 1 to 4 inches in the shallower soils and 7 to 10 inches in the Correco soils. Slopes are 0 to 15 percent. Runoff is very slow to medium, and the hazard of erosion is none to moderate. Elevation is 4,500 to 5,200 feet, average annual precipitation is 10 to 20 inches, and the annual frost-free period is 50 to 90 days.

These soils are best suited to small grains, hay, and pasture. Many areas are used for native sagebrush pasture or range. Deep-rooted crops do not do well in these soils.

Irrigation water is best applied by sprinklers. Borders and furrows can be used if limited land leveling or smoothing is not required. Deep cuts need to be avoided so as not to expose the clayey subsoil or the hardpan. Tests indicate that most crops respond to nitrogen and phosphorus fertilizers. Small or light amounts of irrigation water need to be applied often to avoid building up a perched water table on top of the clay subsoil.

CAPABILITY UNIT IVe-4

Mottsville loamy sand, 2 to 9 percent slopes, is the only soil in this unit. This soil is excessively drained. Permeability is very rapid. The available water capacity is 3.5 to 5 inches in the more than 60 inches of effective rooting depth. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of wind erosion is moderate. Elevation is 4,800 to 5,200 feet, average annual precipitation is 8 to 16 inches, and the annual frost-free period is 60 to 90 days.

This soil is used mainly for sagebrush range. Forage production is sparse and of poor quality. Only the more drought-tolerant domesticated plants can be grown. Pasture plants, alfalfa, and some small grains can be grown in this soil if it is irrigated.

It is best to apply irrigation water by sprinklers. The depth of wetting can be more easily adjusted to the development and growth of the crop with sprinklers than it can using flood irrigation. If water is abundant and can be applied by gravity flow, some of the less steep areas can be irrigated by the border-

flooding method. Border checks should be short and not too wide. Infiltration rates may exceed 10 inches per hour. By growing deep-rooted crops and green manure crops and by incorporating crop residues, the organic-matter content can be built up. This adds to the water-holding capacity of the soil and assists in soil aggregation. Ditches should be on contour and drop structures should be installed on main ditches.

Erosion by both the wind and water is a concern of management.

CAPABILITY UNIT IVw–4

In this unit are soils in the Beckwourth and Ormsby series. They are somewhat poorly drained and poorly drained loamy coarse sands and coarse sandy loams. These soils have a water table at a depth of 2 to 6 feet, and one of the Beckwourth soils has a slowly permeable clay substratum. Otherwise, permeability is moderate to moderately rapid. The available water capacity is 3.5 to 6 inches, based on soil in a drained area. Slopes are 0 to 5 percent. Runoff is slow to very slow, and water ponds on the surface in some areas. The hazard of water erosion is none to slight. The hazard of wind erosion is moderate. Elevation is 4,000 to 5,200 feet, average annual precipitation is 12 to 18 inches, and the annual frost-free period is 50 to 90 days.

These soils are commonly used for unimproved pasture. Crops commonly grown on these soils include alfalfa, improved legume-grass pasture, and domestic rye. A small acreage is cut for grain hay.

The water table is generally beneficial to most plants, but alfalfa may be short-lived, especially in places where the water table is less than 3 feet from the surface. These soils are easy to work, and no problems are encountered when the soil is tilled or leveled. Irrigation water is best applied by sprinklers because of the coarse texture and rapid infiltration rate of the surface layer. Tillage operations and a system of stripcropping at right angles to the wind direction reduce wind erosion. These soils are best maintained under a cover of grass or close-growing crops. All crop residues should be returned to the soil.

CAPABILITY UNIT IVs–6

In this unit are soils in the Bellavista and Loyalton series. Also included are areas of Beckwourth soils that are mapped in complex with Loyalton soils. The soils are mostly moderately well drained. The surface layer is fine sandy loam to silt loam. The subsoil is sandy clay loam to silty clay. Permeability is very slow. The available water capacity is 1.5 to 7 inches. The effective rooting depth is 10 to 40 inches to a hardpan or to a dense, clayey subsoil. Slopes are 0 to 5 percent. Runoff is slow to very slow, and the hazard of erosion is none to slight. Some areas have a moderate hazard of wind erosion. Elevation is 4,500 to 5,000 feet, average annual precipitation is 12 to 20 inches, and the annual frost-free period is 50 to 90 days. These soils contain slight to moderate amounts of salts and alkali (sodium).

These soils are predominantly unimproved and are used for native pasture. Parcels of the Loyalton soils are used for irrigated pasture. In years when there is adequate rainfall, crops of cereal rye are produced without irrigation. Seeding dryland pastures with suitable varieties of wheatgrass greatly increases forage production on former sagebrush lands. If irrigation water is available, these soils are best suited to permanent pasture and hay crops. Salt-tolerant plants such as trefoil, tall fescue, tall wheatgrass, and certain clovers can be grown. Stands of alfalfa are short lived.

These soils have rather severe limitations for growing crops and are best suited to crops that provide permanent cover and those that are tolerant of excess salt and alkali. Alternating rye or barley one year with wheatgrass pasture every 3 to 5 years is good practice. Excessive sodium causes the surface to crust and, as a result, hinders the germination of the seed and the emergence of seedlings. Crusting can be reduced by applying gypsum and a large amount of water and then by using frequent light irrigations to keep the surface moist. After seedlings have emerged, the frequency of irrigation can be reduced. The slow intake of water makes long irrigation runs possible, because it allows enough time for water to penetrate the soil. Irrigating deeply is impossible, but in time the roots of tall wheatgrass and other plants are likely to enter the sublayers and thereby increase the permeability of these layers. Forage crops grown on these soils respond to applications of fertilizers, particularly those fertilizers that contain phosphorus. Grasses respond well to nitrogen fertilizers. Indications of iron deficiency are observable in places. Boron excesses have been found in a few places. Increased production because of fertilizing may not warrant the cost of fertilizing.

CAPABILITY UNIT VIe–1

In this unit are soils in the Delleker, Dotta, Galeppi, Portola, Reba, Sierraville, and Trojan series. These soils are well drained or moderately well drained. The surface layer is loamy coarse sand, sandy loam, or loam. The subsoil is coarse sandy loam to clay. Most of the soils have gravel, cobbles, or stones throughout their profiles. Most are more than 60 inches deep, but some are 30 to more than 60 inches deep to volcanic tuff, andesite, or conglomerate. Permeability is slow to rapid. The available water capacity ranges from 2 to 10 inches. Slopes are 0 to 30 percent. Runoff is slow to rapid, and the hazard of erosion is slight to high. Elevation is 4,500 to 6,500 feet, average annual precipitation is 6 to 28 inches, and the annual frost-free period is 50 to 90 days.

Low temperatures, the short growing season, and adverse soil characteristics restrict the use of these soils to range or woodland. A small acreage, in years with adequate precipitation, produces small crops of cereal rye. Also, areas are used for dryland wheatgrass pasture. Management of these soils is discussed in the sections "Range Management" and "woodland."

Brush clearing, seeding, and fertilizing of adapted forage plants are helpful on these soils. Grazing needs to be carefully controlled to maintain an adequate cover, to assure an adequate seed crop the following

year, and to reduce the erosion hazard. These soils also respond to such woodlot management practices as thinning, pruning, and seeding.

CAPABILITY UNIT VIw–1

In this unit are soils in the Badenaugh, poorly drained variant, Ormsby, Pasquetti, and Ramelli series. Also included is the miscellaneous land type Mixed alluvial land. The soils are somewhat poorly drained to very poorly drained. The surface layer is loamy sand to clay or mucky silty clay. The subsoil or substratum is loam to clay. The Badenaugh soil is extremely cobbly throughout its profile. These soils have a water table ranging from near the surface to a depth of about 5 feet. Permeability is slow to very slow. The available water capacity is 2 to 10 inches in the 15 to more than 60 inches of effective rooting depth. Slopes are 0 to 5 percent. Runoff is slow or very slow, and in places the surface is ponded. The hazard of erosion is none to slight, but the Ramelli soil is channeled. Elevation is 4,000 to 4,200 feet, average annual precipitation is 12 to 22 inches, and the annual frost-free period is 50 to 90 days.

The soils in this unit are heavily sodded with grasses, sedges, and other water-tolerant plants. Many areas are cut off and isolated by deep, meandering river channels and small drainageways. The soils are generally too wet for hay. During all except the summer months, livestock movement and grazing are hampered by wetness.

It is not feasible to drain these soils under the present economy. These soils are restricted in use even for pasture. For suggestions on management refer to the section entitled "Range Management." Care must be exercised to protect these soils from gullying. If gullied, they tend to drain and deteriorate in quality and quantity of forage produced.

CAPABILITY UNIT VIs–1

In this unit are soils in the Bieber, Correco, Newlands, Reno, and Trosi series. The soils are well drained. Cobbles and stones make up 20 to 50 percent of some soils, and rocks crop out on 2 to 30 percent of the surface of the Newlands soils. Soils in this unit are 10 to 36 inches deep to a hardpan, 30 to 50 inches deep to metasedimentary rock, or are more than 60 inches deep. The surface layer is sandy loam that in places is gravelly, very cobbly, or very stony. The subsoil is clay loam to clay and in places is very cobbly. Permeability is moderately slow to very slow. The available water capacity is 1 to 10 inches, depending on the effective rooting depth of the soil. Slopes are 0 to 30 percent. Runoff is slow to rapid, and the hazard of erosion is slight to high. Elevation is 4,500 to 6,000 feet, average annual precipitation is 6 to 20 inches, and the annual frost-free period is 50 to 90 days.

These soils are not generally suited to cultivation because of the steep slopes, shallow depth, or rock fragments in the soil material. Most of the acreage is used for grazing by livestock. A sizable part is covered with sagebrush-grass and used for range. Management of these soils is discussed in the "Range Management" section.

These soils respond to brush clearing and to seeding and fertilizing adapted forage plants. Overgrazing will result in inadequate cover and will increase the hazard of erosion.

CAPABILITY UNIT VIIe–1

In this unit are soils in the Bonta, Portola, Quincy, Toiyabe, and Trojan series. The soils are well drained or excessively drained. Toiyabe soils are 6 to 18 inches deep to decomposed granite, and Bonta, Portola, and Trojan soils are 24 to 60 inches deep to quartz diorite, tuff, or andesitic conglomerate. Quincy soils are more than 60 inches deep. The surface layer in soils of this unit is stony sandy loam to sand. The subsoil and substratum are gravelly clay loam to sand. Permeability is rapid to moderately slow. The available water capacity ranges from 0.5 inch to 9 inches, depending on soil depth. Slopes are 2 to 75 percent. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. Quincy sand has a high hazard of wind erosion. Elevation is 4,900 to 8,000 feet, average annual precipitation is 8 to 30 inches, and the annual frost-free period is 30 to 90 days.

The Bonta, Portola, Toiyabe, and Trojan soils are used for woodland crops and some limited grazing. The Quincy soils are used for sagebrush range. All these soils are used for watershed land and for habitat for some upland game and birds.

The soils, regardless of use, need to be protected from fires or other misuse that might remove the protective vegetative cover. These soils are not suited to intensive management practices, such as seeding and fertilizing.

CAPABILITY UNIT VIIs–1

In this unit are soils in the Aldax, Badenaugh, Glean, Glenbrook, Haypress, Martineck, Millich, Saralegui, Sattley, Toiyabe, and Trosi series. The soils are well drained to excessively drained. Rocks crop out on 10 to 40 percent of the surface, or cobbles and stones cover 30 to 70 percent of it in many areas. The surface layer ranges from loamy coarse sand to extremely stony sandy loam. The subsoil and substratum range from gravelly loamy coarse sand to very stony clay. Soil depth ranges from 6 to more than 60 inches to andesite, basaltic flows, decomposed granite, or a hardpan. Permeability ranges from rapid to very slow. The available water capacity, depending upon soil depth, ranges from 0.5 inch to 10 inches. Slopes are 2 to 75 percent. Runoff is slow to very rapid, and hazard of erosion is slight to very high. Elevation is 4,000 to 8,000 feet, average annual precipitation is 6 to 25 inches, and the annual frost-free period is 30 to 90 days.

The Haypress, Sattley, and Toiyabe soils are used for limited timber production. The other soils are used for range. All of the soils are used for watershed land and wildlife habitat.

A vegetative cover needs to be maintained to protect these soils from erosion. They do not respond favorably to intensive management practices such as seeding, fertilizing, pruning, and the like.

CAPABILITY UNIT VIIIw–1

In this unit is Riverwash, a miscellaneous land type consisting of stony, cobbly, or gravelly material that is often sandy. It is in streambeds and creekbeds. Bank cuts and secondary levees are sometimes loamy and produce some forage. Stone and gravel make up 40 to 90 percent of the material in the streambeds. Sandbars are common. These areas are mainly level, except for the sometimes very steep side banks. Flooding is common.

This unit has little value for farming. It provides water and some forage for livestock and wildlife. It is sometimes used as a source of aggregate for construction purposes. It provides the major drainageways for most of the Area.

CAPABILITY UNIT VIIIs–1

In this unit are three miscellaneous land types—Acidic rock land, Basic rock land, and Rough broken land. Acidic rock land and Basic rock land are mostly steep. Sheer, hard, massive outcroppings of bedrock are common on these land types. Smaller areas with boulder-strewn, flatter slopes are also present. The underlying bedrock of many areas that have a thin mantle of sandy soil is often deeply weathered and crumbly, but the rock exposed above ground is mostly hard and brittle. Rock land is widespread throughout the Area. The vegetation consists of sparse trees, sagebrush, and scant grass (fig. 24).

The Rough broken land is only in Long Valley. It consists of steep terrace escarpments, very shallow ridge crests, and eroded flats. The thin soil material is often sandy or gravelly and underlain by bedded hardpan layers. Slopes are dominantly greater than 30 percent, but some foot slopes and ridges have slopes ranging from 5 to 10 percent. The vegetation is sparse sagebrush and grass. This material can be dug with mechanical hoes, shovels, and other equipment.

These land types have very little value for farming, other than serving as a part of the habitat for deer, rabbits, partridges, doves, and sage hens. They provide a sizable part of the drainage area and are probably one of the main sources of the granitic alluvium in the valley basins. Some of the decomposed granitic rock is used for road surfacing.

Storie Index Rating [2]

The soils of the Area are arranged in alphabetic order in the "Guide to Mapping Units" and are rated according to the Storie index (*10*). This index expresses numerically the relative degree of suitability or value of a soil for general intensive farming. The rating is based on soil characteristics only and is obtained by evaluating such factors as depth, texture of the surface layer, density of the subsoil, drainage, content of salts and alkali, and relief. Other factors that might determine the desirability of growing certain plants in a given locality, such as availability of water for irrigation, climate, and distance from markets, are not considered. The index in itself, therefore, cannot be considered as an index of land value.

Four general factors are considered in the index rating. These factors are (A) the characteristics of the soil profile and soil depth; (B) the texture of the surface layer; (C) slope; and (X) other factors, such as drainage, salts and alkali, and erosion. Each of these four general factors is evaluated on the basis of 100 percent. A rating of 100 percent expresses the most favorable, or ideal, condition; and lower percentage ratings are given for conditions that are less favorable for crop production.

The index rating for a soil is obtained by multiplying the four factors, A, B, C, and X, as percentages. Thus, any factor may dominate or control the final rating. For example, a soil may have an excellent profile, justifying a rating of 100 percent for factor A; an excellent texture of the surface layer, justifying 100 percent for factor B; and a smooth, nearly level surface, justifying 100 percent for factor C. A high accumulation of salts or alkali, however, would give a rating of 10 percent for factor X. These four ratings combined give an index rating of 10 for this soil. The high accumulation of salts or alkali dominate the quality of the soil, render it unproductive for crops, and justify the low index rating of 10.

Soils are placed in grades according to their suitability for general intensive farming as shown by their Storie index ratings. The six grades and their range in index ratings are:

Grade 1	80 to 100
Grade 2	60 to 80
Grade 3	40 to 60
Grade 4	20 to 40
Grade 5	10 to 20
Grade 6	Less than 10

***Figure 24.*—Vegetative cover in an area of Basic rock land near Beckwourth Peak in western Sierra Valley.**

[2] By E. L. Begg, Department of Soils and Plant Nutrition, University of California, Davis.

Soils of grade 1 are excellent or well suited to general intensive farming. Grade 2 soils are good and are also well suited to farming, but not so desirable as soils of grade 1. Grade 3 soils are only fairly well suited, grade 4 soils are poorly suited, and grade 5 soils are very poorly suited. Grade 6 consists of soils and land types that are not suited to farming.

Vegetation

In general, four broad plant associations dominate the present vegetative cover: conifer forest and brush on the uplands and high terraces, big sage brush and cheat grass on the well-drained arid fans and terraces, silver sagebrush and cheat grass on the moderately well drained fans and basins, and wet meadows on the poorly drained valley basins.

The first is on uplands that border the western and southern perimeters of Sierra Valley. This fringe of trees is an easterly extension of the vast woodlands of the western slope of the Sierra Nevada mountain range. The predominant wooded soils are in the Trojan, Delleker, Portola, Toiyabe, Bonta, Haypress, and Sattley series. In this conifer forest-brush association, the dominant species are Jeffrey and ponderosa pine and lesser stands of cedar, white fir, and sugar pine. Understory consists of manzanita, black oak, buckrush, squaw carpet, needlegrass, wildrye, and minor populations of forbs. The canopies become more open as the forests merge with the drier regions to the east. Populations of curlleaf mountainmahogany, whitethorn, big sagebrush, cheat grass, and bitterbrush become important.

The second association—the big sagebrush-cheat grass community—is on the uplands and terraces where the annual precipitation is generally less than 14 inches. The most extensive soils are Aldax, Millich, Dotta, Galeppi, and some of the miscellaneous land types such as rock land. The predominant plant species is big sagebrush and an understory of cheat grass, remnant perennial grasses, and numerous annual and perennial forbs. Here, as in the conifer forest-brush association, bitterbrush is an important constituent in some areas. In Long Valley, desert peach, mormon tea, rabbitbrush, mule ears, tumblemustard and scattered minor stands of juniper are an essential part of the plant community. Mixed in this association are some claypan and hardpan soils, such as those of the Martineck, Trosi, Bieber, and Reno series. These areas have a sparse cover consisting of low sage and cheat grass with some Sandberg bluegrass and forbs.

The third association—the silver sagebrush-cheatgrass community—is on fans, terraces, and basins where the water table fluctuates from near the surface to a depth of 6 feet or more. The predominant soils in this group are in the Balman, Beckwourth, Bidwell, Calpine, Coolbrith, Loyalton, and Ormsby series. The dominant plant cover consists of silver sage and an understory largely of cheat grass with some threadleaf sedge, creeping wildrye, Great Basin wildrye, and big bluegrass. Some of the depressional swales and drainageways in this association that are affected with salt and alkali have a spotty cover of saltgrass, pickleweed, poverty weed, and rabbitbrush, particularly on such soils as the Bellavista, Loyalton, and Balman.

The fourth association is made up of the wet, poorly drained meadowlands that are in the near-central valley basins. The dominant soils are in the Ramelli, James Canyon, and Pasquetti series. This association is dominated by wire grass, sedges, bluegrass, plantain, dandelion, camas, creeping wildrye, tufted hairgrass, redtop, and various other water-tolerant forbs and grasses. In the main, the wet meadowlands are the most productive of native forage in the Area.

The plants in one association may be in others. They are often somewhat mixed and transitional from one association to the other.

Cropland [3]

Cropland occupies about 22,000 acres in the survey area. It is used almost exclusively to produce hay and grain for livestock feed and for supplemental pasture. The variety of crops grown is limited to a few that are relatively hardy, since the growing season is only 60 to 90 days. The supply of irrigation water after the runoff early in spring is quite reliable.

In recent years wells have been drilled to provide dependable irrigation water supplies. These are located mainly in the area between the Sierra and Plumas Counties boundary line and Dyson Lane, about four miles north of Loyalton. Studies by the Department of Water Resources indicate abundant underground water in some parts of Sierra Valley that will probably be developed for irrigation at a later date.

About 8,000 acres along Little Last Chance Creek has received, or will receive, a firm supply of irrigation water from the Frenchman Reservoir. The southern end of Sierra Valley obtains some supplemental water that is diverted from the Little Truckee River by the Sierraville Water District. Ranchers in other locations have developed water for irrigation by impounding runoff water or drilling wells. Several others are considering similar development for their properties.

As dependable sources of irrigation water develop, improved management practices are being applied. Old sod-bound meadows are broken up, the land is leveled for better use of irrigation water, and improved mixtures of grass and legumes are seeded. Some of the new seedings have been fertilized.

Improved plant species and management practices are continually being developed by ranchers cooperating with the Soil Conservation Service and the County Farm Advisor. Other ranchers in the Area adopt many of the improved practices as they prove feasible.

While yields of meadow hayfields over the Area as a whole average less than ¾ ton per acre, many improved fields have produced 5 tons per acre or more. Some of the soils from which high yields have been obtained are James Canyon, Smithneck, Beckwourth, Ormsby, and Coolbrith (fig. 25). Other soils will no doubt prove quite productive after improvement.

[3] By R. R. LARSEN, soil conservationist, Soil Conservation Service.

Figure 25.—Alfalfa-grass hayfield on Ormsby soils, near Vinton.

Alfalfa-grass hay and grain are often grown dryland. Production is quite variable because of the rainfall, and frost often reduces the yield of both crops. Grain crops are most subject to frost damage while in bloom or in the milk stage. If frost occurs at this time, the crop is usually harvested for hay.

Sufficient and timely spring rains are very important to the dryland crops, especially on the sandier or shallower soils. Annual precipitation in the survey area ranges from about 6 inches in Long Valley to about 22 inches at Sierraville. Most of Sierra Valley averages 14 to 20 inches, most of it as snow in the late fall and winter. The rains that fall in the spring are generally adequate for a fair crop, but conditions suitable for a really good crop cannot be expected to occur regularly.

Estimated yields

The yield estimates in this survey are based on observations made by soil scientists who surveyed the Area, on information furnished by ranchers in the Area, and by local technicians in the Agricultural Extension Service and the Soil Conservation Service. Federal and county census data are also reviewed and considered. More information was available for some soils than for others. If little or no information was available, yield estimates were made by comparison with similar soils.

Table 2 gives the yields of principal crops grown in the Area under the best level of management known (whether actually applied or not). This is the level of management that, according to experience, field trials, and research findings, would give the highest possible yields at the present time.

Yield figures given are estimates of what may be expected over a period of years. Yields in any one year may be considerably lower or higher. Also, there are wide variations within some soils. Such factors as alkali, gravel spots, or small patches of another soil too small to separate on the maps may affect yields.

Dryland barley, wheat, rye, and oats for grain and cereal rye for hay.—A typical cropping system includes 2 or 3 years of grain and 4 or 5 years of alfalfa-grass hay or pasture. Fields are plowed in the fall of alternate years, followed in the spring by shallow (2 to 3 inches) disking, and packing with a ringroller. Improved, certified, adapted varieties of seed are planted 2 to 3 inches deep with a press drill or with a double-disk drill followed once or twice with a ringroller. In alternate years fields are disked to a depth of 6 to 8 inches in the spring and then packed with a ringroller. Oats and rye are planted by April 1 and wheat and barley by April 15 with a press drill. In years when cereal rye is damaged by frost, it can be harvested as hay (fig. 26).

Irrigated pasture, irrigated legume-grass hay, and irrigated oat hay.—A typical cropping sequence includes 3 to 5 years of irrigated pasture or hay and 2 or 3 years of small grain. In preparing the seedbed the field is leveled to a 0.1 to 0.3 percent grade, and in the fall the grain stubble is plowed 6 to 8 inches deep. The field is disked to a depth of 2 to 3 inches, ringrolled, and seeded with a press drill about ½ to 1 inch deep. It is ringrolled after seeding, if needed, to get a firm seedbed. Seed should consist of adapted improved varieties of grasses or legumes. Seeds should be planted between April 1 and May 15. All legume seeds should be innoculated.

Irrigation is typically by border checks, usually 30 to 40 feet wide and 500 to 1,000 feet long. Irrigation begins about May 1, or when soil and weather conditions indicate a need. Fields are then irrigated every 10 to 14 days, depending upon plant use and soils. In poorly drained soils, drainage ditches are dug and excessive irrigation is avoided. More trials are needed to determine exact fertilizer needs. Most grasses appear to use 60 to 80 pounds of nitrogen. About 200 to 400 pounds of gypsum per acre is generally applied to alfalfa.

If harvested for hay, one or two crops are cut, beginning when the forage is ready, usually about June 15. Regrowth of alfalfa-grass mixtures is allowed after the second crop. Fields are grazed after October 15, leaving adequate residues for winter protection of the plant crowns (fig. 27).

In areas planted to pasture, grazing is started in spring when grasses are about 8 inches high. Grazing

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

[Only arable soils are listed in this table. Absence of data indicates that the crop is not grown on the soil or that the crop is not suited to the soil]

Soil	Oat hay	Legume-grass hay	Pasture	Dryland crops					
				Barley	Wheat	Rye	Oats	Cereal-rye hay	Alfalfa-grass hay
	Tons	*Tons*	*Animal-unit months* [1]	*Lbs*	*Lbs*	*Lbs*	*Lbs*	*Tons*	*Tons*
Balman loam, 0 to 2 percent slopes	1.5	3.0	8	700	700	600	800	1.25	2.0
Balman loam, 2 to 5 percent slopes	1.5	3.0	8	700	700	600	800	1.25	2.0
Balman-Ramelli complex, 0 to 2 percent slopes	1.5	2.0	8	700	700	600	700	1.1	1.0
Beckwourth loamy coarse sand	2.0	3.0	7	1,200	1,200	1,000	1,200	1.5	1.5
Beckwourth loamy coarse sand, clayey substratum	2.0	3.0	7	1,200	1,200	1,000	1,200	1.5	1.5
Beckwourth sandy loam	2.0	3.0	7	1,200	1,200	1,000	1,200	1.5	1.5
Beckwourth-Loyalton complex, saline-alkali, 0 to 2 percent slopes	1.5	1.5	4	600	600	550	600	0.8	1.0
Beckwourth-Ormsby loamy coarse sands	1.5	2.5	7	800	700	600	700	1.0	1.5
Bellavista loam, 0 to 2 percent slopes	----	2.0	5	700	700	600	800	1.0	1.0
Bellavista loam, 2 to 5 percent slopes	----	2.0	5	700	700	600	800	1.0	1.0
Bidwell sandy loam, 0 to 2 percent slopes	2.5	4.0	10	1,200	1,500	1,000	1,500	1.5	1.75
Bidwell sandy loam, 2 to 5 percent slopes	2.5	4.0	10	1,200	1,500	1,000	1,500	1.5	1.75
Bidwell sandy loam, sandy substratum, 0 to 2 percent slopes	2.5	4.0	10	1,200	1,500	1,000	1,500	1.5	1.75
Bidwell loam, 0 to 2 percent slopes	2.5	4.0	10	1,200	1,500	1,000	1,500	1.5	1.75
Bieber sandy loam, moderately deep, 0 to 2 percent slopes	1.5	2.5	8	650	650	600	650	1.2	1.2
Calpine coarse sandy loam, 0 to 2 percent slopes	----	3.0	8	900	1,000	800	900	1.1	1.5
Calpine coarse sandy loam, 2 to 5 percent slopes	----	3.0	8	900	1,000	800	900	1.1	1.5
Calpine coarse sandy loam, 5 to 9 percent slopes	----	3.0	8	900	1,000	800	900	1.1	1.5
Calpine coarse sandy loam, clayey variant, 0 to 2 percent slopes	----	3.0	8	900	1,000	800	900	1.1	1.5
Coolbrith silt loam, 0 to 2 percent slopes	2.5	4.0	10	1,200	1,750	1,000	1,200	1.3	1.75
Coolbrith silt loam, 2 to 5 percent slopes	2.5	4.0	10	1,200	1,750	1,000	1,200	1.3	1.75
Correco sandy loam, 2 to 5 percent slopes	----	2.5	8	800	1,000	700	800	1.1	1.5
Correco sandy loam, 5 to 15 percent slopes	----	2.5	8	800	1,000	700	800	1.1	1.5
Delleker sandy loam, 2 to 15 percent slopes, eroded	----	2.0	6	800	1,000	700	800	1.1	1.5
Dotta sandy loam, 0 to 2 percent slopes	1.5	3.5	10	1,000	1,200	800	1,000	1.1	2.0
Dotta sandy loam, 2 to 9 percent slopes	1.5	3.5	10	1,000	1,200	800	1,000	1.1	2.0
Galeppi loamy coarse sand, 2 to 5 percent slopes	----	4.0	10	----	----	----	----	----	----
James Canyon gravelly loam, 2 to 5 percent slopes	2.5	4.0	10	1,200	1,200	1,000	1,200	1.1	2.25
James Canyon silt loam, 0 to 2 percent slopes	2.5	4.0	10	1,200	1,200	1,000	1,200	1.1	2.25
Lovejoy loam, 0 to 5 percent slopes	----	----	----	----	----	800	----	1.0	----
Loyalton fine sandy loam	1.5	1.5	4	600	600	550	600	0.8	1.0
Loyalton silt loam	1.5	1.5	4	600	600	550	600	0.8	1.0
Ormsby loamy coarse sand, 0 to 2 percent slopes	----	2.5	7	----	----	----	----	----	1.5
Ormsby loamy coarse sand, 2 to 5 percent slopes	----	2.5	7	----	----	----	----	----	1.5
Ormsby coarse sandy loam, poorly drained, 0 to 2 percent slopes	----	2.5	7	----	----	----	----	----	1.5
Ormsby coarse sandy loam, poorly drained, 2 to 5 percent slopes	----	2.5	7	----	----	----	----	----	1.5
Ramelli clay	1.75	2.0	8	700	700	600	700	1.1	1.0
Smithneck sandy loam	2.5	3.5	10	1,000	1,200	800	1,000	1.5	3.0

[1] The amount of forage or feed required to maintain one animal unit—one cow, one horse, one mule, five sheep, or five goats—for a period of 30 days.

Figure 26.—Stand of rye grown in a year of adequate rainfall on a moderately deep, nearly level sandy loam.

is rotated, allowing 25 to 28 days for regrowth. Grazing and irrigation cycles are staggered so a pasture is never grazed during the time it is being irrigated. An average of 4 inches of stubble should be left at the end of each grazing period and at the end of the grazing season. Pasture is clipped as needed to eliminate weeds and rank growth. Pastures should be harrowed to scatter animal droppings.

Native meadow pasture or hay is irrigated by wild flooding or by contour ditches. If used for hay, harvesting starts July 1 and is followed by grazing. If used for pasture, grazing starts when the grasses are about 6 inches high, usually about May 1 to May 15.

Dryland alfalfa-grass hay or pasture.—A typical cropping system is a grass-legume mixture or alfalfa for 5 to 10 years, or more if the stand remains good, followed by grain for 1 or 2 years. The grain stubble is plowed to a depth of 6 to 8 inches in the fall, disked to a depth of 2 to 3 inches in the spring, and floated with a leveling drag. Seed is planted ¾ to 1½ inches deep with a press drill, and ringrolled as needed to make a firm seedbed. A simple mixture of adapted improved varieties of certified varieties of grasses and legumes should be planted between April 1 and May 25. Grasses and legumes should be planted in alternate rows. All legume seeds should be innoculated. Where

Figure 27.—Alfalfa-grass pasture about 5 years old. Alfalfa is thinning out because of the restricted root zone.

trials indicate a need, about 300 to 400 pounds of gypsum per acre are applied to alfalfa every 3 to 4 years. Pastures are protected from grazing until the stand is well established, usually after seed set the second season. Grazing is deferred and rotated to allow plants to set seed one year in three. Grazing in spring is started when new grass growth has reached about 6 inches. Adequate stubble should be left for winter protection, depending upon the species of plants used. When used for hay, management is much the same as for pasture.

Range Management [4]

Management of the soils for range is discussed in this section. The soils considered are those that are too wet, steep, or rocky to be used as cropland, or are in arid eastern parts of the Area where the annual precipitation is insufficient to produce crops under dryland conditions. Management of the arable soils on the valley bottoms and those on the gently sloping fans around the edges of the valleys are discussed in the sections "Description of the Soils," "Cropland," and "Management by Capability Units."

The range in the Area has been very heavily grazed by cattle and sheep, and the present plant communities differ greatly from their original, or climax, condition. Big sagebrush and cheat grass brome have replaced what was once mixtures of grasses and forbs and sparse sagebrush.

Soils have observable differences. These are reflected by their ability to produce different kinds and

[4] By ROCHE D. BUSH, range conservationist, Soil Conservation Service.

amounts of vegetation. Range soils that will produce essentially the same kind and amount of vegetation have been grouped into range sites. Each range site has its own set of environmental conditions. Where range is properly used, a balance in the plant community will be reached. This balance of grazing use results in a stable plant community, which is the highest point of plant succession and the "potential" for that site.

Eight different range sites are recognized in the Area. Two of these are only in Long Valley. The other six sites are spread throughout the Area.

Grazing values of the woodlands are placed in two categories, based on their capacities to produce forage. These are discussed in more detail in the "Woodland" section.

Range condition is the present state of the vegetation as compared to the potential for the range site. It is expressed as a percentage that shows how much of the present vegetation is of the same kind and amounts as that in the potential plant community.

The deterioration or improvement of range condition is generally gradual. In the course of such changes the same area of land is successively occupied by many kinds of plants in many combinations. The ranch operator should know the major kinds of range plants that should be growing on the different sites on his ranch. He needs to know how these plants respond to differences in time and intensity of grazing. He needs to know the condition of his range and whether it is deteriorating or improving.

As range condition deteriorates, some kinds of plants decrease in number, and some increase. Others originally not present may invade. These responses to grazing are used in a system for classifying range condition.

Decreaser species for a site are those present in the original plant community that decrease in amount of total herbage they contribute if they are continuously closely grazed during the growing season. Increaser plants are those of the original plant community that normally increase, at least for a time, in relative amount of herbage they produce. They increase as the decreaser plants cover less of the site. Invader plants are those not in the original plant community that begin growing in an area after the decreasers and increasers have been weakened, thinned out, or eliminated.

Range condition of an area is determined by comparing its present vegetation with the original, or potential, for the site. Four condition classes—*excellent, good, fair*, and *poor*—are used to indicate this departure from the potential (fig. 28).

The goal of range management is to maintain range in the excellent or good range condition class. Generally, the greatest yields of forage are obtained, on a sustained basis, if range is in excellent condition. Also, soil and water losses are reduced to the minimum possible without artificial aids, and maximum use is made of rainfall and snowmelt.

Most of the rangeland in the Area is in poor condition. Sagebrush dominates most of the range. It produces good quantities of herbage each year, but only very small amounts are used by livestock. When the plant cover is made up of good forage species, as it is when the condition is good to excellent, much more forage is available for use by livestock.

Descriptions of range sites

Brief descriptions of the eight range sites are presented in this section. The reader can determine the kinds and names of soils in each of the range sites by checking the "Guide to Mapping Units" at the back of the survey.

Listed in the description of each range site are estimates of total potential herbage production for each. Two production figures are given in each case. These two figures reflect the differences in annual production caused by variation in growing conditions.

Stocking rates and carrying capacities should not be computed from the total annual herbage yield. As the operator becomes familiar with seasonal grazing readiness and production of his forage resources, his judgment will determine the current grazing plan. Local Soil Conservation Service technicians or farm advisors can assist in determining initial stocking rates, which should be made only after onsite inspection.

Sizable acreages have been seeded in the Area. Most of the seeding has been on arable lands that have been converted from cropland or on lands cleared of brush and seeded to improved species. The gentle slopes where an adequate seedbed can be prepared on the Intermediate Mountains in the 12-inch+ precipitation zone and the Hardpan Terrace range sites are also adapted for seeding. The Intermediate Mountains in the 6- to 12-inch precipitation zone range site has suitable soils for seeding, but the difficulty of establishing satisfactory stands during unfavorable years makes it a risky undertaking. Range cattle require supplemental feeding of hay during the winter in most years.

RANGE SITE 1: INTERMEDIATE MOUNTAINS, 12-INCH+ PRECIPITATION ZONE

This range site consists of sandy loams on fans and foot slopes around the edge of the valley floor and in and around small valleys in upland areas. Slope range is dominantly 2 to 30 percent, but slopes are as much as 50 percent. Most of these soils have more clay in the subsoil than in the surface layer and have moderately low to high available water capacity. All of these soils have rock outcrops on the surface or contain cobbles, stones, or gravel.

This site has a higher potential for producing forage than any of the other seven range sites recognized in the Area. The potential plant community is 65 to 75 percent perennial grasses, 15 to 20 percent brush, and 15 to 20 percent forbs. Important decreaser species on this site are Idaho fescue, western needlegrass, Thurber needlegrass, Great Basin wildrye, prairie Junegrass, big bluegrass, melic grass, dryland sedge, bitterbrush, snowberry, serviceberry, geranium, and hawksbeard. Increaser plants include Sandberg bluegrass, squirreltail, creeping wildrye, big sagebrush, rabbitbrush, wild currant, lupine, little sunflower, yarrow, phlox, arrowleaf balsamroot, mule ears, and

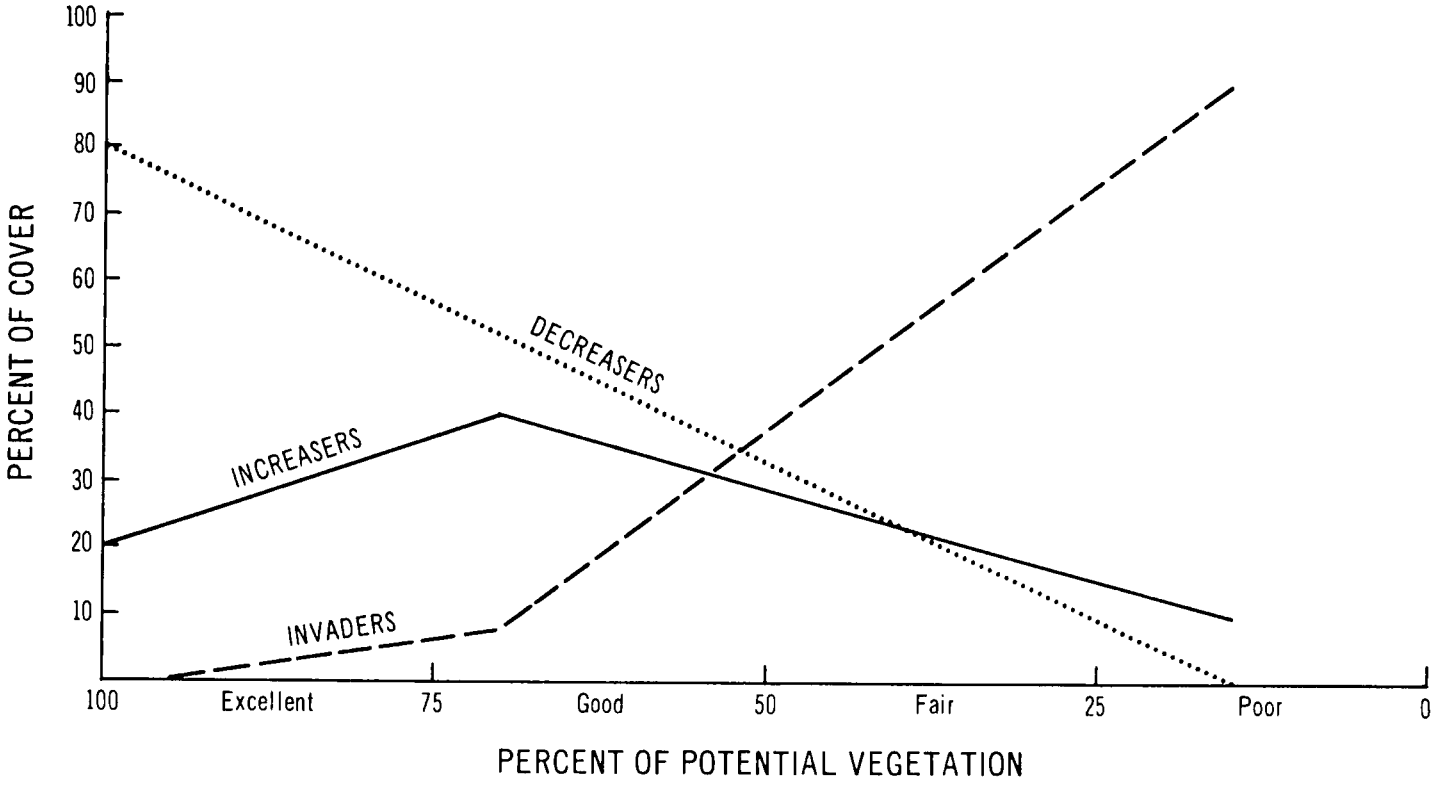

***Figure 28.*—Four range-condition classes—*excellent, good, fair,* and *poor*—and percentage of cover per class.**

buckwheat. Invaders are cheat grass brome, annual fescues, Russian-thistle, tumblemustard, and other annual forbs.

The plant cover on this site is predominantly big sagebrush, but some areas have good stands of bitterbrush interspersed with the sagebrush. The understory is mostly cheat grass brome and remnant plants of Thurber needlegrass, western needlegrass, Sandberg bluegrass, and squirreltail, as well as annual forbs and a few perennial forbs. The condition of the range is predominantly poor. Only small areas are rated fair. Some acreages have been cleared of brush and are producing good quantities of such introduced grasses as crested wheatgrass, intermediate wheatgrass, and pubescent wheatgrass.

Small areas of this site have slopes of more than 30 percent. In these areas runoff is greater, and the hazard of erosion is more severe, necessitating light use practices in order to leave greater amounts of plant material on the ground for soil protection. Some areas in this range site are too stony or rocky to be cleared and seeded, but not enough to impede livestock movement or reduce forage production.

The estimated total annual herbage production is 1,400 pounds per acre in favorable years and 900 pounds per acre in unfavorable years.

RANGE SITE 2: INTERMEDIATE MOUNTAINS, 6- TO 12-INCH PRECIPITATION ZONE

This range site consists of sandy loams and loamy coarse sands underlain by a clayey subsoil. The soils are on hills in the drier parts of the Area east of Long Valley Creek and in the vicinity of Beckwourth Pass. Slope range is dominantly 2 to 30 percent, but slopes are more than 30 percent in a few small areas. These soils are mostly more than 60 inches deep. They are somewhat droughty in the surface layer, but they have moderate available water capacity throughout the profile.

The potential plant community is 50 to 65 percent perennial grasses, 20 to 30 percent brush, and 10 to 20 percent forbs. Important decreaser species on this site are Indian ricegrass, needleandthread, basin wildrye, Thurber needlegrass, bitterbrush, and hawksbeard. Increaser plants are mainly Sandberg bluegrass, squirreltail, creeping wildrye, desert needlegrass, big sagebrush, gray horsebrush, rabbitbrush, cutleaf balsamroot, phlox, buckwheat, lupine, astragalus, and mule ears. Invaders are cheat grass, Russian-thistle, mustard, filaree, and other annual forbs.

The plant cover on this site is mainly big sagebrush. Bitterbrush is present in a few places. The understory is mostly cheat grass and filaree but includes needleandthread, desert needlegrass, and, in places, Indian ricegrass. Nearly all of the decreaser plants have been eliminated by past grazing. The condition of the range is poor.

The estimated total annual herbage production is 1,000 pounds per acre in favorable years and 600 pounds per acre in unfavorable years.

RANGE SITE 3: SHALLOW STONY UPLANDS

This range site consists of very stony loams, very cobbly sandy loams, or areas where 10 to 25 percent

of the surface area is rock outcrop. These soils generally range from 6 to 20 inches in depth to bedrock. A few range to 60 inches in depth, but their production potential appears to be no better than other soils in this site. These soils are mostly on upland slopes on the hills and mountainous terrain that divides Sierra Valley and Long Valley. Some small areas are on the upland fringe around Sierra Valley. Slopes are predominantly over 15 percent, but they are as little as 2 percent in some areas. Runoff is medium to very rapid. The available water capacity is very low to moderate. Rocks and stones on the surface impede livestock movement somewhat, and those in the profile reduce potential production.

This site has a low potential for forage production. The potential plant community is made up of 55 to 65 percent perennial grasses, 25 to 35 percent brush, and 10 to 15 percent forbs. Important decreaser species on this site are Idaho fescue, Thurber needlegrass, big bluegrass, Great Basin wildrye, prairie junegrass, bitterbrush, hawksbeard, and cutleaf balsamroot. Increaser plants include Sandberg bluegrass, squirreltail, creeping wildrye, stunted big sagebrush, lupine, yarrow, penstemon, and phlox. Some invaders are cheatgrass brome, mustard, filaree, Russian-thistle, and other annual forbs.

The plant cover on this site is mainly stunted big sagebrush. The understory is cheatgrass brome and remnant plants of Sandberg bluegrass, squirreltail, and occasional Thurber needlegrass. Nearly all of the decreaser plants have been eliminated by past grazing. The condition of the range is poor. An erosion pavement has formed on large acreages, and plants are pediceled. Steep slopes and rocks on the surface and in the soil profile provide very little or no opportunity to improve the cover by seeding.

The estimated total annual herbage production is 900 pounds per acre in favorable years and 550 pounds per acre in unfavorable years.

RANGE SITE 4: HARDPAN TERRACES

This range site consists of sandy loams that in places are gravelly or very stony. They are underlain, at a depth of 8 to 36 inches, by a claypan over an indurated hardpan. The soils are in eastern Sierra Valley on low benches and in Long Valley on the benches and terraces west of Long Valley Creek. Slopes range from 0 to 15 percent but are generally less than 9 percent. These soils have low available water capacity. The stones and cobbles in some of the soils do not impede livestock movement or reduce forage production appreciably.

The potential plant community is 50 to 60 percent perennial grasses, 30 to 40 percent brush, and 10 to 15 percent forbs. Important decreaser species are onespike oatgrass, Sandberg bluegrass, Idaho fescue, Thurber needlegrass, and big bluegrass. Increaser plants include squirreltail, low sagebrush, stunted big sagebrush, cutleaf balsamroot, phlox, buckwheat, low larkspur, deathcamas, penstemon, and yarrow. Among the invaders are cheatgrass brome, Russian-thistle, poverty weed, mustard, peppergrass, and other annual forbs.

The plant cover on this site is mainly low sagebrush. The understory is Sandberg bluegrass, cheatgrass brome, some perennial and annual forbs, and remnant perennial grasses. This site has a low potential for producing forage. Grazing has been heavy in the past, and range condition is poor. Some areas, however, have enough of the decreaser plants remaining to be placed in fair condition. Moderate stands of grass are obtained on selected areas of this site after clearing and seeding to crested wheatgrass. The soil in this site responds to seeding and fertilizing.

The estimated total annual herbage production is 600 pounds per acre in favorable years and 350 pounds per acre in unfavorable years.

RANGE SITE 5: CLAYPAN TERRACES

This range site consists of loams and sandy loams that generally have a very slowly permeable claypan at a depth of 8 to 20 inches. The soils are in the west-central part of Sierra Valley on low benches that merge with the valley floor. Slopes are seldom more than 5 percent. Some of the soils have a slowly permeable clayey subsoil. They are moderately well drained and well drained. Plant roots penetrate the clay subsoil in cracks and are able to get some summer moisture from this layer. Available water capacity is low to moderate.

The potential plant community is 65 to 75 percent perennial grasses, 15 to 25 percent brush, and 10 to 15 percent forbs. Important decreaser species on this site are Sandberg bluegrass, Idaho fescue, Thurber needlegrass, big bluegrass, and dryland sedges. Increaser plants include low sagebrush, squirreltail, cutleaf balsamroot, lupine, and yarrow. Invaders are cheatgrass brome, Russian-thistle, poverty weed, mustard, and other annual forbs.

The plant cover on this site is mainly low sagebrush, cheatgrass brome, and some remnants of Sandberg bluegrass, squirreltail, and dryland sedge. The cover is spotty and sparse. The condition of the range is generally poor because of low fertility and past grazing. The soils respond to fertilizing and seeding in years of favorable moisture.

The estimated total herbage production is 500 pounds per acre in favorable years and 300 pounds per acre in unfavorable years.

RANGE SITE 6: VERY STONY TERRACES

This range site consists of very stony or extremely stony sandy loams that are underlain at a depth of 10 to 30 inches by an indurated hardpan. The soils are in the same general areas as those of the Hardpan Terraces site. Slopes are 2 to 50 percent. These soils have low available water capacity. Root development is severely restricted. Stones and cobbles are prevalent to the extent that livestock movements are impeded and forage production is reduced.

The potential plant community is similar to that of the Hardpan Terraces site, as far as species composition is concerned. The plant-cover density and production potential are lower because of stones on the surface and in the soil material.

The plant cover on this range site is mainly low sagebrush. An occasional stunted bitterbrush and very few Jeffrey pine are present. The understory is mostly cheatgrass brome and scattered Sandberg bluegrass and squirreltail, along with some annual and perennial forbs. Condition of the range is poor. Seeding to improve forage production is not feasible because of the amount of stones on the surface and in the soil material.

The estimated total annual herbage production is 400 pounds per acre in favorable years and 250 pounds per acre in unfavorable years.

RANGE SITE 7: SANDY FANS AND UPLANDS

This range site consists of very droughty, very deep sands. The soils are on terraces north of Vinton and east in the vicinity of Beckwourth Pass. Slopes range from 2 to 15 percent. These soils have low available water capacity. They are subject to a severe hazard of wind erosion if they are not adequately protected.

The potential plant community is 45 to 60 percent perennial grasses, 20 to 35 percent brush, and 10 to 15 percent forbs. Important decreaser species on this site are Indian ricegrass, needleandthread, big bluegrass, Great Basin wildrye, bitterbrush, serviceberry, and mormon tea. Increaser plants include Thurber needlegrass, squirreltail, desert needlegrass, arrowleaf balsamroot, mule ears, lupine, yarrow, hawksbeard, big sagebrush, and rabbitbrush. Invaders are cheatgrass brome, Russian-thistle, mustard, and other annual forbs.

The plant cover on this site is mainly big sagebrush and some bitterbrush. The understory is cheatgrass brome. Remnant plants of Indian ricegrass, needleandthread, squirreltail, and some annual and perennial forbs are present. The condition of the range is poor as a result of past grazing. This range site has a moderate potential for forage production, but brush clearing and seeding treatments are not feasible because of the severe hazard of wind erosion and the droughty nature of the soils.

The estimated total annual herbage production is 1,100 pounds per acre in favorable years and 700 pounds per acre in unfavorable years.

RANGE SITE 8: WET MEADOWS

This range site consists of moderately deep to deep clay loams, clays and mucky silty clays. The soils are almost entirely in Sierra Valley in the area of the valley basin north of Sierraville and in the broad drainageways west of Vinton. In some areas stones and cobbles are on the surface and in the soil material. The soils of this site are poorly and very poorly drained and are so wet, cobbly, or both, that any cultural improvement other than better water management is precluded. These soils are perennially wet. They are high in organic matter. The hazard of erosion is none to slight. Some of the soils have enough stones and cobbles on the surface to hamper livestock movement and prohibit haymaking.

The potential plant community is 75 to 90 percent perennial grasses and grasslike plants, 10 to 20 percent forbs, and 0 to 5 percent brush. Important decreaser species on this site are tufted hairgrass, Nevada bluegrass, redtop, timothy, meadow fescue, and clovers. Increaser plants include fineleaf sedge, broadleaf sedge, rushes, creeping wildrye, meadow barley, five-finger, yarrow, dandelion, camas, buttercup, wild rose, and willow. Invaders are annual forbs, foxtail, bullthistle, curly dock, silver sagebrush, and rabbitbrush.

The plant cover on this site is mainly sedge and wire grass and lesser amounts of desirable grasses such as tufted hairgrass, redtop, timothy, Kentucky bluegrass, and perennial forbs. Some native clovers are in areas that are slightly less wet than other areas. On much of this site is a heavy infestation of camas, which is of little value as a forage plant. The range is generally in fair to poor condition. Some of these wet meadow areas are cut for hay where rocks or surface water do not interfere, but the soils are used mostly for summer grazing. This range site produces more forage than any other in the Area. Improved management practices such as irrigation water management or deferred and rotation grazing could be applied and would increase forage.

The estimated total annual forage production is 4,500 pounds per acre in favorable years and 3,000 pounds per acre in unfavorable years.

Woodland [5]

Woodlands in the Sierra Valley Area provide many wood products for sale or for use on farms and ranches. They also protect the watersheds that supply water to several communities and irrigation water for the Area. They provide food and cover for deer and many other kinds of wildlife and serve as recreation areas for many persons.

Trees cut from the woodlands in the Area and in the near vicinity supply timber for local sawmills. Some timber is exported to mills outside the Area. A few farmers own small mills in which they saw lumber for their own use. The principal products are dimensional lumber, firewood, cedar shakes, fenceposts, and pulp chips. The principal tree species are ponderosa pine, Jeffrey pine, sugar pine, white fir, and incense cedar. Other common tree species are California black oak, cottonwood, and several species of willow. Juniper serves as an excellent source of fencepost material.

Woodlands have been important to the economy of the Area since settlement began in 1851. At first only the material needed for farm use was cut. It was used mainly for shelter, firewood, and fenceposts. Then, in only a short time, large lumber operations began. Extensive railroad logging was developed, and huge ponderosa and Jeffrey pine logs were hauled to the mills by rail. Some tracks were in use until the 1930's, and roadbeds can still be traced for miles in many directions. A few rotted ties and scattered rusty spikes are the only identifying evidence remaining in some areas. Today most logging is done with tractors, and logs are hauled by truck.

[5] By MILTON B. EDWARDS, woodland conservationist, Soil Conservation Service.

Some of the original woodland does not support trees now. Some of it was cleared for farming and grazing. Other areas were destroyed by the many fires that have burned over the Area. Some are now covered with brush.

Since the woodlands in the Area are where rainfall is less than optimum, the trees often are associated with grasses and forbs that have grazing values. Here such management practices as thinning not only increase the growth rate of trees but also improve the growing conditions for forage plants. Thus, the growing of wood crops and the production of livestock are compatible if both operations are managed properly.

Woodland management

The main purposes of woodland management are to promote tree growth and protect the soils and adjacent areas, particularly those downstream, from runoff and erosion; to obtain maximum yields of high-quality wood products at the smallest possible cost; and to improve areas for recreation and for wildlife food and cover.

Woodlands can be maintained and improved by protecting the areas from fire and erosion, overgrazing by livestock, and damage by pests and disease. Other practices of value are weeding, thinning, and pruning the trees; harvesting the trees in a manner that will provide for natural regeneration of the stand; and planting young trees where necessary.

Protecting the trees from fire is the most important practice in management of woodland. Fire can wipe out a wood crop in a few minutes. It destroys forest litter and exposes the soil to the weather. As a result, runoff and erosion increase, and flooding of the streams below increases. Even a light fire destroys protective litter, kills young trees, weakens older trees by scarring the roots, and opens the way for pests and diseases. Practices that help protect the areas from fire are constructing firebreaks, preventing the accumulation of large amounts of slash and trash, providing for storage of water at strategic locations, and keeping firefighting tools and equipment readily accessible for use when needed.

Road, skid trails, and landings should be located, if possible, on the less erodible soils. They should be above stream channels and graded properly, and suitable culverts and bridges should be provided. Secondary roads should be slightly outsloped. Mulching is needed on areas that are likely to erode after use, and cross ditches are needed in some places.

In many places trees can be protected from pests if those trees that are susceptible to pests are removed. Trees that are already infested can be treated by cutting out the part infested, by spraying, or by removing the entire tree.

Protection from disease can also be attained in places by harvesting trees that are susceptible, but specific treatment for the disease is sometimes necessary.

Livestock, deer, bears, rabbits, porcupines, mice, squirrels, and beavers are all likely to cause damage to trees. Damage by animals can be controlled if animal populations are restricted to the number that can be supported by the forage available. Reducing the numbers of some wild animals, however, is restricted by game laws.

Improvement cuttings are generally feasible if the sale of wood brings a return at least equal to the cost of the cutting. The poorest and least valuable trees should be removed and the faster growing, better trees left standing. Only those trees that will add several inches of clear wood by the time they are harvested should be pruned. Harvest cuttings can be made in several ways. The method used should be designed to ensure minimal disturbance of the surface layer, and harvesting should be restricted to areas where the soil is more nearly level. Upon completion of the harvesting, a new stand should be able to generate naturally, or provisions for planting should be made immediately after cutting. Otherwise the soils are likely to be severely eroded, and brush will quickly encroach on the areas.

The success of tree planting varies. If brush has been completely removed, planting is generally successful. On soils that are steep or subject to erosion, bulldozing of brush should be on the contour. Ponderosa and Jeffrey pine are the most commonly planted trees in the Sierra Valley Area. Little direct seeding of these species has been tried.

Woodland that has grazing value.—These are areas of woodlands on the south, west, and north edges of the Area that have considerable grazing value. When well managed they can produce moderate amounts of wood products and also provide forage for livestock. These areas have been placed in two groups: shallow to moderately deep soils that are forming in granitic bedrock, and moderately deep to deep soils that are forming in andesitic and basaltic rock.

Specific soils have not been placed in these sites. They can be determined by reviewing the soil descriptions or by making onsite investigations.

Woodland in an area of granitic soils.—This woodland area is in the hills north and east of Vinton and on the west side of the valley near Calpine. The soils are mostly shallow to moderately deep loamy coarse sands with some rock outcrops. Their available water capacity is low to moderate. Slopes range from 2 to 75 percent, but most of the acreage is soils that have slopes of more than 30 percent.

The understory plant cover, growing beneath the open and scattered stands of ponderosa and Jeffrey pine, is a mixture of browse, grasses, and forbs. It is predominantly big sagebrush with some bitterbrush, mountainmahogany, squawcarpet, western needlegrass, squirreltail, mule ears, and considerable amounts of cheatgrass brome. Past grazing pressures have reduced this area to fair or poor range condition. The deeper soils, which have the gentler slopes of the complex, can produce moderate amounts of forage, but they are minor in acreage. The steeper, shallower parts of these areas furnish only small amounts of forage for grazing animals. Little or no opportunity for improvement of grazing values through clearing or seeding exists in these areas. Good woodland management practices, however, would increase both the wood crops and forage production.

The potential understory plant community in an open but fully stocked all-age stand of trees is 30 to 50 percent perennial grasses, 25 to 50 percent brush, and 5 to 15 percent forbs. Important decreaser species are Indian ricegrass, big bluegrass, Thurber needlegrass, western needlegrass, hawksbeard, and bitterbrush. Increaser plants include squirreltail, Sandberg bluegrass, big sagebrush, mountainmahogany, squawcarpet, mule ears, arrowleaf balsamroot, lupine, yarrow, and penstemon. Some of the invader plants are cheatgrass brome, Russian-thistle, mullein, annual grasses, and forbs.

The estimated total annual forage production is 700 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

Woodland in an area where soils formed in material weathered from andesitic or basaltic rock.—This woodland area is along the southern and western edges of the Area. The soils are gravelly and stony or cobbly sandy loams and loams. They are generally more than 60 inches in depth but in places are as shallow as 30 inches. Cobbles and stones are throughout the soil profile. The available water capacity is moderate. Slopes range from 2 to 50 percent, but in more than half the acreage slopes are less than 30 percent.

Considerable acreages of this woodland area are covered with a dense stand of young trees that produces little or no forage. The understory in the open and scattered stands of Jeffrey pine and ponderosa pine is dominated by big sagebrush with some bitterbrush and cheatgrass brome along with minor amounts of remnant perennial grasses and annual and perennial forbs. The condition of the understory cover is poor. This woodland area has a moderately high potential for producing both wood crops and forage on the gentle slopes. The steep areas have little grazing value.

The potential understory plant community is an open but fully stocked all-age stand of trees is made up of 40 to 60 percent perennial grasses, 20 to 40 percent brush, and 5 to 15 percent forbs. Important decreaser species are Idaho fescue, western needlegrass, big bluegrass, bitterbrush, butterweed, geranium, and hawksbeard. Increaser plants include Sandberg bluegrass, dryland sedge, squirreltail, big sagebrush, squawcarpet, lupine, mule ears, and yarrow. Some of the invader plants are cheat grass brome, Russian-thistle, annual grasses, and forbs.

The total annual forage production is 900 pounds per acre in favorable years and 500 pounds per acre in unfavorable years.

Woodland suitability groups

To assist owners of woodland in planning the use of the soils, the soils have been placed in woodland suitability groups. Each group is made up of soils that have similar characteristics, respond to similar management, and have like hazards for the production of of wood crops. For each group, ratings are given according to similarities of site quality, hazard of erosion, limitations to use of equipment, insect and disease hazards, windthrow hazard, and manageability. These are discussed in the paragraphs that follow. The soils in each group are listed in the "Guide to Mapping Units," in the back of the survey. Each woodland suitability group is described. The factors that affect management of each group are discussed in this section. Woodland suitability groups are made up of soils that naturally produce a cover of trees. Soils not placed in these groups generally are not wooded because of the lack of precipitation.

Site quality is the measure of the productivity of the soil for growing trees. In this survey it refers to site quality for ponderosa pine. Studies show that associated conifers on similar sites have about the same relationship of height to age as ponderosa pine (*3*).

Site index for ponderosa pine is based on the height attained by the average dominant and codominant trees at 100 years of age (*8*). The ratings used for site quality are *high, medium,* and *low*. No soil with *high* site quality has been found in this survey area. A rating of *medium* means that site quality ranges from 75 to 115, and a rating of *low* means that it is less than 75. In the Sierra Valley Area, site quality depends on the average annual precipitation and the effective depth of the soil. Except for a small triangle in the southwest corner of the Area, precipitation is not sufficient to produce conditions for *high* site quality. Precipitation rates diminish as one moves eastward until there is not enough to support any trees.

Effective depth of the soil is the depth to a layer that prevents or restricts root penetration. It may reduce site quality below that which would be possible otherwise, because shallow depth limits the number of trees a soil can support. Texture has some effect on effective depth, but only if it is clayey enough to prevent penetration of roots or to restrict drainage. Generally, loose stones or cobbles in the soil material have little effect on growth of trees, particularly if the soil is deep. In soils that are extremely stony or cobbly, however, the number of trees a soil can support diminishes in proportion to the number of rock fragments present.

The hazard of erosion in this section refers to the potential hazard of erosion of the soil. The length and steepness of the slope and the texture and stability of the soil aggregates are considered in rating the hazard. If soils are kept under a protective cover of forest litter and duff, they generally do not erode. Consequently, soils are rated accordingly to their susceptibility to erosion if the cover is removed through fire, logging, trampling by animals, or other disturbances. The susceptibility of soils to erosion if they are cultivated was not considered in rating the hazard of erosion.

Equipment limitation refers to the characteristics of the soils that would restrict or prevent the use of equipment that is commonly used in tending and harvesting trees. For example, Trojan stony sandy loam, 2 to 30 percent slopes, has few equipment limitations except when it is wet. When this soil is wet, which could be six months out of a year, heavy equipment mires down. Tree planting machines can be used on this soil, however, at carefully selected times. Steep slopes and large boulders on the surface increase the limitation to use of equipment. Sand or gravel decrease the limitation.

The hazard of pests and disease depends on many properties and qualities of the soil, most of which are not well understood. Soil depth and texture that influence water capacity and inherent fertility of soil are probably the more important factors. Trees growing in shallow, stony soils that have a limited water supply are generally more susceptible to pests and diseases.

The hazard of windthrow is generally not serious, except on shallow soils that are forming in granitic rock, such as the Toiyabe soils.

Ratings for manageability are based, more or less, on a summation of all the qualities of a soil for growing forest trees, including the qualities already listed.

WOODLAND SUITABILITY GROUP 1

This group consists of loams to loamy coarse sands. In most places these soils have stones or cobbles in the soil material or rock outcrops at the surface. Rooting depth of trees is very deep or moderately deep. Slopes are as much as 75 percent, but most are less than 30 percent.

Soils in this group are of medium site quality. The hazard of erosion is slight to severe. Equipment limitations are moderate and severe. Hazards of pests and diseases are slight and moderate. The hazard of windthrow is slight and medium. Adaptability to management is moderate to low.

Trees in these soils grow at a medium rate. Fairly intensive management practices can be applied at a reasonable cost. Pruning is of benefit only to trees less than 15 inches in diameter.

Logging is fairly easy except on very steep slopes. Locating and constructing roads is not difficult. Good management practices include using ditches and culverts on major roads, using outsloping on minor and temporary roads, keeping road gradients to a maximum of 8 percent, and mulching on landings and skid trails where the soil has been excessively disturbed.

Fire control is moderately difficult on these soils, but soils left bare by fire or other causes are fairly easy to prepare for planting. Planting by machine is feasible on gentler slopes but not on steeper slopes, unless they are terraced, using outsloping on the terraces.

WOODLAND SUITABILITY GROUP 2

This group consists of sandy loams to loamy coarse sands. In many places rock fragments make up more than 50 percent of the soils. The soils have a low available water capacity because they are shallow, excessively stony, or both. In places, root penetration is restricted by bedrock or stones. Most slopes are more than 30 percent.

Soils in this group are of low site quality. The hazard of erosion is moderate to very severe. Equipment limitations are severe. Hazards of pests and diseases are moderate and severe. The hazard of windthrow is moderate to severe. Adaptability to management is low.

Trees on these soils grow slowly. Generally only those management practices that enhance the esthetic value are feasible.

Roads are difficult to locate and construct. In many places a gravel surface is necessary only for those roads that are covered by deep snow in winter. Good construction and management practices require keeping road gradients to a maximum of 8 percent or less, using ditches and culverts on major roads, using outslopes on minor and temporary roads, and using mulches on landings and skid trails if the soil has been excessively disturbed.

Fire control is difficult on these soils. Soils left bare because of fire or other reasons have to be planted by hand in most places. Planting is not economically feasible in most places because of cost and the slow growth of plants.

Wildlife and Fish [6]

Hunting and fishing are important to the economy of the Area. They furnish not only recreational opportunities for local residents and the general public, but also direct and indirect income for the rancher. As the population pressures in California and the Sierra Valley Area increase, the wildlife habitat will no doubt decrease, and the value of fish and wildlife will continue its upward spiral.

Mule deer and trout are the most prominent wildlife species, but mourning doves, quail, chukar, and waterfowl are also important. Important nongame birds are broadwinged hawks, eagles, shore birds, and others. These animals use a wide variety of habitats, which are dependent upon soil and water. The soil and its inherent fertility influence the quality of the food and cover plants that characterize specific wildlife habitats. Soils that produce essentially the same type of habitat are placed together in wildlife suitability groups. The soils that make up each group are listed in the "Guide to Mapping Units," in the back of this survey. Soils in the Sierra Valley Area have been placed in nine wildlife suitability groups.

Wildlife food plants

Important wildlife food plants are rated in table 3 according to their suitability for use on the soils in the nine wildlife suitability groups and according to their suitability as food for wildlife species commonly found in the Sierra Valley Area. Plants that have special value as wildlife cover are footnoted. Those listed are food plants that have a widespread occurrence, plants that have a high value for one or more species of wildlife and are suitable for use in more than one group, or plants that are readily available for planting and can be easily grown for wildlife use.

The list of plants given in the table is not intended to be a complete list of food plants but is a list of the more important ones. Food plants considered choice for only one species of wildlife, or suitable for only one group, are listed only in the text.

The nine wildlife suitability groups in this area are discussed in the paragraphs that follow.

WILDLIFE SUITABILITY GROUP 1: PERENNIALLY WET LANDS

This group consists of poorly drained and very poorly drained clay loams to mucky silty clays. Large

[6] By WENDELL MILLER, biologist, Soil Conservation Service.

areas are subject to flooding or have water at or near the surface. These soils are mainly in the area north of Sierraville and in other wet portions of the Sierra Valley basin. Content of organic matter is high, and the sod is thick and peaty in many places. Slopes are generally 0 to 2 percent, but in places they are as much as 5 percent. These soils are generally deep and are underlain by variably stratified sediment of coarse to fine texture, and in places by layers of ash. A few areas are extremely cobbly.

Soils in this group are suited to such aquatic plants as spike rush, bulrushes, and cattails; to such grasses as wire grass (Baltic rush), sedges, tufted hairgrass, redtop, timothy, and Kentucky bluegrass; and to such forb as buttercup, camas, and arrowgrass. The wetter areas provide fairly good nesting habitat for ducks, Canada geese, and shore birds if these areas are not overgrazed. The lack of open-water areas where broods can escape predators is a limitation to this use. Blackbirds and marsh wrens nest wherever patches of cattail or tules exist. True marsh is too limited to sustain a good muskrat population, but more water impoundments on this site would improve habitat for muskrat and also for waterfowl during the hunting season and spring migration.

WILDLIFE SUITABITY GROUP 2: SEASONALLY WET MEADOWS

This group consists of very deep, poorly drained gravelly loams to clays. These soils are on flood plains of the valleys adjacent to perennially wet meadows, particularly along Last Chance Creek. They generally have water on the surface in places in spring but become dry enough to allow haymaking and some tillage later in the year. The water table is generally below a depth of 24 inches. Slopes are 0 to 2 percent.

Soils in this group are suited to such water-tolerant plants as Baltic rush, saltgrass, spike rush, and sprangletop. Under cultivation this cover can be converted to improved pasture grasses, clover, trefoil, and after a year or two, to grain. Sage grouse, rabbits, and deer use the margins of these areas during summer. Where open-water areas are present, waterfowl and shore birds use soils of this group during spring migration and to some extent during fall. The potential for waterfowl nesting is good in areas that have enough cover to protect nests and that are within a mile of permanent water. The soils of this group are suited to shallow-water impoundments that can be used for duck ponds.

WILDLIFE SUITABILITY GROUP 3: LOWLAND FLATS

This group consists of soils that have slight to moderate saline-alkali conditions, excessive amounts of lime, or low fertility levels. They are deep to moderately shallow and have a clayey subsoil and a siliceous or ashy substratum. Surface layers range from loam to loamy coarse sand. The soils are generally free of rock fragments. These soils are on the valley floor adjacent to and interlaced with the seasonally wet meadows. In general the soils on these areas are slightly higher in elevation than those in the seasonally wet meadow group and are not regularly flooded. They are generally moderately well drained to well drained. Slopes are less than 2 percent in most places.

Soils in this group produce silver sagebrush, cheat grass, rabbitbrush, saltgrass, and Baltic rush. Some of the deeper soils are used for irrigated pasture. This group provides choice habitat for jackrabbits and cottontails and fair habitat for sage grouse, California quail, Canada geese, and deer, particularly where the soils are irrigated.

When water is available and gradients are slight, shallow water impoundments can be constructed for waterfowl use. Such impoundments reduce the accumulation of salts in the surface layer if the ponds are flushed periodically. Barnyard grass or alkali bulrush is suitable for planting in shallow-water impoundments for waterfowl food, and a pondweed can be planted in water deeper than 18 inches. Barley or rye can be planted on soil adjacent to the ponds.

WILDLIFE SUITABILITY GROUP 4: VALLEY SOILS

This group of arable soils is mainly on the valley floor and partly on the adjoining terraces. The soils are dominantly somewhat poorly drained to well drained. They are mostly deep to very deep and range in texture from loamy sand to loam. Some are gravelly. Slopes are mostly 0 to 9 percent but range to 30 percent in some areas. This is the largest wildlife suitability group in the Area.

Soils in this group are suited to a wide variety of plants, and a wide variety of wildlife species thrive on them. Uncultivated areas are important winter range for deer. The few ring-necked pheasants that survive in the valley are found mainly on soils of this group. Quail and doves are common, as are black-billed magpies, flicker woodpeckers, robins, kingbirds, starlings, and many others. Black-tailed jackrabbits, cottontails, pocket gophers, ground squirrels, and meadow mice are plentiful, as evidenced by the numbers of broad-winged hawks, short-eared owls, and golden eagles that can be seen in the valley—especially in the fall. Ducks and geese feed in the stubble fields and pastures located on soils in this group. These soils are suitable for most choice wildlife foods.

WILDLIFE SUITABILITY GROUP 5: SLOPING TERRACES OF SIERRA VALLEY

The soils in this group are on fans and foot slopes around the edge of the valley floor. They are differentiated from the soils in wildlife suitability group 7 (Sloping Terraces of Long Valley) by a higher average annual rainfall (about 12 to 16 inches). These soils are mostly deep, except for a minor acreage on the granitic uplands. They are generally well drained to excessively drained. Surface layers range from sand or loamy sand to sandy loam. In many areas soils have rock outcrops. Rock fragments are in these soils. Some soils from granitic sources are quite droughty. Slopes range up to 30 percent, but a small acreage has slopes of as much as 50 percent.

The soils in this group are mainly suitable for livestock use and deer winter range; but rabbits, quail, and other birds also use them. Such plants as big sagebrush, bitterbrush, cheat grass, Indian ricegrass, and sunflowers are important wildlife foods that are suitable for these soils.

TABLE 3.—*Suitability of specified plants for*

[Wildlife suitability groups: The Arabic number 1 means well suited; the Arabic number 2 means fair to marginal. Dashes in the columns the plant is choice food for the kind of wildlife; the Arabic number 2 means fair to marginal for food. Food is the seed of the plant unless and cover; and "d," that it is used for fruit. Dashes in the columns mean that

Plants	Wildlife suitability group								
	1	2	3	4	5	6	7	8	9
Alfalfa	—	—	—	1	2	—	2	—	—
Balsamroot	—	—	—	—	—	—	1	—	1
Barley (cultivated)	—	2	2	1	1	2	2	2	—
Barnyardgrass	2	2	—	1	—	—	—	—	—
Bitterbrush	—	—	—	2	1	—	2	—	2
Bitter cherry	—	—	2	—	2	1	2	—	2
Brome (smooth)	—	2	2	1	1	—	—	2	—
Bulrush	1	2	2	—	—	—	—	—	—
Ceanothus	—	—	—	2	2	—	—	—	1
Cheat grass	—	—	—	1	1	—	1	1	—
Chokecherry	—	—	—	—	2	—	2	—	1
Clover	—	2	2	1	—	—	2	—	1
Fescue, tall	—	2	1	1	—	—	—	—	—
Filaree	—	—	—	1	1	—	1	1	—
Gooseberry	—	—	—	—	2	—	2	2	2
Indian ricegrass	—	—	—	2	1	—	1	—	—
Jeffrey pine	—	—	—	—	2	—	—	—	1
Mormon-tea (Ephedra)	—	—	—	1	2	—	—	—	—
Mountainmahogany	—	—	—	—	2	—	—	—	1
Oat (common)	—	2	2	1	2	—	2	—	1
Rabbitbrush	—	—	—	2	1	2	1	2	—
Rose	—	2	—	1	2	—	2	2	—
Russian-olive	2	1	2	1	2	—	2	—	—
Rye (cultivated)	—	2	1	1	2	—	2	—	—
Safflower	—	—	—	1	2	—	2	—	—
Sagebrush (big)	—	—	—	2	1	—	1	1	2
Sagebrush (silver)	—	2	2	1	—	—	—	—	—
Saltgrass	2	1	1	—	—	—	—	—	—
Serviceberry	—	—	—	—	2	—	2	—	2
Snowberry	—	—	2	—	2	—	—	—	1
Spike rush	1	1	—	—	—	—	—	—	—
Sunflower	—	—	—	1	1	—	2	—	—
Turkey mullein	—	—	—	1	2	—	1	—	—
Wheat	—	2	—	1	2	—	2	—	—
Wheatgrass	—	2	2	1	1	2	2	—	2

WILDLIFE SUITABILITY GROUP 6: HARDPAN TERRACES

This group consists of soils on the east side of Sierra Valley and on benches on the west side of Long Valley. They are sandy loams or loams that are gravelly or very stony in places and are underlain by a hardpan. These soils are shallow and have a low available water capacity. Root development is restricted. Slopes are mostly less than 15 percent but in some areas are as much as 30 percent. The soils are well drained and moderately well drained. Most are in range that is used principally by rabbits and to a lesser extent by mourning doves, sage grouse, chukar, and deer.

Low sagebrush and cheat grass are the main vegetation on these soils. On the upper steps a few sentinal Jeffrey pine and some stunted bitterbrush are present. A few areas have big sagebrush and a few scattered juniper. Other species present are Sandberg bluegrass, remnant stands of other perennial grasses, and forbs such as mule ears, sunflower, and turkeymullein. The less stony soils of the lower slopes support seed-producing forbs such as sunflower and turkeymullein when the brush and grass competition is destroyed by disking. Light stands of wheat and rye can be grown on small areas of moderately deep soil. Such food patches, when planted in plots or in strips, lessen the hazard of wind erosion.

WILDLIFE SUITABILITY GROUP 7: SLOPING TERRACES OF LONG VALLEY

The soils in this group are sagebrush range, crossed by small canyons coming down from higher ground. Surface layers are mostly sandy loam, but many range to loamy sand. Some areas are cobbly. The soils are mainly in the eastern part of the Area in Long Valley, where the rainfall averages between 6 to 14 inches. The soils are quite variable, ranging from very deep and moderately permeable soils to soils that have a shallow hardpan. They are forming mostly in old lake terraces, but a small acreage is forming in material weathered from igneous rocks. Slopes are mostly less than 30 percent. Wind erosion is a concern in some areas.

Soils in this group are suited to such plants as big sagebrush and cheat grass and to a lesser extent bitter-

wildlife suitability groups and for kinds of wildlife

mean the plant is not suited to soils of the wildlife group or its suitability is not known. Kinds of wildlife: The Arabic number 1 means otherwise indicated. The symbol "a" means that the plant is used for forage; "b," that it is used for cover; "c," that it is used for browse the plant is seldom used by the particular kind of wildlife or its use is not known]

Kinds of wildlife									
Chukar	Mule deer	Doves	Ducks	Canada geese	Sage grouse	Pheasants	California quail	Mountain quail	Rabbits
—	1a	—	2	1a	1a	2ab	1	—	1c
—	1a	2	—	—	2	—	2	2	—
2	2a	2	1	1a	2	1	1	1	1a
—	—	1	1	1	—	1	2	—	—
—	1c	2	—	—	—	2	2	2	1c
—	2c	—	—	—	2d	—b	1	1	—
—	2	—	—	1a	—	—	—	—	2a
—	—	—	1	1	—	—	—	—	—
—	1c	—	—	—	—	—	—b	2b	2c
1a	2a	—	—	—	2	1	1	1	2a
—	1c	—	—	—	—	2d	2b	1	—
—	1a	—	1	1	1	2	1	1	2a
—	2a	—	—	2a	—	2	—	—	2a
1	2a	2	—	—	2	2	1	1	1a
—	—	—	—	—	—	—	1b	1b	—b
1	2a	—	—	—	—	—	2	2	2a
—	1	1	—	—	—	—	1	1	—
2	2a	—	—	—	—	—	2b	2b	2c
—	1c	—	—	—	—	—	—	2b	—
1	2a	2	1	1	—	1	1	—	2a
—	2c	—	—	—	—	—	—	—	1c
2	—	—	—	—	—	2	2	2b	—b
—	—	—	—	—	—	2	2	—	—
2	2a	2	2	2	—	2	2	2	2a
—	—	1	2	—	—	2	2	—	—
—	1c	—	—	—	1	—	—	—b	2c
—	—	—	—	—	1	—	—	—	2c
—	—	—	—	2a	—	—	—	—	2a
1	1c	—	—	—	1	—	2	1d	—
—	1c	—	—	—	—	2	2	2d	—
—	—	—	1	1	—	—	—	—	—
2	1a	1	—	—	—	2	2	2	—
2	—	1	—	—	—	—	1	—	—
1	1a	1	1	1	1	1	1	1	1a
1	2a	—	—	—	—	2	—	2	2a

brush, low sage, gooseberry, desert peach, and juniper. In the understory are filaree, Sandberg bluegrass, squirreltail, and remnant stands of needleandthread, desert needlegrass, and Indian ricegrass. This group provides habitat for jackrabbits, cottontail, chukar, sage grouse, mountain quail, valley quail, mourning doves, and mule deer. During years with adequate rainfall the deeper soils in the lower slope classes are somewhat suitable for the production of food plants, such as wheat, rye, turkeymullein, and sunflower. Surface water for wildlife is scarce on these soils.

WILDLIFE SUITABILITY GROUP 8: SHALLOW STONY UPLANDS

This group consists of well-drained to somewhat excessively drained very stony sandy loams. The soils are 6 to 20 inches deep over bedrock. Some areas are covered by numerous rock outcrops. The soils are on upland slopes of the hills south of Vinton on the Sierra Valley side and south from Beckwourth Pass on the west side of Long Valley. The group is similar to the Shallow Stony Uplands Range Site. Slopes range from 5 to 75 percent.

Soils of this group are suited to big sagebrush and cheatgrass. Scattered juniper trees, serviceberry, and bitterbrush are on these soils, along with relic plants of Sandberg bluegrass, squirreltail, and needlegrass. Forbs such as wild buckwheat, balsamroot, and filaree are present. Many of the plants are pedestalled, and a desert pavement of gravel commonly is on the soil surface in places.

In addition to rabbits and nongame birds such as rock wrens, wildlife in this group includes mule deer and chukar and some mourning doves, sage grouse, and quail.

WILDLIFE SUITABILITY GROUP 9: FORESTED UPLANDS

This group consists of commonly rocky or cobbly to extremely stony loamy coarse sands to sandy loams. The soils are mostly wooded and are on the fringes of the Sierra Valley basin. They formed in granitic, andesitic, and basaltic residuum. They vary in depth of shallow to deep. Slopes range from 2 to 75 percent. The soils are well drained to excessively drained.

The soils of this group produce ponderosa and Jef-

frey pine with an understory of brush, grass, and forbs. The composition varies from dense second growth that has no understory to heavy brush (chaparral) with only an occasional tree and little or no understory. Chaparral species are mainly greenleaf manzanita, snowbrush, and mountain white thorn. Other important browse species are bitterbrush, curlleaf mountainmahogany, squawcarpet, and snowberry. Cheatgrass is the most common grass, but Columbia needlegrass and other perennial grasses also occur. Prominent forbs are mule ears and mullein. This group furnishes fair summer range for deer and produces a population density of deer in excess of 10 per square mile. Other game are mountain quail, tree squirrels, and a few blue grouse, black bear, and snowshoe rabbits. Chipmunks and various nongame birds are common on soils of this group.

Water areas

Irrigation reservoirs, stockwater ponds, and live streams were not covered in the foregoing discussions, but they are important to the Area. Most of these waters are cool enough for trout (surface water temperature less than 75° F.). Rainbow trout is the principal species, but both rainbow and brown trout are found in the streams. The river channels and sloughs of the meadowland in Sierra Valley contain brown bullheads and provide some habitat suitable for bass and bluegills. Ponds on the valley floor are also suitable for stocking bass and bluegill (water temperature higher than 65° F.). Ponds stocked with bass and bluegills usually need to be stocked only once, while those stocked with trout must be restocked every one to three years, because of the lack of live tributary streams with suitable gravel for spawning.

The Middle Fork of the Feather River and its tributary streams in Sierra Valley have intermittent colonies of beaver, but the riparian vegetation along these streams is not extensive enough to sustain a thriving population. Aspen, willows, alder, and cottonwoods are the main species used by beaver.

Engineering Uses of the Soils [7]

This section presents soil information that is useful to engineers, planners, contractors, and others interested in the engineering properties of soils. Many of the soil properties of interest to the farmer are also of interest to the engineer. Other soil properties are of unique interest to the engineer.

Engineers are interested in soil properties that affect the ability of the soil to support various types of structures or affect use of soils as a construction material from which structures are built. Included are such structures as roads, buildings, pipelines, channels, dams, water impoundments, and a variety of others. The soil properties that determine the stability of soil as a building material and those that impose limitations or special requirements for its use in construction include shear strength, permeability, compaction characteristics, shrink-swell behavior, depth to limiting layers, water-holding capacity, mechanical analysis, plasticity, piping and cracking potential, reaction, slope, and infiltration rates. Laboratory analyses are needed to determine certain of these soil properties. Such analyses are often limited, however, or are not available for many soils. In such cases it is necessary to estimate physical and chemical characteristics by comparing these soils to similar soils for which such data are available.

The estimated physical and chemical properties of the soils in this section are based on a limited number of soils tested in the laboratory. All references are to the soil down to a depth of 5 feet, or to bedrock if it is encountered at a depth of less than 5 feet. Engineering interpretations are general and are not intended to eliminate onsite investigations or sampling and testing of soils for the design and construction of specific engineering works or uses. These interpretations are usable in broad planning by engineers, planners, and others. They are also suitable for planning detailed field investigations to determine the behavior of the soil in place at the site of the proposed engineering works.

Users of this soil survey may not be familiar with some of the terms used by soil scientists. These and other terms are defined in the Glossary.

The information presented in this section of the soil survey can be used in:

1. Making preliminary estimates of the engineering properties of soils for determining the feasibility of irrigation and drainage systems, small dams and reservoirs, soil and water conservation structures, and similar works.
2. Making preliminary evaluations of soils that will aid in selecting locations for highways, airports, rural roads, pipelines, and cables, and in planning detailed investigations at selected locations.
3. Locating probable sources of sand and gravel.
4. Locating probable sources of borrow material for road fill and for construction of dams, dikes, levees, and other embankments.
5. Determining the suitability of soils for cross-country movement of vehicles and construction equipment.
6. Developing other preliminary estimates for construction purposes pertinent to the particular area.
7. Supplementing the information in other published maps, reports, or on aerial photographs to prepare reports that can be readily used by engineers or others.
8. Correlating performance of engineering structures with individual soils to develop information for overall planning that will be useful in designing and maintaining engineering practices and structures.

Engineering information is given in tables 4, 5, and 6.

[7] By ROBERT S. MILLER, civil engineer, Soil Conservation Service.

Engineering classification systems

The American Association of State Highway Officials (AASHO) (*1*) uses an engineering classification system based on field performance of highways. In this system soil materials are classified in seven principal groups. The groups range from A–1 through A–8 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing capacity—the best soils for a subgrade. At the other extreme, in group A–8, are organic soils having low strength when wet—the poorest soils for subgrade. The estimated AASHO classifications for all the soils in the survey area are given in table 5.

The Unified soil classification system (*15*) identifies soils according to their grain-size distribution and plasticity qualities, and groups them in 15 classes according to their performance as engineering construction materials. In this system GP, GW, SP, and SW are clean gravels and sands. GM, GC, SM, and SC are gravels and sands that contain an appreciable amount of nonplastic and plastic fines respectively. ML and CL are nonplastic and plastic, fine-textured materials that have a low liquid limit, while MH and CH are nonplastic and plastic fine-textured materials that have a high liquid limit. Organic soils and peat are designated by the symbols OL, OH, and Pt. A joint classification symbol, such as ML–CL, is used on soils that have characteristics bordering on two groups.

The estimated classification of each soil in the survey area, according to the Unified classification system, is given in table 5.

Engineering test data

Selected horizons from 4 soils in the Sierra Valley Area were tested in the laboratory to help evaluate the soil properties significant to engineering uses. Results of these tests are shown in table 4 along with the soil name, the location where it was sampled, and the depth at which the sample was taken.

The moisture-density or compaction test is made by compacting the soil several times, using a constant compactive effort, at successively higher moisture content. The density of the compacted soil increases as the moisture content increases until the optimum moisture content is reached. Beyond this point, density decreases with an increase in moisture content. Maximum dry density and associated optimum moisture are thus determined.

Mechanical analysis determines the size and proportions of soil particles which affect the behavior of soils for various engineering uses. The California Division of Highways uses the sieve-and-hydrometer method in determining the mechanical analysis.

Liquid limit and plasticity index (Atterberg limits) tests determine the plastic limit and liquid limit, which measure the effect of water on the consistence of the soil. As the moisture content of a plastic (clayey) soil increases from a dry state, the soil changes from a semisolid state to a plastic state. As the moisture content is further increased, the material changes from a plastic state to a liquid state. The plastic limit is the moisture content at which the material passes from a semisolid state to a plastic state. The liquid limit is the moisture content at which the soil passes from a plastic state to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which the soil is in a plastic condition. Moisture content, liquid limit, and plasticity index are expressed as percent of dry weight of the soil. The terms are not applicable to predominantly gravelly or sandy soils.

USDA texture ratings are used by soil scientists to determine soil texture (*12*). Soil texture under this system is determined by the relative proportions of sand, silt, and clay in the soil material smaller than 2.0 millimeters in diameter. Modifiers such as gravelly, very stony, extremely shaly, etc., are used as needed for materials larger than 2.0 millimeters in diameter.

Estimated soil properties significant to engineering

Table 5 lists estimated properties of soils and interpretations significant to engineering practices. This table also lists the soil series name and mapping symbols, depth to bedrock and seasonal high water table, depth to and thickness of material in a typical profile, and the dominant USDA texture and Unified and AASHO classifications. In addition, the mechanical analysis, Atterberg values, permeability, available water capacity, reaction, salinity, shrink-swell potential, and corrosivity to uncoated steel are listed. These estimates are based on test results given in table 4, field examination, and experience with soils in the area or similar soils from other areas. Since these estimates are for the typical, or representative, soils, some variations from the values should be anticipated. A more detailed explanation of the various properties estimated is included in the preceding discussion or in the Glossary. Only shrink-swell potential and corrosivity to untreated steel will be further defined here.

Shrink-swell potential of a soil is its potential for volume change with change in moisture content. The volume change of soils is influenced by the amount and kind of clay in the soil as well as moisture change.

Damage to building foundations, roads, and other structures may result from soils shrinking when drying and swelling when becoming wet. The shrink-swell potential limitation ratings are an indication of the hazard to structures resulting from this volume change. Three degrees of limitation are used—*low*, *moderate*, and *high*. Soils with a *low* limitation rating have few problems of shrinking and swelling and are more suitable for construction sites if other features are favorable. *Moderate* and *high* limitation ratings indicate greater shrink-swell potentials. These ratings do not mean that structures cannot be built, but are warnings that a shrink-swell problem exists.

The three shrink-swell limitation ratings are based on the kind and amount of clay and the coefficient of linear extensibility. These ratings are for each soil horizon listed on the table.

Corrosivity to untreated steel is the tendency of soil material to corrode or cause to deteriorate untreated steel that is buried in soil. The rate at which this occurs depends largely upon the physical, chemical, and

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TABLE 4.—

[Tests performed by District III, California Division of Highways, in accordance

Soil name and location	Parent material	Report number	Depth	Moisture density [1]	
				Maximum dry density	Optimum mositure
			In	*Lb per cu ft*	*Pct*
Beckwourth loamy coarse sand:		62-379	2½-15	128	9
0.6 mile north and 0.2 mile west of SE. corner of sec. 21, T. 22 N., R. 15 E., Plumas County.	Alluvium.	62-376 62-381	23-34 34-48	129 125	11 11
Calpine coarse sandy loam:		62-393	4-11	124	13
SE corner of NW1/4 SW1/4, sec. 11, T. 21 N., R. 14E., Sierra County.	Alluvium.	62-394 62-397	27-41 41-58	122 123	11 13
Lovejoy loam:		62-380	0-2½	111	16
0.6 mile north and 600 feet west of corner, sec. 14, T. 22 N., R. 14 E., Plumas County.	Alluvium.	62-383 62-389	16-21 41-53	111 106	15 16
Ramelli clay:		62-385	7-14	81	9
100 feet north and 600 feet east of center, sec. 28, T. 22 N., R. 15 E., Plumas County.	Alluvium.	62-396 62-387	14-18 34-45	99 119	18 14

[1] Based on the moisture density relations of soils using 5.5-pound rammer and 12-inch drop, AASHO designation T 99 (*1*). Method of test for relative compaction of untreated and treated soils and aggregates, test method No. Calif. 216E.

[2] Mechanical analyses according to the AASHO designation T 88 (*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-sized fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

biological characteristics of the soil and the physical and chemical characteristics of the steel. Corrosion probability is generally greater for extensive installations that intersect soil boundaries or soil horizons than for installations in one kind of soil or one soil horizon. The depth that a pipe or other steel item is buried can affect the rate and extent of corrosion.

Ratings for corrosivity are based on soil in its natural state and do not consider the effects of other factors such as amount of soil water or the effect of adding materials to the soil. Corrosion to untreated steel pipes or other steel items is likely to be increased by electrical leaks from underground cables and by electrical charges resulting from dissimilar metal composition.

Limitation ratings of *low, moderate,* and *high* are based on the soil properties of texture and drainage class, total acidity, and conductivity of the saturation extract.

Engineering interpretations

Table 6 rates the soils according to their suitability as sources of topsoil, sand and gravel, and road fill. It also lists those soil features that affect road location, water- retention structures, agricultural drainage, and irrigation. These features are also important for construction, operation, or maintenance of the structure or practice shown. Hydrologic soil groups and soil limitation ratings for septic tank filter fields are also given.

Topsoil.—This suitability rating is for soils used as a source of topsoil for use on slopes, shoulders of roads, areas along waterways, and lawns or golf courses or similar areas. The ratings reflect suitability for the growth of vegetation.

Suitability ratings of *good, fair,* and *poor* are based on such soil features as texture, presence of gravel or stones, salinity, reaction, inherent fertility, thickness, slope, and natural drainage class of the source material.

Sand and gravel.—This rating is for soils used as a source of sand and as a source of gravel for construction purposes. Gradation, mineral quality, and accessibility of materials are not considered. Suitability ratings of good, fair, poor, and unsuitable are based on USDA texture, Unified classification, depth of overburden, thickness of material, percent passing a number 200 sieve, and percentage of gravel.

Road fill.—This suitability rating is for soils used as a source of road fill when excavated and for use as fill for road subgrade material. Accessibility of source material is not considered.

Suitability ratings of *good, fair,* and *poor* are based on the AASHO classification system.

Road location.—The soil features of interest to the

Engineering test data

with procedures given in California Materials Manual for Testing and Control procedures]

Mechanical analysis [2]						Liquid limit	Plasticity index	Classification	
Percentage passing sieve—				Percentage smaller than—				AASHO [3]	Unified [4]
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.005 mm	0.001 mm				
						Pct			
100	95	61	18	9	5	18	[5] NP	A-2-4(0)	SM
100	98	67	24	12	5	NP	NP	A-2-4(0)	SM
100	94	48	11	6	2	NP	NP	A-1-b(0)	SW-SM
100	98	72	25	11	6	NP	NP	A-2-4(0)	SM
100	99	80	31	16	9	NP	NP	A-2-4(0)	SM
100	98	64	20	10	6	22	NP	A-2-4(0)	SM
----------	100	97	81	30	13	25	5	A-4(8)	ML-CL
----------	100	92	70	39	18	35	17	A-6(10)	CL
----------	100	96	65	21	9	36	15	A-6(8)	CL
----------	100	97	87	47	19	57	26	A-7-5(18)	MH
----------	100	95	78	47	23	53	29	A-7-6(18)	CH
100	99	75	30	11	5	25	NP	A-2-4(0)	SM

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO designation M 145-49 (*1*).
[4] Based on the Unified Soil Classification System, MIL-STD-619-B, 1968 (*15*).
[5] NP = Nonplastic.

engineer in selecting a road location are soil depth, slope, rockiness or stoniness, and water table.

Where excavation is anticipated to depths greater than 5 feet, geologic exploration would be desirable.

Water-retention.—Various soil features affecting the construction of water-retention structures, such as irrigation reservoirs, fishponds, stock-water ponds, recreation lakes, and sewage lagoons, are considered in establishing the limitation ratings for this use. This requires separate ratings of the structure as a reservoir area and as a source of embankment material.

Reservoir area.—The soil properties considered include soil texture, presence of coarse fragments (gravel, stones, etc.), permeability, slope, soil depth, and percentage of organic matter in the soil.

Embankments.—The soil properties considered include strength, stability, susceptibility to piping and cracking, and compressibility.

Onsite investigations are necessary to determine the type, amount, and availability of borrow materials and to obtain data for design.

Drainage for crops and pasture.—Soil properties that affect the drainability of a soil include permeability, texture, and degree of stratification. The availability of adequate outlets is not considered in making this interpretation and must be determined through onsite investigations.

Irrigation.—Soil features pertinent to design and management of irrigation systems include basic intake rate of the soil, available water capacity, depth to restrictive layers, slope, and permeability. The quantity and quality of irrigation water available are not considered here but need to be determined before designing any irrigation system.

Septic tank filter fields. These are subsurface tile systems designed in such a way that effluent from the septic tank is distributed with reasonable uniformity into the natural soil.

Soil limitation ratings of *slight, moderate,* and *severe* are based on permeability, depth to seasonal or permanent water table, natural drainage class, depth to impervious layers, slope, and overflow hazard and duration. Results of percolation tests, when available, should also be considered. Limitation ratings are for the most limiting soil horizon or for the 10- to 40-inch zone.

Rapidly permeable, coarse-textured or gravelly soils may allow contamination of ground water supplies.

Hydrologic soil groups. These groups are used for estimating the runoff potential of soils. Groupings are based on potential runoff at the end of a long storm occurring after prior wetting and opportunity for swelling. This grouping assumes the absence of a protective vegetative cover.

TABLE 5.—*Estimated soil*

[An asterisk in the first column indicates that at least one soil in this series is made up of two or more kinds of soil. The soils in such mapping another series in the first column of this table. The

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				
Acidic rock land: AcG. Too variable for valid estimates.							
*Aldax: AkG, AmE, AmG. Rock outcrop part of AkG is too variable for valid estimates. For Millich parts of AmE and AmG, see Millich series.	½–1	(1)	0–12 12	Very gravelly loam Bedrock.	SM or GM	A–2	20–40
Badenaugh: BaE	>5	(1)	0–6 6–60	Very cobbly sandy loam Very cobbly sandy clay loam	SM or GM GC	A–1 or A–2 A–2	50–65 60–85
Badenaugh, poorly drained variant: BbB.	>5	1–4	0–13 13–27 27–60	Extremely cobbly clay loam Very cobbly clay Very gravelly sandy clay loam.	SC or GC GC GP–GC	A–2 A–2 A–2	15–45 15–45 15–45
*Balman: BcA, BcB, BdA. For Ramelli part of BdA, see Ramelli series.	>5	5–7	0–30 30–60	Loam and sandy clay loam Fine sandy loam, sandy loam, and loamy coarse sand.	ML SM	A–4 or A–6 A–2 or A–4	
Basic rock land: BeG. Too variable for valid estimates.							
*Beckwourth: Bf, BmA, Bn. For Loyalton part of BmA and Ormsby part of Bn, see Loyalton and Ormsby series, respectively.	>5	3–7	0–23 23–34 34–60	Loamy coarse sand Coarse sandy loam Loamy coarse sand and coarse sand.	SM SM SM	A–2 A–2 or A–4 A–1 or A–2	
Bh	>5	3½–5+	0–40 40–60	Loamy coarse sand Clay	SM CH	A–2 A–7	
Bk	>5	3½–5+	0–60	Sandy loam	SM	A–4	
Bellavista: BoA, BoB	>5	(1)	0–20 20–64	Loam and sandy clay loam Indurated hardpan	CL	A–6	
Bidwell: BrA, BrB, BtA	>5	(1)	0–38 38–58 58–62	Sandy clay loam and heavy sandy loam. Loamy sand Coarse sand and fine gravel	SC or CL SM SW	A–6 A–2 A–1	
BsA	>5	(1)	0–30 30–60	Sandy clay loam and heavy sandy loam. Coarse sand and fine gravel	SC or CL SW	A–6 A–1	
Bieber: BuB, BwA	>5	(1)	0–6 6–17 17–60	Gravelly sandy loam Sandy clay Hardpan	SM SC or CL	A–1 or A–2 A–6	(3)
Bonta. Mapped only in complex with Toiyabe series.	2–5	(1)	0–12 12–31 31	Loamy coarse sand Sandy loam Weathered quartz diorite	SM SC	A–1 A–2 or A–6	0–5
*Calpine: CaA, CaB, CaC, CgB2. For Lovejoy part of CgB2, see Lovejoy series.	>5	(1)	0–21 21–46 46–81	Coarse sandy loam Sandy loam Loamy fine sand and sand	SM SC or SM SM	A–2 A–4 A–2	

See footnote at end of table.

properties significant to engineering

units may have different properties and limitations, and for this reason the reader should follow carefully the instructions for referring to symbol > means more than; the symbol < means less than]

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to uncoated steel
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Liquid limit	Plastic index						
				Percent		*Inches per hour*	*Inches per inch of soil*	*pH*	*Mmhos per cm*		
50–70	45–65	35–50	25–35	20–30	[2]NP–5	2.0–6.0	0.07–0.11	5.6–6.5		Low	Low.
50–75	50–75	40–60	20–35	10–30	NP–5	6.0–20.0	0.08–0.10	6.6–7.3		Low	Low.
40–60	40–60	30–50	20–30	30–40	10–20	2.0–6.0	0.07–0.12	5.6–7.3		Low	High.
50–70	40–60	35–55	25–35	35–45	15–25	0.6–2.0	0.06–0.08	6.1–6.5		Low	Low.
40–60	35–50	30–45	20–35	40–50	20–30	0.06–0.2	0.08–0.10	6.1–6.5		Low	Moderate.
15–30	15–30	15–25	5–10	30–40	10–20	0.2–0.6	0.04–0.06	5.6–6.5		Low	Moderate.
100	95–100	85–95	70–80	35–40	5–15	0.2–0.6	0.13–0.15	8.5–9.0+	0–15	Moderate	High.
90–100	85–100	70–80	25–50	15–30	NP	0.2–0.6	0.11–0.13	7.9–8.4	0–15	Low	High.
100	90–100	55–65	15–30	NP	NP	6.0–20.0	0.08–0.10	5.6–7.3	0–15	Low	High.
100	95–100	60–70	25–40	5–25	NP–5	0.6–2.0	0.09–0.11	7.9–8.4	0–15	Low	High.
100	90–100	40–50	10–30	NP	NP	6.0–20.0	0.50–0.07	7.9–8.4	0–15	Low	High.
100	90–100	55–65	10–20	5–20	NP–5	6.0–20.0	0.08–0.15	5.6–8.4	0–15	Low	High.
100	100	90–100	80–90	50–60	25–35	<0.06	0.03–0.05	6.1–7.3		High	High.
100	95–100	70–80	35–50	5–20	NP–5	0.6–2.0	0.09–0.12	5.6–8.4	0–15	Low	High.
100	95–100	70–80	60–70	25–35	10–20	0.6–2.0	0.16–0.18	7.9–8.4	4–15	Moderate	High.
						<0.06					
100	95–100	65–80	40–60	30–40	10–20	0.2–0.6	0.13–0.16	5.6–8.4	0–1	Moderate	High.
100	90–100	70–80	10–20	NP	NP	2.0–6.0	0.06–0.08	8.4–9.0	0–4	Low	High.
60–80	30–60	15–25	0–5	NP	NP	6.0–20.0	0.03–0.05	8.4–9.0	0–4	Low	High.
100	95–100	65–80	40–60	30–40	10–20	0.2–0.6	0.13–0.16	5.6–8.4	0–1	Moderate	High.
60–80	30–60	15–25	0–5	NP	NP	6.0–20.0	0.03–0.05	8.4–9.0	0–4	Low	High.
65–90	60–90	35–50	20–35	5–20	NP–5	2.0–6.0	0.11–0.13	5.6–6.5		Low	Low.
100	95–100	60–80	40–55	30–40	15–25	<0.06	0.03–0.05	6.1–6.5		High	High.
						<0.06					
70–90	60–80	30–45	10–20	NP	NP	6.0–20.0	0.06–0.08	6.1–6.5		Low	Low.
70–90	60–80	50–70	20–40	30–40	10–20	0.6–2.0	0.14–0.16	5.1–6.0		Moderate	Moderate.
100	95–100	60–75	15–30	5–25	NP–5	2.0–6.0	0.11–0.13	5.1–5.5		Low	Moderate.
100	95–100	65–80	35–50	20–30	5–10	2.0–6.0	0.13–0.15	5.6–6.0		Low	Low.
100	95–100	60–70	10–20	NP	NP–5	2.0–6.0	0.06–0.08	5.6–6.0		Low	Low.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO	
Calpine, clayey variant: CmA	>5	(1)	0–26	Coarse sandy loam	SM	A–2	
			26–45	Clay and silty clay	CH or MH	A–7	
			45–60	Weakly cemented loamy sediments.			
Coolbrith: CnA, CnB	>5	(1)	0–10	Silt loam	ML or CL	A–4 or A–6	
			10–43	Clay loam and gravelly sandy clay loam.	SC or CL	A–6 or A–7	
			43–68	Gravelly coarse sand	GW or SW	A–1	
Correco: CoB, CoD, CpE	>5	(1)	0–15	Sandy loam	SM	A–4	(4)
			15–39	Clay	CH	A–7	(4)
			39–60	Sandy clay loam	SC	A–6	(4)
Delleker: DdD2, DeE	3½–>5	(1)	0–13	Sandy loam and loam	ML or SM	A–4 or A–6	(5)
			13–60	Sandy clay loam and clay loam.	CL	A–6 or A–7	(5)
*Dotta: DfA, DfC, DgE, DhE, DmC. For Lovejoy part of DmC, see Lovejoy series.	>5	(1)	0–13	Sandy loam and loam	SM	A–1 or A–2	(6)
			13–41	Heavy loam and sandy clay loam.	SC or CL	A–6	
			41–68	Sandy loam	SM	A–1 or A–2	(6)
Galeppi: GaB, GaE, GdE	>5	(1)	0–9	Sandy loam	SM	A–2	(7)
			9–36	Sandy clay loam	SC	A–6	(7)
			36–60	Sandy loam and loamy sand	SM	A–2	(7)
Glean: GpF	>5	(1)	0–51	Extremely stony, cobbly, or very gravelly sandy loam.	GM	A–1	55–85
			51–54	Andesite.			
Glenbrook: GrF. Rock outcrop part too variable for valid estimates.	½–1½	(1)	0–20	Gravelly loamy coarse sand	SM	A–1	
			20	Decomposing granodiorite.			
*Haypress: HtE, HtG. For Toiyabe parts, see Toiyabe series.	3½–5	(1)	0–49	Loamy coarse sand	SM	A–1	
			49–67	Weathered granite.			
James Canyon:							
JbB	>5	3–5	0–60	Gravelly loam	SM or SC	A–4	
JcA	>5	2–5	0–36	Silt loam	CL–ML or CL	A–4 or A–6	
			36–60	Heavy sandy loam and sandy clay loam.	SC	A–6	
Lovejoy: LaB	>5	(1)	0–16	Loam	CL–ML or CL	A–4 or A–6	
			16–21	Clay	CL	A–6	
			21–41	Hardpan			
			41–60	Clay loam	CL	A–6	
Loyalton:							
Lo	>5	(1)	0–8	Fine sandy loam	SM	A–2 or A–4	
			8–33	Sandy clay loam	CL	A–6	
			33–63	Gravelly loamy coarse sand	SP	A–1	
Lp	>5	(1)	0–10	Silt loam	ML	A–4 or A–6	
			10–36	Silty clay	CL	A–7	
			36–60	Loamy coarse sand	SM	A–1	
Martineck: MaE	>5	(1)	0–12	Very stony sandy loam and very stony sandy clay loam.	SM	A–1 or A–2	55–75
			12–19	Very stony clay	CH	A–7	55–75
			19–24	Hardpan			
			24–60	Stratified lake sediment			

See footnotes at end of table.

significant to engineering—Continued

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to uncoated steel
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plastic index						
100	95–100	60–75	15–30	5–25	NP–5	0.6–2.0	0.11–0.13	5.6–6.5		Low	Moderate.
100	100	90–100	85–95	50–60	20–30	<0.06	0.03–0.05	6.1–7.3		High	High.
100	100	90–100	75–85	25–35	5–15	0.6–2.0	0.19–0.21	5.6–6.5		Moderate	Low.
70–95	60–90	45–65	35–60	35–45	15–25	0.2–0.6	0.14–0.16	6.1–6.5		High	Moderate.
50–70	40–60	20–40	0–5	NP	NP	0.6–2.0	0.03–0.05	6.1–7.3		Low	Moderate.
95–100	85–100	70–85	35–50	5–20	NP–5	6.0–2.0	0.11–0.13	5.6–6.5		Low	Low.
95–100	85–100	80–95	70–90	50–60	25–35	0.06–0.2	0.14–0.16	6.1–6.5		High	High.
95–100	85–100	60–80	35–50	30–40	10–20	0.06–0.2	0.14–0.16	5.6–6.5		Moderate	Moderate.
85–100	75–95	60–75	40–60	20–35	5–10	0.6–2.0	0.16–0.18	5.6–6.5		Low	Low.
85–100	75–95	65–75	50–70	30–45	10–20	0.6–2.0	0.15–0.17	5.6–6.0		Moderate	Moderate.
60–100	50–90	45–75	20–35	5–20	NP–5	0.6–2.0	0.12–0.14	6.1–6.5		Low	Low.
95–100	90–100	70–90	45–70	30–40	10–20	0.2–0.6	0.15–0.17	5.6–6.5		Moderate	Moderate.
60–100	50–90	45–75	20–35	5–20	NP–5	2.0–6.0	0.11–0.13	6.1–7.3		Low	Moderate.
95–100	90–100	70–80	25–35	5–20	NP–5	2.0–6.0	0.10–0.12	6.1–7.3		Low	Low.
95–100	90–100	70–80	35–50	30–40	10–20	0.2–0.6	0.14–0.16	6.6–7.8	0–1	Moderate	High.
95–100	90–100	70–80	15–35	5–20	NP–5	2.0–6.0	0.10–0.12	6.6–7.8	0–1	Low	High.
45–60	35–50	25–35	10–20	5–20	NP–5	2.0–6.0	0.04–0.06	6.1–6.5		Low	Low.
80–95	65–85	40–50	10–20	NP	NP	6.0–20.0	0.05–0.07	6.1–7.3		Low	Low.
70–100	60–95	30–50	10–25	NP	NP	6.0–20.0	0.06–0.08	5.6–6.0		Low	Low.
70–80	60–75	55–65	35–45	20–30	0–10	0.6–2.0	0.11–0.13	7.9–8.4	0–4	Low	High.
100	95–100	85–95	70–85	25–35	5–15	0.6–2.0	0.19–0.21	7.9–8.4	0–4	Moderate	High.
100	95–100	70–80	40–50	20–35	10–20	0.6–2.0	0.14–0.16	7.9–8.4	0–4	Moderate	High.
100	100	90–100	75–85	20–30	5–15	0.6–2.0	0.17–0.19	5.1–6.0	0–8	Moderate	High.
100	100	90–100	70–80	30–40	15–25	<0.06	0.03–0.05	5.6–8.4	0–8	High	High.
100	100	90–100	60–70	30–40	10–20	0.2–0.6		5.6–8.4	0–8	Moderate	High.
100	95–100	70–80	30–40	5–20	NP–5	0.6–2.0	0.16–0.18	6.1–9.0	4–15	Low	High.
100	95–100	75–85	50–60	30–40	15–25	<0.06	0.03–0.05	7.9–9.0+	4–15	Moderate	High.
80–90	50–70	35–45	5–10	NP	NP	2.0–6.0		7.9–9.0+	4–15	Low	High.
100	100	90–100	80–90	30–40	5–15	0.6–2.0	0.18–0.20	7.9–9.0	8–15	Moderate	High.
100	100	90–100	90–100	40–50	20–25	<0.06	0.03–0.05	7.9–9.0+	8–15	High	High.
95–100	90–100	40–50	15–25	NP	NP	2.0–6.0		7.9–9.0+	8–15	Low	High.
85–90	75–85	45–55	20–30	10–20	NP–5	2.0–6.0	0.10–0.12	5.6–6.5		Low	Low.
85–95	75–85	70–80	60–70	50–60	25–35	<0.06	0.02–0.04	5.6–6.0		Moderate	High.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO	
Millich	1–1½	(1)	0–8	Very stony loam and cobbly clay loam.	ML or CL	A–4 or A–6	10–55
Mapped only in complex with Aldax series.			8–16	Clay	CH	A–7	0–10
			16	Andesite.			
Mixed alluvial land: MdB. Too variable for valid estimates.							
Mottsville: MrC	>5	(1)	0–60	Loamy sand	SM	A–1 or A–2	
Newlands: NaE	2½–4	(1)	0–14	Sandy loam	SM	A–4	
			14–21	Clay loam	CL	A–7 or A–6	
Rock outcrop part too variable for valid estimates.			21–45	Silt loam	ML	A–4 or A–6	
			45	Rock.			
Ormsby: OrA, OrB, OtA, OtB	>5	2–6	0–45	Loamy coarse sand	SM	A–1	
			45–60	Gravelly coarse sand	SP or SW	A–1	
Ormsby, hardpan variant: OuA	>5	2½–5	0–13	Loamy sand	SM	A–2	
			13–20	Loam	ML	A–4	
			20–26	Hardpan			
			26–45	Loam	ML	A–4	
			45–66	Cemented loamy sand			
Pasquetti:							
Pa	>5	1½–2½	0–20	Silty clay (mucky surface)	ML, CL or OL	A–7	0–5
			20–43	Clay loam	ML	A–7	
			43–60	Very fine sandy loam and sandy loam.	SM	A–4	
Pd	>5	0–1½	0–20	Silty clay (mucky surface)	ML, CL or OL	A–7	0–5
			20–40	Fine sandy loam	SM	A–4	
			40–60	Clay	CH	A–7	
Portola: PrE, PrF	2½–3½	(1)	0–30	Cobbly coarse sandy loam and coarse sandy loam.	SM	A–1 or A–2	5–35
			30	Softly consolidated tuff			
Portola, moderately well drained variant: Ps.	>5	4–5	0–29	Loam	ML or CL	A–4 or A–6	
			29–37	Gravelly loamy coarse sand	SM	A–1	5–25
			37–51	Gravelly sandy clay loam	SC	A–2 or A–6	5–25
			51–64	Clay	CH	A–7	
Quincy: QuD	>5	(1)	0–78	Sand	SP–SM	A–3	
Ramelli: Ra, Rb, Rc	>5	0–5	0–18	Clay	MH or CH	A–7	
			18–26	Sandy clay loam	SC	A–6	
			26–64	Sandy loam and loamy coarse sand.	SM	A–2	
Reba: ReE	>5	(1)	0–10	Sandy clay loam	SC or SM–SC	A–4 or A–6	
			10–21	Silty clay	CL	A–7	
			21–40	Heavy sandy loam	SC	A–2 or A–6	0–5
			40–66	Coarse sandy loam	SM	A–1 or A–2	0–5
Reno: RtD	>5	(1)	0–10	Sandy loam	SM	A–4	0–5
			10–26	Clay	CH	A–7	0–5
			26–40	Hardpan			
			40–60	Very gravelly loamy sand	GW or GM	A–1	0–5
Riverwash: Rw. Too variable for valid estimates.							

See footnotes at end of table.

significant to engineering—Continued

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to uncoated steel
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Liquid limit	Plastic index						
90–100	85–95	60–80	60–70	30–40	5–20	0.2–0.6	0.14–0.18	6.1–7.3		Moderate	Moderate.
90–100	85–95	70–85	60–80	50–60	25–35	0.06–0.2	0.14–0.16	5.6–6.5		High	High.
90–100	80–95	40–55	10–25	NP	NP	6.0–20.0	0.06–0.08	5.6–6.5		Low	Low.
100	95–100	70–80	40–50	5–20	NP–5	2.0–6.0	0.12–0.14	6.6–7.3		Low	Low.
100	95–100	70–80	60–70	35–45	15–25	0.2–0.6	0.18–0.20	6.6–7.3		High	Moderate.
100	95–100	85–95	80–90	30–40	5–15	0.6–2.0	0.19–0.21	6.1–7.3		Moderate	Low.
95–100	85–95	40–50	10–20	NP	NP	2.0–6.0	0.06–0.08	5.6–6.5		Low	Low.
75–90	65–5	25–35	0–5	NP	NP	6.0–20.0	0.05–0.07	6.6–8.4	0–1	Low	High.
100	100	70–80	10–20	NP	NP	0.6–2.0	0.06–0.08	6.1–9.0	4–15+	Low	High.
100	100	80–90	50–60	5–20	NP–5	0.2–0.6	0.16–0.18	6.6–9.0	4–15+	Low	High.
						<0.06		7.4–9.0	4–15+		
100	100	80–90	50–60	5–20	NP–5	0.2–0.6		7.4–9.0	4–16+	Low	High.
						0.2–0.6		7.4–9.0	4–15+		
100	100	90–100	85–95	40–50	15–25	0.06–0.2	0.15–0.17	7.9–8.4	0–1	High	High.
100	90–100	80–90	70–80	40–50	10–20	0.2–0.6	0.19–0.21	7.9–8.4	0–1	Moderate	High.
100	90–100	75–85	35–45	10–30	NP–5	0.6–2.0	0.13–0.15	7.9–8.4	0–1	Low	High.
100	100	90–100	85–95	40–50	15–25	0.06–0.2	0.15–0.17	7.9–8.4	0–1	High	High.
100	90–100	80–90	35–45	10–30	NP–5	0.6–2.0	0.13–0.15	7.9–8.4	0–1	Low	High.
100	100	90–100	90–100	55–65	30–40	<0.06	0.03–0.05	7.9–8.4	0–1	High	High.
70–90	60–85	40–60	15–30	5–20	NP–5	6.0–20.0	0.07–0.11	5.6–6.0		Low	Low.
75–100	65–95	60–75	50–65	25–35	5–15	2.0–6.0	0.16–0.18	5.6–6.5		Moderate	Low.
75–100	60–95	30–45	10–20	NP	NP	6.0–20.0	0.05–0.07	5.6–6.5		Low	Low.
75–100	60–95	50–75	30–50	30–40	10–20	0.2–0.6	0.10–0.12	6.6–7.3		Moderate	Moderate.
70–100	60–100	55–90	50–80	55–65	30–40	0.06–0.2	0.03–0.05	7.4–7.8	0–1	High	High.
100	100	50–60	5–10	NP	NP	6.0–20.0	0.05–0.07	6.1–7.3		Low	Low.
100	100	90–100	75–90	50–60	20–30	0.06–0.2	0.14–0.16	5.6–6.5	4–15	High	High.
100	100	75–85	40–50	25–35	10–20	0.06–0.2	0.14–0.16	6.6–7.8	4–15	Moderate	High.
100	95–100	70–80	20–35	10–30	NP–5	2.0–6.0	0.07–0.09	6.1–7.8	4–15	Low	High.
100	95–100	75–85	40–50	20–30	5–15	0.2–0.6	0.14–0.16	5.6–6.5		Moderate	Moderate.
100	95–100	90–100	80–90	40–50	15–25	0.06–0.2	0.03–0.05	6.1–7.3		High	High.
60–100	50–95	45–75	30–45	20–30	10–20	0.2–0.6	0.03–0.05	7.4–8.4	0–1	Low	High.
60–100	50–95	30–50	15–30	5–20	NP–5	2.0–6.0	0.03–0.05	7.9–8.4	0–1	Low	High.
100	75–100	50–70	35–45	5–20	NP–5	2.0–6.0	0.11–0.13	5.6–6.5		Low	Low.
100	90–100	85–95	55–70	50–60	25–35	<0.06	0.03–0.05	6.6–8.4	0–1	High	High.
						<0.06					
50–60	35–50	20–30	5–20	NP	NP	2.0–6.0		7.9–8.4	0–1	Low	High.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO	
Rough broken land: RyF. Too variable for valid estimates.							
Rock outcrop. Mapped only in complex with Aldax, Glenbrook, and Newlands soils. Too variable for valid estimates.							
Saralegui: SaD	>5	(1)	0–12	Heavy loam	CL	A–6	--------
			12–51	Sandy clay loam	SM–SC or SC	A–4 or A–6	--------
			51–61	Light sandy loam	SM	A–2	--------
Sattley: StF	3–5	(1)	0–15	Extremely stony sandy loam	SM	A–1 or A–2	15–65
			15–46	Extremely stony sandy clay loam and extremely stony clay loam.	SC	A–2	65–80
			46–50	Andesitic conglomerate.			
Sierraville: SvE	4–>5	(1)	0–9	Stony loam	SM–SC or SC	A–2	35–65
			9–24	Stony clay loam	CL or S C	A–6	35–65
			24–75	Heavy clay loam and light clay.	CL	A–6 or A–7	20–45
Smithneck: Sw	>5	3–5	0–48	Heavy sandy loam	SM	A–2 or A–4	--------
			[3]48–60	Stratified fine gravel to sandy loam.	GP–GM	A–1	--------
*Toiyabe: TbE, TbG. For Bonta parts, see Bonta series.	½–1½	(1)	0–12	Loamy coarse sand	SM or SP	A–1	--------
			12	Weathered granodiorite.	GM		
Trojan: TrE, TrF	3½–>5	(1)	0–10	Stony sandy loam	SM	A–1 or A–2	10–50
			10–67	Gravelly loam and gravelly light clay loam.	CL	A–6	10–50
*Trosi: TsD, TtD, TuF2. For Saralegui portion of TuF2, see Saralegui series.	>5	(1)	0–7	Very stony sandy loam	SM	A–1 or A–2	35–75
			12–19	Very cobbly clay	CL or GC	A–7	35–75
			19–26	Hardpan	----------	----------	--------
			26–60	Sediment	----------	----------	--------

[1] No seasonal high water table observed within a depth of 5 feet.
[2] NP = Nonplastic.
[3] Content of coarse fragments on surface ranges from 0 to 10 percent.
[4] Content of coarse fragments (throughout unit CpE only) ranges from 25 to 65 percent.

Four groups are used—A, B, C, and D. Group A has the least runoff and highest infiltration potential, and Group D has the highest runoff and lowest infiltration potential. Groups B and C are intermediate. Hydrologic soil groups are based on such soil properties as texture, presence of restrictive layers, depth, subsoil permeability, and natural drainage class.

Formation, Morphology, and Classification of the Soils [8]

Data presented in this section were provided by the soil survey laboratories of the Soil Conservation Service at Riverside, California, and Beltsville, Maryland.

[8] By GRANT M. KENNEDY, soil specialist, Soil Conservation Service.

Formation of Soils

Soil has been defined as a natural body on the surface of the earth, composed of organic and mineral materials in which plants grow (*11*). Soils differ in appearance, composition, management requirements, and productivity in different localities or even within very short distances. The factors that influence soil development are *parent material, relief, climate, biological activity,* and *time.* Each soil is affected by all five factors, but the relative importance of each varies from one soil to another.

Parent material

Parent material is the unconsolidated and more or less chemically weathered mineral or organic matter in which the soil is forming. A variety of mineral par-

significant to engineering—Continued

Percentage passing sieve—				Atterberg values		Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity to uncoated steel
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plastic index						
100	100	70–80	50–60	25–35	10–20	0.6–2.0	0.14–0.16	5.6–6.5		Moderate	Low.
85–100	75–95	65–75	35–50	25–35	5–15	0.2–0.6	0.14–0.16	6.1–7.3		Moderate	Low.
80–100	70–90	60–70	20–30	5–20	NP–5	2.0–6.0	0.11–0.13	7.9–8.4	0–1	Low	High.
70–80	60–80	35–50	15–25	NP	NP	6.0–20.0	0.05–0.07	5.6–6.5		Low	Low.
70–80	60–80	50–65	20–35	25–35	10–20	0.6–2.0	0.07–0.09	5.1–6.0		Low	Low.
75–90	70–85	60–75	25–35	20–30	5–15	0.6–2.0	0.09–0.11	6.1–6.5		Low	Low.
75–90	70–85	65–80	40–60	30–40	10–20	0.2–0.6	0.11–0.13	6.1–6.5		Moderate	Moderate.
75–95	70–90	65–80	50–70	35–50	20–30	0.2–0.6	0.14–0.16	5.6–6.5		Moderate	High.
95–100	85–100	70–80	30–45	10–20	NP–5	2.0–6.0	0.12–0.14	6.1–7.3		Low	Low.
40–50	30–50	15–35	5–15	NP	NP	6.0–20.0	0.06–0.08	6.1–7.3		Low	Low.
70–85	65–90	30–40	5–15	NP	NP	6.0–20.0	0.06–0.08	5.6–6.5		Low	Low.
70–95	65–90	40–55	20–35	5–20	NP–5	2.0–6.0	0.08–0.10	6.1–6.5		Low	Low.
70–95	65–90	60–85	50–65	25–40	10–20	0.2–0.6	0.15–0.17	5.6–6.5		Moderate	Moderate.
70–90	60–80	35–55	20–35	5–20	NP–5	2.0–6.0	0.07–0.09	5.6–6.5		Low	Low.
70–90	60–80	55–75	45–60	40–50	20–30	<0.06	0.07–0.09	6.1–6.0		Moderate	High.
						<0.06					

[5] Content of coarse fragments throughout unit DeE only ranges from 10 to 40 percent.
[6] Content of coarse fragments throughout unit DhE only ranges from 5 to 40 percent.
[7] Content of coarse fragments throughout unit GdE only ranges from 35 to 55 percent.
[8] Estimates are for the horizon when mixed—not including strata.

ent materials are in the Area. These range from weathered granitic, volcanic, and metamorphic rocks to the alluvium derived from these rock sources. The numerous soil patterns shown on the General Soil Map in the back of this survey are related in part to the many diverse parent materials.

A mountainous range of metamorphic rocks, the oldest rocks in the Area, divides Sierra Valley and Long Valley. The rocks are metavolcanic quartzite, slate, and limestone. Although fractured, they are hard and resistant to disintegration. The development of soil material from them has barely exceeded losses by erosion. The soils formed are mostly shallow and stony. Soils of the Aldax series are representative of soils forming in material derived from these metamorphic rocks.

The granitic rocks are mostly in the northeastern uplands of the Area, but there are lesser exposures on mountain fronts along the western rim of Sierra Valley. The granitic rocks have broken down readily by physical weathering. They have formed sandy soils because of their high quartz content. The quartz minerals strongly resist chemical weathering. The sandy soils are highly susceptible to erosion. They lack enough clay to bind sand particles together into stable aggregates. The particles are easily detached by moving water. The sand in suspension is quite abrasive. Soils from granitic sources may be either shallow or deep, depending on the stability of the landscape. Toiyabe and Glenbrook soils are shallow granitic soils that formed on less stable slopes, and Bonta and Haypress soils are on more stable landscapes. The erosion

TABLE 6.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such to another series in the

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location [1]
Acidic rock land: AcG. Too variable for valid interpretation.				
*Aldax: AkG, AmE, AmG. Rock outcrop part of AkG is too variable for valid interpretation. For Millich parts of AmE and AmG, see Millich series.	Poor: coarse fragment content more than 15 percent.	Poor: SM or GM	Good	Bedrock at depth of ½ to 1 foot; slopes of 5 to 75 percent; low shrink-swell potential; cobble and stone content is 20 to 40 percent.
Badenaugh: BaE	Poor: coarse fragment content more than 15 percent.	Poor to unsuited: SM, GM, SC, GC.	Good	Slopes of 2 to 30 percent; low shrink-swell potential; cobble and stone content is 50 to 85 percent.
Badenaugh, poorly drained variant: BbB.	Poor: coarse fragment content more than 15 percent.	Unsuited: GM or SC.	Good	Water table at depth of 1 to 4 feet; slopes of 2 to 5 percent; low shrink-swell potential; cobble and stone content is 15 to 45 percent.
*Balman: BcA, BcB, BdA. For Ramelli part of BdA, see Ramelli series.	Good to poor: conductivity of 0–15 mmhos/cm.	Poor to unsuited: ML, SM.	Good to poor: A–4, A–6, A–2.	Water table at depth of 5 to 7 feet; slopes of 0 to 5 percent; moderate shrink-swell potential.
Basic rock land: BeG. Too variable for valid interpretation.				
*Beckwourth: Bf, BmA, Bn. For Loyalton part of BmA and Ormsby part of Bn, see Loyalton and Ormsby series, respectively.	Poor: loamy coarse sand; conductivity of 0–15 mmhos/cm.	Poor: SM	Good to fair: A–1 or A–4.	Water table at depth of 3 to 7 feet; slopes of 0 to 2 percent; low shrink-swell potential.
Bh	Poor: loamy coarse sand over clay; conductivity of 0–15 mmhos/cm.	Poor to unsuited: SM, CH.	Good to poor: A–2, A–7.	Water table at depth of 3½ to more than 5 feet; slopes of 0 to 2 percent; high shrink-swell potential.
Bk	Good to poor: conductivity of 0–15 mmhos/cm.	Poor: SM	Fair: A–4	Water table at depth of 3½ to more than 5 feet; slopes of 0 to 2 percent; low shrink-swell potential.

See footnote at end of table.

engineering properties of the soils

mapping units may have different properties and limitations, and for this reason the reader should follow carefully the instructions for referring first column of this table]

Soil features affecting—Continued				Soil limitations for septic-tank filter field [1]	Hydrologic soil group
Water retention		Drainage for crops and pasture	Irrigation		
Embankments	Reservoir area				
Medium strength; medium to low permeability if compacted; low to high susceptibility to piping; low to medium compressibility.	Moderately rapid permeability; bedrock at depth of ½ to 1 foot; slopes of 5 to 75 percent.	Moderately rapid permeability; bedrock at depth of ½ to 1 foot; somewhat excessively drained.	Very low available water capacity; rapid intake rate; bedrock at depth of ½ to 1 foot; slopes of 5 to 75 percent.	Severe: bedrock at depth of ½ to 1 foot; slopes of 5 to 75 percent.	D
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; low to medium compressibility.	Moderately rapid permeability; slopes of 2 to 30 percent.	Moderately rapid permeability; well drained.	Moderate available water capacity; moderately rapid intake rate; slopes of 2 to 30 percent.	Severe: cobble and stone content is 50 to 85 percent.	B
Medium to low strength; low permeability if compacted; medium to low susceptibility to piping, low to medium compressibility.	Slow permeability; water table at depth of 1 to 4 feet; slopes of 2 to 5 percent.	Slow permeability; water table at depth of 1 to 4 feet; poorly drained.	Low available water capacity; moderate intake rate; water table at depth of 1 to 4 feet; slopes of 2 to 5 percent.	Severe: slow permeability; water table at depth of 1 to 4 feet.	D
Medium to low strength; medium to low permeability if compacted; medium to high susceptibility to piping; medium to low compressibility.	Moderately slow permeability; water table at depth of 5 to 7 feet; slopes of 0 to 5 percent.	Moderately slow permeability; water table at depth of 5 to 7 feet; moderately well drained.	Moderate available water capacity; moderate intake rate; water table at depth of 5 to 7 feet; slopes of 0 to 5 percent; saline.	Severe: moderately slow permeability; water table at depth of 5 to 7 feet.	C
Medium strength; medium to low permeability if compacted; medium to high susceptibility to piping; low to medium compressibility.	Moderate permeability; water table at depth of 3 to 7 feet; slopes of 0 to 2 percent.	Moderate permeability; water table at depth of 3 to 7 feet; somewhat poorly drained.	Low available water capacity; rapid intake rate; water table at depth of 3 to 7 feet; slopes of 0 to 2 percent; saline.	Severe: water table at depth of 3 to 7 feet.	C
Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping; low to high compressibility.	Very slow permeability; water table at depth of 3½ to more than 5 feet; slopes of 0 to 2 percent.	Very slow permeability; water table at depth of 3½ to more than 5 feet; somewhat poorly drained.	Low available water capacity; rapid intake rate; water table at depth of 3½ to more than 5 feet; slopes of 0 to 2 percent; saline.	Severe: very slow permeability; water table at depth of 3½ to more than 5 feet.	C
Medium strength; medium to low permeability if compacted; medium to high susceptibility to piping; low to medium compressibility.	Moderate permeability; water table at depth of 3½ to more than 5 feet; slopes of 0 to 2 percent.	Moderate permeability; water table at depth of 3½ to more than 5 feet; somewhat poorly drained.	Moderate available water capacity; moderately rapid intake rate; water table at depth of 3½ to more than 5 feet; slopes of 0 to 2 percent; saline.	Severe: water table at depth of 3½ to more than 5 feet.	C

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location [1]
Bellavista: BoA, BoB	Fair to poor: conductivity of 4–15 mmhos/cm.	Unsuited: CL	Poor: A–6	Hardpan at depth of 20 to 40 inches; slopes of 0 to 5 percent; moderate shrink-swell potential.
Bidwell: BrA, BrB, BtA	Fair: sandy clay loam and heavy sandy loam.	Good to unsuited: SC, CL, SM, SW, GW.	Good to poor: A–2, A–1, A–6.	Slopes of 0 to 5 percent; moderate shrink-swell potential.
BsA	Fair: sandy clay loam and heavy sandy loam.	Good to unsuited: SC, CL, SW, GW.	Good to poor: A–6, A–1.	Slopes of 0 to 2 percnet; moderate shrink-swell potential.
Bieber: BuB, BwA	BuB poor: coarse fragment content is more than 15 percent. BwA good.	Poor to unsuited: SM, SC, CL.	Good to poor: A–1, A–2, A–7.	Hardpan at depth of 10 to 40 inches; slopes of 0 to 5 percent; high shrink-swell potential; cobble and stone content on surface is 0 to 10 percent.
Bonta. Mapped only in complex with Toiyabe soils.	Poor: coarse fragment content is more than 15 percent.	Poor to unsuited: SM, SC.	Good to poor: A–2, A–6.	Bedrock at depth of 2 to 5 feet; slopes of 2 to 75 percent; moderate shrink-swell potential; cobble stone and stone content is 0 to 5 percent.
*Calpine: CaA, CaB, CaC, CgB2. For Lovejoy part of CgB2, see Lovejoy series.	Good	Poor: SM, SC	Good to poor: A–2, A–4, A–6.	Slopes of 0 to 9 percent; low shrink-swell potential.
Calpine, clayey variant: CmA	Good	Poor to unsuited: SM, CH, MH.	Good to poor: A–2, A–7.	Slopes of 0 to 2 percent; high shrink-swell potential.
Coolbrith: CnA, CnB	Fair: clay loam and sandy clay loam subsoil.	Good to unsuited: ML, CL, SC, GW, SW.	Good to poor: A–6, A–7, A–4, A–1.	Slopes of 0 to 5 percent; moderate shrink-swell potential.

See footnote at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Soil limitations for septic-tank filter field [1]	Hydrologic soil group
Water retention		Drainage for crops and pasture	Irrigation		
Embankments	Reservoir area				
Medium to low strength; low permeability if compacted; low to medium susceptibility to piping; medium compressibility.	Very slow permeability; hardpan at depth of 20 to 40 inches; slopes of 0 to 5 percent.	Very slow permeability; hardpan at depth of 20 to 40 inches; moderately well drained.	Low available water capacity; moderate intake rate; hardpan at depth of 20 to 40 inches; slopes of 0 to 5 percent; saline.	Severe: very slow permeability; hard-permeability; hardpan at depth of 20 to 40 inches.	D
Medium to low strength; low to medium permeability if compacted; low to high susceptibility to piping; low to medium compressibility.	Moderately slow permeability; slopes of 0 to 5 percent.	Moderately slow permeability; well drained.	Moderate available water capacity; moderately rapid intake rate; slopes of 0 to 5 percent.	Severe: moderately slow permeability.	B
Medium to high strength; low to high permeability if compacted; low to medium susceptibility to piping; low to medium compressibility.	Rapid permeability; sand and gravel at depth of 22 to 40 inches; slopes of 0 to 2 percent.	Rapid permeability; sand and gravel at depth of 22 to 40 inches; well drained.	Low available water capacity; moderately rapid intake rate; sand and gravel at depth of 22 to 40 inches; slopes of 0 to 2 percent.	Slight [2]	B
Low to medium strength; low to medium permeability if compacted; low to high susceptibility to piping; low to medium compressibility.	Very slow permeability; hardpan at depth of 10 to 40 inches; slopes of 0 to 5 percent.	Very slow permeability; hardpan at depth of 10 to 40 inches; well drained.	Very low to low available water capacity; moderately rapid intake rate; hardpan at depth of 10 to 40 inches; slopes of 0 to 5 percent.	Severe: very slow permeability; hardpan at depth of 10 to 40 inches.	D
Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping; low to medium compressibility.	Moderate permeability; bedrock at depth of 2 to 5 feet; slopes of 2 to 75 percent.	Moderate permeability; bedrock at depth of 2 to 5 feet; well drained.	Low to moderate available water capacity; rapid intake rate; bedrock at depth of 2 to 5 peet; slopes of 2 to 75 percent.	Severe: bedrock at depth of 2 to 5 feet; slopes of 2 to 75 percent.	C
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; low to medium compressibility.	Moderately rapid permeability; slopes of 0 to 9 percent.	Moderately rapid permeability; well drained.	Moderate available water capacity; moderately rapid intake rate; slopes of 0 to 9 percent.	Slight	B
Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping; low to high compressibility.	Very slow permeability; slopes of 0 to 2 percent.	Very slow permeability; moderately well drained.	Low available water capacity; moderately rapid intake rate; slopes of 0 to 2 percent.	Severe: very slow permeability.	C
Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping; low to medium compressibility.	Moderately slow permeability; slopes of 0 to 5 percent.	Moderately slow permeability; moderately well drained.	Moderate available water capacity; moderate intake rate; slopes of 0 to 5 percent.	Severe: moderately slow permeability.	B

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location [1]
Correco: CoB, CoD, CpE	Poor: clay subsoil	Poor to unsuited: SM, CH, MH, SC.	Fair to poor: A-4, A-6, A-7.	Slopes of 2 to 30 percent; high shrink-swell potential; cobble and stone content in CpE is 25 to 65 percent.
Delleker: DdD2, DeE	Fair: sandy clay loam and clay loam subsoil.	Unsuited: ML, CL, SM, SC.	Fair to poor: A-4, A-6, A-7.	Bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 30 percent; moderate shrink-swell potential; cobble and stone content in DeE is 10 to 40 percent.
*Dotta: DfA, DfC, DgE, DhE, DmC. For Lovejoy part of DmC, see Lovejoy series.	Poor: coarse fragment content more than 15 percent.	Poor to unsuited: SM, SC, CL.	Good to poor: A-1, A-2, A-6.	Slopes of 0 to 30 percent; moderate shrink-swell potential; cobble and stone content is 0 to 40 percent.
Galeppi: GaB, GaE, GdE	GaB and GaE fair: sandy clay loam subsoil. GdE poor: cobbly.	Poor to unsuited: SM, SC.	Good to poor: A-2, A-6.	Slopes of 2 to 30 percent; moderate shrink-swell potential; cobble and stone content in GdE is 35 to 55 percent.
Glean: GpF	Poor: extremely stony.	Good	Good	Slopes of 9 to 50 percent; low shrink-swell potential; cobble and stone content is 55 to 85 percent.
Glenbrook: GrF. Rock outcrop part is too variable for valid interpretation.	Poor: coarse fragment content is more than 15 percent.	Poor: SM	Good	Bedrock at depth of ½ to 1½ feet; slopes of 5 to 50 percent; low shrink-swell potential.
*Haypress: HtE, HtG. For Toiyabe parts, see Toiyabe series.	Poor: loamy coarse sand.	Poor: SM	Good	Bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 75 percent; low shrink-swell potential.
James Canyon: JbB	Poor: coarse fragment content is more than 15 percent.	Poor: SM	Fair: A-4	Water table at depth of 3 to 5 feet; slopes of 2 to 5 percent; low shrink-swell potential.

See footnote at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Soil limitations for septic-tank filter field [1]	Hydrologic soil group
Water retention		Drainage for crops and pasture	Irrigation		
Embankments	Reservoir area				
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; low to high compressibility.	Slow permeability; slopes of 2 to 30 percent.	Slow permeability; well drained.	Moderate to high available water capacity; moderately rapid intake rate; slopes of 2 to 30 percent.	Severe: slow permeability; slopes of 2 to 30 percent.	C
Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping; medium to low compressibility.	Moderate permeability; bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 30 percent.	Moderate permeability; bedrock at depth of 3½ to more than 5 feet; well drained.	Low to moderate available water capacity; moderately rapid intake rate; bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 30 percent.	Severe: bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 30 percent.	A
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; low to medium compressibility.	Moderately slow permeability; slopes of 0 to 30 percent.	Moderately slow permeability; well drained.	Moderate to high available water capacity; moderately rapid intake rate; slopes of 0 to 30 percent.	Severe: moderately slow permeability; slopes of 0 to 30 percent.	B
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; low to medium compressibility.	Moderately slow permeability; slopes of 2 to 30 percent.	Moderately slow permeability; well drained.	Moderate available water capacity; rapid intake rate; slopes of 2 to 30 percent.	Severe: moderately slow permeability; slopes of 2 to 30 percent.	C
High strength; high permeability if compacted; low susceptibility to piping; low compressibility.	Moderately rapid permeability; slopes of 9 to 50 percent.	Moderately rapid permeability; well drained.	Low available water capacity; moderately rapid intake rate; slopes of 9 to 50 percent.	Moderate to severe: slopes of 9 to 50 percent.	B
Medium strength; medium to low permeability if compacted; medium to high susceptibility to piping; low to medium compressibility.	Rapid permeability; bedrock at depth of ½ to 1½ feet; slopes of 5 to 50 percent.	Rapid permeability; bedrock at depth of ½ to 1½ feet; somewhat excessively drained.	Very low available water capacity; rapid intake rate; bedrock at depth of ½ to 1½ feet; slopes of 5 to 50 percent.	Severe: bedrock at depth of ½ to 1½ feet; slopes of 5 to 50 percent.	D
Medium strength; medium to low permeability if compacted; medium to high susceptibility to piping; low to medium compressibility.	Rapid permeability; bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 75 percent.	Rapid permeability; bedrock at depth of 3½ to more than 5 feet; somewhat excessively drained.	Low available water capacity; rapid intake rate; bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 75 percent.	Severe: bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 75 percent.	A
Medium strength; medium to low permeability if compacted; medium to high susceptibility to piping; low to medium compressibility.	Moderate permeability; water table at depth of 3 to 5 feet; slopes of 2 to 5 percent.	Moderate permeability; water table at depth of 3 to 5 feet; poorly drained.	Moderate available water capacity; moderately rapid intake rate; water table at depth of 3 to 5 feet; slopes of 2 to 5 percent.	Severe: water table at depth of 3 to 5 feet.	B

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location
James Canyon—Continued JcA	Good	Unsuited: ML, CL, SC.	Fair to poor: A-4, A-6.	Water table at depth of 2 to 5 feet; slopes of 0 to 2 percent; moderate shrink-swell potential.
Lovejoy: LaB	Poor: clay subsoil	Unsuited: CL, ML	Fair to poor: A-4, A-6.	Hardpan at depth of 10 to 30 inches; slopes of 0 to 5 percent; high shrink-swell potential.
Loyalton: Lo	Poor: conductivity of 4–15 mmhos/cm.	Poor to unsuited: SM, CL, GM.	Good to poor: A-2, A-4, A-6, A-1.	Slopes of 0 to 2 percent; moderate shrink-swell potential.
Lp	Poor: silty clay subsoil; conductivity of 8–15 mmhos/cm.	Poor to unsuited: ML, CL, SM.	Good to poor: A-1, A-4, A-6, A-7.	Slopes of 0 to 2 percent; high shrink-swell potential.
Martineck: MaE	Poor: very stony	Poor to unsuited: SM, CH.	Good to poor: A-1, A-2, A-7.	Hardpan at depth of 10 to 20 inches; slopes of 2 to 30 percent; moderate shrink-swell potential; cobble and stone content is 55 to 75 percent.
Millich Mapped only in complex with Aldax series.	Poor: very stony	Unsuited: ML, CL, CH.	Fair to poor: A-4, A-6, A-7.	Bedrock at depth of 1 to 1½ feet; slopes of 5 to 75 percent; high shrink-swell potential; cobble and stone content is 0 to 55 percent.
Mixed alluvial land: MdB. Too variable for valid interpretation.				
Mottsville: MrC	Poor: loamy sand	Poor: SM	Good	Slopes of 2 to 9 percent; low shrink-swell potential.
Newlands: NaE Rock outcrop part is too variable for valid interpretation.	Fair to poor: clay loam subsoil.	Poor to unsuited: SM, ML, CL.	Fair to poor: A-4, A-6, A-7.	Bedrock at depth of 2½ to 4 feet; slopes of 2 to 30 percent; moderate shrink-swell potential.

See footnotes at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Soil limitations for septic-tank filter field [1]	Hydrologic soil group
Water retention		Drainage for crops and pasture	Irrigation		
Embankments	Reservoir area				
Medium to low strength; low to medium permeability if compacted; low to high susceptibility to piping; medium to low compressibility.	Moderate permeability; water table at depth of 2 to 5 feet; slopes of 0 to 2 percent.	Moderate permeability; water table at depth of 2 to 5 feet; poorly drained.	High available water capacity; moderate intake rate; water table at depth of 2 to 5 feet; slopes of 0 to 2 percent.	Severe: water table at depth of 2 to 5 feet.	C
Medium to low strength; low to medium permeability if compacted; low to high susceptibility to piping; medium compressibility.	Very slow permeability; hardpan at depth of 10 to 30 inches; slopes of 0 to 5 percent.	Very slow permeability; hardpan at depth of 10 to 30 inches; moderately well drained.	Very low available water capacity; moderate intake rate; hardpan at depth of 10 to 30 inches; slopes of 0 to 5 percent; saline.	Severe: very slow permeability; hardpan at depth of 10 to 30 inches.	C
Medium to low strength; low to medium permeability if compacted; low to high susceptibility to piping; medium to low compressibility.	Very slow permeability; slopes of 0 to 2 percent.	Very slow permeability; moderately well drained.	Very low to low available water capacity; moderately rapid intake rate; slopes of 0 to 2 percent; saline.	Severe: very slow permeability; moderately rapid permeability below subsoil.	D
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; medium compressibility.	Very slow permeability; slopes of 0 to 2 percent.	Very slow permeability; moderately well drained.	Very low to low available water capacity; moderate intake rate; slopes of 0 to 2 percent; saline.	Severe: very slow permeability; moderately rapid permeability below subsoil.	D
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; low to high compressibility.	Very slow permeability; hardpan at depth of 10 to 20 inches; slopes of 2 to 30 percent.	Very slow permeability; hardpan at depth of 10 to 20 inches; well drained.	Very low available water capacity; moderately rapid intake rate; hardpan at depth of 10 to 20 inches; slopes of 2 to 30 percent.	Severe: very slow permeability; hardpan at depth of 10 to 20 inches.	D
Medium to low strength; low to medium permeability if compacted; high to low susceptibility to piping; medium to high compressibility.	Slow permeability; bedrock at depth of 1 to 1½ feet; slopes of 5 to 75 percent.	Slow permeability; bedrock at depth of 1 to 1½ feet; well drained.	Very low available water capacity; moderate intake rate; bedrock at depth of 1 to 1½ feet; slopes of 5 to 75 percent.	Severe: slow permeability; bedrock at depth of 1 to 1½ feet; slopes of 5 to 75 percent.	D
Medium strength; medium to low permeability if compacted; medium to high susceptibility to piping; low to medium compressibility.	Rapid permeability; slopes of 2 to 9 percent.	Rapid permeability; excessively drained.	Low available water capacity; rapid intake rate; slopes of 2 to 9 percent.	Slight [2]	A
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; medium to low compressibility.	Moderately slow permeability; bedrock at depth of 2½ to 4 feet; slopes of 2 to 30 percent.	Moderately slow permeability; bedrock at depth of 2½ to 4 feet; well drained.	Low to moderate available water capacity; moderately rapid intake rate; bedrock at depth of 2½ to 4 feet; slopes of 2 to 30 percent.	Severe: moderately slow permeability; bedrock at depth of 2½ to 4 feet; slopes of 2 to 30 percent.	B

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location [1]
Ormsby: OrA, OrB, OtA, OtB	OrA and OrB poor: loamy coarse sand. OtA and OtB poor: poorly drained.	Good to poor: SM, SP, SW.	Good	Water table at depth of 2 to 6 feet; slopes of 0 to 5 percent; low shrink-swell potential.
Ormsby, hardpan variant: OuA	Poor: loamy sand	Poor to unsuited: SM, ML.	Good to poor: A-2, A-4.	Water table at depth of 2½ to more than 5 feet; hardpan at depth of 15 to 37 inches; slopes of 0 to 2 percent; low shrink-swell potential.
Pasquetti: Pa	Poor: mucky silty clay.	Poor to unsuited: ML, CL, OL, SM.	Fair to poor: A-7, A-8, A-4.	Water table at depth of 1½ to 2½ feet; slopes of 0 to 2 percent; moderate shrink-swell potential; surface is 0 to 5 percent cobbles and stones.
Pd	Poor: mucky silty clay.	Poor to unsuited: ML, CL, OL, SM, CH.	Fair to poor: A-7, A-8, A-4.	Water table at depth of 0 to 1½ feet; slopes of 0 to 2 percent; high shrink-swell potential; surface is 0 to 5 percent cobbles and stones.
Portola: PrE, PrF	Poor: coarse fragment content is more than 15 percent.	Poor: SM	Good	Bedrock at depth of 2½ to 3½ feet; slopes of 9 to 50 percent; low shrink-swell potential; cobble and stone content is 5 to 35 percent.
Portola, moderately well drained variant: Ps.	Fair: gravelly loamy coarse sand substratum.	Poor to unsuited: ML, CL, SM, SC, CH.	Good to poor: A-4, A-6, A-2, A-1, A-7.	Water table at depth of 4 to 5 feet; slopes of 0 to 2 percent; high shrink-swell potential; cobble and stone content is 0 to 25 percent.
Quincy: QuD	Poor: sand	Good	Good	Slopes of 2 to 15 percent; low shrink-swell potential.
Ramelli: Ra, Rb, Rc	Poor: clay	Poor to unsuited: MH, CH, SC, SM.	Good to poor: A-7, A-6, A-2.	Water table at depth of 0 to 5 feet; slopes of 0 to 2 percent; high shrink-swell potential.

See footnotes at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Soil limitations for septic-tank filter field [1]	Hydrologic soil group
Water retention		Drainage for crops and pasture	Irrigation		
Embankments	Reservoir area				
Medium to high strength; high to low permeability if compacted; medium to high susceptibility to piping; low to medium compressibility.	Moderately rapid permeability; water table at depth of 2 to 6 feet; slopes of 0 to 5 percent.	Moderately rapid permeability; water table at depth of 2 to 6 feet; somewhat poorly and poorly drained.	Low available water capacity; moderately rapid intake rate; water table at depth of 2 to 6 feet; slopes of 0 to 5 percent.	Severe: water table at depth of 2 to 6 feet.	C
Medium to low strength; medium to low permeability if compacted; high to medium susceptibility to piping; low to medium compressibility.	Very slow permeability; water table at depth of 2½ to more than 5 feet; hardpan at depth of 15 to 37 inches; slopes of 0 to 2 percent.	Very slow permeability; water table at depth of 2½ to more than 5 feet; hardpan at depth of 15 to 37 inches; somewhat poorly drained.	Very low available water capacity; rapid intake rate; water table at depth of 2½ to more than 5 feet; hardpan at depth of 15 to 37 inches; slopes of 0 to 2 percent; saline.	Severe: very slow permeability; water table at depth of 2½ to more than 5 feet; hardpan at depth of 15 to 37 inches.	D
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; medium to high compressibility.	Slow permeability; water table at depth of 1½ to 2½ feet; slopes of 0 to 2 percent.	Slow permeability; water table at depth of 1½ to 2½ feet; poorly drained.	High available water capacity; slow intake rate; water table at depth of 1½ to 2½ feet; slopes of 0 to 2 percent.	Severe: slow permeability; water table at depth of 1½ to 2½ feet.	D
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; low to high compressibility.	Very slow permeability; water table at depth of 0 to 1½ feet; slopes of 0 to 2 percent.	Very slow permeability; water table at depth of 0 to 1½ feet; very poorly drained.	Low to moderate available water capacity; slow intake rate; water table at depth of 0 to 1½ feet; slopes of 0 to 2 percent.	Severe: very slow permeability; water table at depth of 0 to 1½ feet.	D
Medium strength; medium to low permeability if compacted; medium to high susceptibility to piping; low to medium compressibility.	Rapid permeability; bedrock at depth of 2½ to 3½ feet; slopes of 9 to 50 percent.	Rapid permeability; bedrock at depth of 2½ to 3½ feet; well drained.	Low available water capacity; rapid intake rate; bedrock at depth of 2½ to 3½ feet; slopes of 9 to 50 percent.	Severe: bedrock at depth of 2½ to 3½ feet; slopes of 9 to 50 percent.	D
Medium to low strength; low to medium permeability if compacted; low to high susceptibility to piping; low to medium compressibility.	Slow permeability; water table at depth of 4 to 5 feet; slopes of 0 to 2 percent.	Slow permeability; water table at depth of 4 to 5 feet; moderately well drained.	Moderate available water capacity; moderate intake rate; water table at depth of 4 to 5 feet; slopes of 0 to 2 percent.	Severe: slow permeability; water table at depth of 4 to 5 feet.	D
Medium strength; high permeability if compacted; medium to high susceptibility to piping; low compressibility.	Rapid permeability; slopes of 2 to 15 percent.	Rapid permeabitliy; excessively drained.	Low available water capacity; rapid intake rate; slopes of 2 to 15 percent.	Slight to moderate: slopes of 2 to 15 percent.	A
Low to medium strength; low to medium permeability if compacted; low to high susceptibility to piping; high to low compressibility.	Slow permeability; water table at depth of 0 to 5 feet; slopes of 0 to 2 percent.	Slow permeability; water table at depth of 0 to 5 feet: very poorly drained.	Moderate available water capacity; water table at depth of 0 to 5 feet; slopes of 0 to 2 percent; saline.	Severe: slow permeability; water table at depth of 0 to 5 feet.	C

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location [1]
Reba: ReE	Poor: silty clay subsoil.	Poor to unsuited: SC, MH, CH, SM.	Good to poor: A-4, A-6, A-7, A-2, A-1.	Slopes of 2 to 30 percent; high shrink-swell potential; cobble and stone content is 0 to 5 percent.
Reno: RtD	Poor: clay subsoil	Good to unsuited: SM, CH, GW, GM.	Good to poor: A-4, A-7, A-1.	Hardpan at depth of 20 to 36 inches; slopes of 2 to 15 percent; high shrink-swell potential; cobble and stone content is 0 to 5 percent.
Riverwash: Rw. Too variable for valid interpretation.				
Rough broken land: RyF. Too variable for valid interpretation.				
Rock outcrop. Mapped only in complex with Aldax, Glenbrook, and Newlands soils. Too variable for valid interpretation.				
Saralegui: SaD	Fair: sandy clay loam subsoil.	Poor to unsuited: ML, CL, SM, SC.	Good to poor: A-6, A-4, A-2.	Slopes of 2 to 50 percent; low shrink-swell potential.
Sattley: StF	Poor: extremely stony.	Poor to unsuited: SM, SC.	Good	Bedrock at depth of 3 to more than 5 feet; slopes of 2 to 50 percent; low shrink-swell potential; cobble and stone content is 15 to 80 percent.
Sierraville: SvE	Poor: stony	Poor to unsuited: SM, SC, CL.	Good to poor: A-2, A-6, A-7.	Bedrock at depth of 4 to more than 5 feet; slopes of 2 to 30 percent; moderate shrink-swell potential; cobble and stone content is 20 to 65 percent.
Smithneck: Sw	Good	Good to poor: SM, GP, GM.	Good to poor: A-4, A-2, A-1.	Water table at depth of 3 to more than 5 feet; slopes of 0 to 2 percent; low shrink-swell potential.
*Toiyabe: TbE, TbG. For Bonta parts, see Bonta series.	Poor: loamy coarse sand.	Good to poor: SM or SP.	Good	Bedrock at depth of ½ to 1½ feet; slopes of 2 to 75 percent; low shrink-swell potential.

See footnotes at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Soil limitations for septic-tank fitler field [1]	Hydrologic soil group
Water retention		Drainage for crops and pasture	Irrigation		
Embankments	Reservoir area				
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; high to low compressibility.	Slow permeability; slopes of 2 to 30 percent.	Slow permeability; well drained.	Moderate available water capacity; moderately rapid intake rate; slopes of 2 to 30 percent.	Severe: slow permeability; slopes of 2 to 30 percent.	C
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; low to high compressibility.	Very slow permeability; hardpan at depth of 20 to 36 inches; slopes of 2 to 15 percent.	Very slow permeability; hardpan at depth of 20 to 36 inches; well drained.	Low available water capacity; moderately rapid intake rate; hardpan at depth of 20 to 36 inches; slopes of 2 to 15 percent.	Severe: very slow permeability; hardpan at depth of 20 to 36 inches; moderately rapid permeability below hardpan.	D
Medium to low strength; medium to low permeability if compacted; low to high susceptibility to piping; low to high compressibility.	Moderately slow permeability; slopes of 2 to 50 percent.	Moderately slow permeability; well drained.	Moderate to high available water capacity; moderately rapid intake rate; slopes of 2 to 50 percent.	Severe: moderately slow permeability; slopes of 2 to 50 percent.	B
Medium to low strength; low to medium permeability if compacted; low to high susceptibility to piping; low to medium compressibility.	Moderate permeability; bedrock at depth of 3 to more than 5 feet; slopes of 2 to 50 percent.	Moderate permeability; bedrock at depth of 3 to more than 5 feet; well drained.	Low available water capacity; moderately rapid intake rate; bedrock at depth of 3 to more than 5 feet; slopes of 2 to 50 percent.	Severe: bedrock at depth of 3 to more than 5 feet; slopes of 2 to 50 percent.	B
Medium to low strength; low to medium permeability if compacted; low to high susceptibility to piping; medium to low compressibility.	Moderately slow permeability; bedrock at depth of 4 to more than 5 feet; slopes of 2 to 30 percent.	Moderately slow permeability; bedrock at depth of 4 to more than 5 feet; well drained.	Moderate available water capacity; moderately rapid intake rate; bedrock at depth of 4 to more than 5 feet; slopes of 2 to 30 percent.	Severe: moderately slow permeability; bedrock at depth of 4 to more than 5 feet; slopes of 2 to 30 percent.	B
High to medium strength; high to low permeability if compacted; low to high susceptibility to piping; low to medium compressibility.	Moderately rapid permeability; water table at depth of 3 to more than 5 feet; slopes of 0 to 2 percent.	Moderately rapid permeability; water table at depth of 3 to more than 5 feet; moderately well drained.	Moderate available water capacity; moderately rapid intake rate; water table at depth of 3 to more than 5 feet; slopes of 0 to 2 percent.	Severe: water table at depth of 3 to more than 5 feet.	B
Medium strength; high to low permeability if compacted; medium to high susceptibility to piping; low to medium compressibility.	Rapid permeability; bedrock at depth of ½ to 1½ feet; slopes of 2 to 75 percent.	Rapid permeability; bedrock at depth of ½ to 1½ feet; excessively drained.	Very low available water capacity; rapid intake rate; bedrock at depth of ½ to 1½ feet; slopes of 2 to 75 percent.	Severe: bedrock at depth of ½ to 1½ feet; slopes of 2 to 75 percent.	C

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Road location [1]
Trojan: TrE, TrF	Poor: stony	Poor to unsuited: SM, CL.	Good to poor: A-1, A-2, A-6.	Bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 50 percent; low shrink-swell potential; cobble and stone content is 10 to 50 percent.
Trosi: TsD, TtD, TuF2	Poor: very stony and extremely stony.	Poor to unsuited: SM, CL, SC.	Good to poor: A-1, A-2, A-7.	Slopes of 2 to 50 percent; moderate shrink-swell potential; cobble and stone content is 35 to 75 percent.

[1] Cobble and stone content is given on the basis of percentage by weight.

of granitic uplands has been a major source of sediment that formed much of the alluvium of the low terraces and flood plains of Sierra Valley.

The volcanic rocks consist mostly of andesite, basalt, and other pyroclastic rocks. Included are flows of fractured basalt, rhyolite, massive to platy andesite, bedded mudflow, tuff, and ash. These rocks are often porous, and penetrating water accelerates physical and chemical weathering. The rocks are generally fine grained and have minerals susceptible to relatively rapid chemical decomposition. The soils that formed in material derived from these rocks on stable landscapes, therefore, are deeply weathered. They usually have loamy surfaces and fine-textured B horizons. The soil materials have weathered to clays within the soil profile, and there is evidence of translocation of silicate clays. Soils that are forming in these parent materials are generally dominated by montmorillinitic clays and are relatively fertile. This is partly a result of the mineral composition of the parent materials, which are rich in bases. The Trojan and Sierraville soils represent deeply weathered soils on stable landscapes. They are associated with recent deposits that have not had sufficient time to weather or in which erosion has about equaled the rate of soil formation. Aldax soils are shallow.

Ash is a common constituent of the parent materials, and in a few places it makes up most of the soil material. Portola series formed mainly in ashy materials. The soils are youthful, because the removal of the soil mantle by erosion has about equaled the rate of soil formation.

Sierra and Long Valleys have been filled with sediment from the surrounding mountains. Some of this material was laid down in lake waters and is now exposed as terraces. Terraces, alluvial fans, flood plains, and basins are composed of transported materials from the surrounding watersheds. The composition and the distribution of sediment in the valleys are mainly related to stream action and the rock sources. Tributaries of the Middle Fork of the Feather River and Long Valley Creek have deposited a variety of alluvium. This sediment is mostly from granitic and volcanic rock sources or is a mixture of material from both these sources. Cyclic deposition from these varied sources accounts for many discontinuities in soils forming in waterborne sediment.

The granitic alluvium has considerable quartz sand that is resistant to chemical weathering. The sandy Mottsville soils are an example of soils that are forming in this alluvium. Much of the alluvium of the flood plain of Sierra Valley is mixed material from different sources. Hard, rounded quartz grains dominate the mineral fraction, but finer grained minerals from the volcanic rocks are a source of weatherable minerals which have altered and contributed to a slight deposition of silicate clays. The Calpine series is an example of mixed mineral soils whose appearance seems to be dominated by granitic materials. Soils dominated by parent materials of alluvium from volcanic rocks are finer textured and generally show more evidence of orientation of clays.

Some volcanic ash is in most sediment of the valleys. A few soils, however, are derived principally from ashy materials. The ash not only weathers quickly, but where it is a major constituent of the soil it influences the water regime and increases the cation exchange capacity. Soils of the Delleker series are examples of the relationship of ash content to exchange capacity. These soils are forming mainly in ashy deposits that were laid down in water and finally exposed as terraces. Examination of the very fine sand fraction of the Delleker soils in the laboratory indicates that about two-thirds of this fraction consists of aggregates with a cation exchange capacity of about 30 milliequivalents per 100 grams. A high cation-

properties of the soils—Continued

Soil features affecting—Continued				Soil limitations for septic-tank filter field [1]	Hydrologic soil group
Water retention		Drainage for crops and pasture	Irrigation		
Embankments	Reservoir area				
Medium to low strength; low to medium permeability if compacted; low to high susceptibility to piping; medium to low compressibility.	Moderately slow permeability; bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 50 percent.	Moderately slow permeability; bedrock at depth of 3½ to more than 5 feet; well drained.	Moderate available water capacity; moderately rapid intake rate; bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 50 percent.	Severe: moderately slow permeability; bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 50 percent.	B
Medium to low strength; low to medium permeability if compacted; low to high susceptibility to piping; medium to low compressibility.	Very slow permeability; slopes of 2 to 50 percent.	Very slow permeability; well drained.	Very low available water capacity; moderately rapid intake rate; slopes of 2 to 50 percent.	Severe: very slow permeability; slopes of 2 to 50 percent.	D

[2] Pollution of ground water is a hazard in places.

exchange capacity of the sand fraction is a common characteristic of soils in which ash is a major constituent.

Ash is also a source of soluble silica, the cementing agent in indurated layers, or duripans. The duripans in the Lovejoy, Bieber, Bellavista, and Trosi soils may be in part a result of ash-influenced materials.

Relief

The Area is composed of two valleys: Sierra Valley, the larger of the two in the western part, and Long Valley in the east. Both valleys are encircled by steep uplands and are separated by a mountainous range.

Sierra Valley is a hatchet-shaped basin about 19 miles long and 10 miles wide. It is almost surrounded by a mountainous rim. The Middle Fork of the Feather River and its tributaries originate in the surrounding mountains. These streams have steep gradients until they reach the valley. They become meandering waterways on the valley floor, as stream gradients are reduced to less than 5 feet per mile. They form an interlacing network across the valley flood plain, then coalesce into one stream and flow from the valley through a narrow gorge in the northwestern corner of the Area, about 3 miles east of the town of Portola.

A margin of alluvial fans and lake terraces is around the perimeter of Sierra Valley, and remnants of ashy deposits partly flank the lower slopes of the mountains on the west side. The mountainous uplands are composed of volcanic, granitic, and metamorphic rocks.

The slight depressions in basin areas on the valley floor are poorly drained and consist of fine-textured alluvium. The dominant soils are those of the Ramelli series. Among the network of depressional watercourses, or adjacent to them, are areas of soils on slightly higher mounds. Water tables are deeper in these soils but moisture moves upward by capillarity and concentrates lime and other salts in the upper part of the solum. Balman soils are on these more elevated positions.

On the flood plain of Sierra Valley a water table fluctuates from a depth of about 2 to 3 feet during the moist season to around 6 to 8 feet during the dry season. The waters are a source of carbonates and other minerals, some of which originate from deep thermal waters and are added to a perched water table by hot springs and, more recently, by flowing artesian wells. Beckwourth, Loyalton, and Bellavista soils are the principal soils most affected by waters high in carbonates and sodium.

Long Valley is a narrow, trough-shaped valley 3 to 4 miles in width and about 18 miles long. It is oriented in a northwest-southeast direction. The valley is drained by Long Valley Creek, a small stream that has its source west of Peavine Mountain near Reno, Nevada. The creek drains northwest through Long Valley and dissipates into the dry Honey Lake basin. The stream approximately bisects the valley in an entrenched and somewhat meandering channel. Along its course are narrow flood plains and low terraces. Eastern Long Valley consists of a series of dissected rolling terraces interspersed with small alluvial fans. These terraces are, in part, tilted remnants of an ancient lakebed that occupied the area during Pliocene times. West of the creek is a series of high terraces or benches that break along abrupt escarpments into Long Valley Creek and a series of small alluvial fans. These terraces are cobbly alluvium that was deposited in the area when it was a lake during Pleistocene times. The mountainous uplands surrounding Long Valley are made up of metamorphic, granitic, and volcanic rocks.

The soils are mostly well drained to excessively drained. Some soils on second bottom show evidence of

former wet conditions by their thick A horizon and mottled solum. The entrenchment of Long Valley Creek in recent times lowered the water table and subsequently drained these soils.

Climate

A brief review of the major aspects of climate, as it affects soil formation, follows. The climate of the Area is cool and semiarid to subhumid. Winters are cold, and summers are dry and cool. The precipitation, a large part of which may be snow, varies from 6 inches in the eastern part in Long Valley to about 22 inches in the southern part of Sierra Valley near Sierraville. Precipitation increases from east to west. Because most precipitation occurs when temperatures are cool and the evapotranspiration rate is low, many soils in Sierra Valley are moist throughout during some part of the wet season. Where precipitation is highest, some moisture is lost through percolation. In the drier parts, particularly in Long Valley, the soils are not always regularly moistened below the rooting depth. Where surplus moisture occurs, percolation of water has removed carbonates and other water-soluble constituents from the soil material. Consequently, most well-drained soils in Sierra Valley are free of carbonates and are slightly acid or medium acid in reaction. In the more arid parts of the Area (such as Long Valley), there has been some removal and translocation of water-soluble constituents, but not enough percolation has occurred to have removed all the carbonates. The Dotta soils represent well-drained profiles with moist regimes, and the Saralegui soils are examples of well-drained soils with moderate percolation and leaching. The Dotta soils are free of carbonates and are slightly acid to medium acid. The Saralegui soils become more alkaline with depth and have carbonates in their C horizon.

The total amount of organic matter in a soil is dependent upon the climate. Cool temperatures retard decomposition. Considerable organic matter has accumulated in soils where adequate moisture has been favorable for abundant plant growth. Where it is more arid, vegetation has been less abundant and the organic-matter content of the soils is low.

The cooler temperatures and moderate amounts of moisture combine to retard chemical weathering. Although removal or translocation of carbonates has taken place, the soils are not appreciably leached and hence have a relatively high base status. Weathering intensities are not as great as they would be in a more humid and warmer climate.

The soils are frozen during winter months. Frost action tends to keep the A horizons more friable and soft, particularly in soils with finer textures. Frost action may account for some gravelly and stony horizons overlying less fragmental, fine-textured horizons. The fragments are forced upward by the formation of ice on their lower sides.

Windy periods are common, particularly in the spring. Medium sands and finer particles, especially from sandy and silty soils, are transported by wind from drier, less vegetated sites. The sands are deposited around shrubs, forming a hummocky and winnowed surface. Against the foot slopes of the hills bordering Sierra Valley on the north and northeast, prevailing winds have deposited sand. Most of the sand has been stabilized, but some local movement may still occur on Quincy soils that are forming in windblown sand.

Biological activity

The vegetation of the Area is variable. Wet meadow species are in basins and depressions. A mixture of sagebrush and grass covers valley flood plains, alluvial fans, terraces, and uplands. Conifers or a combination of conifers, sagebrush, and grass are on uplands, fans, and a few terraces where precipitation is more than approximately 18 inches. Sagebrush and grass vegetation, however, is predominant.

The dense growth of grasses and herbaceous plants in meadows supplied abundant amounts of organic matter. Grazing and harvesting of hay during the past century has reduced the natural addition of surface residue, but the organic-matter content of the soils is still high. Cool soil temperatures and inadequate aeration of soils during prolonged wet periods have resulted in slow rates of decomposition of plant residues. Organic-matter content varies in these areas from about 18 percent near the soil surface to about 2 percent at a depth of 18 to 20 inches.

Most of the soils in the sagebrush-grass areas have relatively thick and dark-colored A horizons. Perennial grasses were more abundant before the Area was grazed by cattle and sheep. The composition of the vegetation has changed over a long period of grazing, but a number of perennial grasses persist. The present average total yield of herbage is estimated to range from about 400 pounds per acre on the poorer sites to about 1,400 pounds per acre on the better sites in favorable years. This yearly production of herbage is not great. The decaying root systems of plants, especially the perennial grasses, have produced much of the organic residue. The rooting habits are reflected in the thickness and organic-matter content of the A horizons. The rate of decomposition of the organic matter has been slowed by the cool climate that prevails, and by periods when the soil is dry in the summer. The organic-matter content varies according to the amount of herbage the site produces, which in turn depends on the quality of the soil, the moisture available to the plants, and the plant density. Most soils in the sagebrush-grass areas have more than 1 percent organic matter in their A horizons. Moderately well drained soils and soils that are where precipitation is about 14 to 18 inches have somewhat thicker and darker A horizons. Organic-matter content averages from about 3 to 5 percent in the upper 3 inches to about 1 percent at a depth of 15 to 24 inches.

The uplands, some of the fans, and a few terraces surrounding Sierra Valley have scattered to fairly dense stands of conifers, principally Jeffrey pine. The better stands are where moisture relationships are more favorable. On the drier sites the cover is mostly a sagebrush-grass mixture, other shrubs, and scattered areas of pine. Organic-matter content is about the same as it is under a sagebrush and grass cover.

The shade provided by the better stands of conifers causes the understory to be sparse. Moisture is not optimum for tree growth, and not much water percolates through the soils. The litter on the forest floor is thin and decomposes slowly. Some bases are removed from the soil, but the intensity of leaching is not as great as in more humid climates where complex organic acids combine with percolating waters to remove bases and other minerals from the soils. The soils under the conifers, therefore, have a thin A horizon and a solum that has a fairly high base saturation. Selected chemical data on the Trojan soils, which illustrate wooded soils that formed in material derived from volcanic rocks, show a base saturation of 56 percent to 60 percent in the A horizon, 71 percent in the B2t horizon, and 79 percent in the lower part of the solum.

Time

The age of the soil is related to the length of time the parent materials have been influenced by soil-forming processes. Where the rate of erosion has been slow, the soils have distinct horizons. Where erosion is relatively rapid or where parent materials have been recently deposited, the soils have indistinct horizons. Thus, the oldest soils are on the oldest, relatively undissected surfaces. The youngest soils are in areas where slopes are steep and dissected or on flood plains covered with recent alluvium.

Because most of the landscapes were formed in Pleistocene times following tremendous uplifts of the earth's crust, the soils are not old as measured in geological time. Erosion on the mountainous uplands and aggradation and degradation within the valleys have been such active forces that soils have been slow to evolve.

The older soils of the Area generally are on terrace positions. Slopes are gentle but somewhat dissected in places. These older soils include those of the Bieber, Martineck, Trosi, Reno, and Lovejoy series. The Trosi and Lovejoy soils appear to be the oldest. The Trosi soils are forming in cobbly alluvium deposited in Pleistocene times. Because of their gentle slopes and the cobby nature of the sediment, erosion has progressed at a very slow rate. Trosi soils have developed prominent morphological features, including a clayey B2t horizon and an iron-silica cemented pan. The Lovejoy soils are forming on the older land surfaces in Sierra Valley, on old lake terraces. Evidence of their being older is the buried clayey substratum over fine-textured lake sediment that underlies some of the Calpine soils. This substratum has the morphological features of Lovejoy soils. It has been buried by alluvium, which is not of recent origin because enough time has elapsed for a weakly defined B2 horizon to develop. The upland areas are relatively young. Steep slopes have favored erosion. The thicker, more developed soils are a result of a combination of less steep slopes, more easily weathered parent material, better protective vegetation, or a combination of these factors.

The Bonta, Glenbrook, Haypress, and Toiyabe soils, which are all forming in material weathered from granitic rocks, illustrate these differences. The Glenbrook and Toiyabe soils generally are steeper or are under sparse vegetation. Natural erosion has almost equaled weathering, with the result of shallow soils and little horizonation. The Bonta soils are gently sloping or are in places where conditions are more favorable for better plant cover. They are relatively deeply weathered and have developed finer textured Bt horizons. Haypress soils are gently sloping, but the deposits are more recently exposed, and sufficient time has not elapsed for appreciable chemical weathering. The Haypress soils have a relatively thick, dark-colored A horizon and are more deeply weathered than the Toiyabe and Glenbrook soils.

On the flood plains of Sierra Valley, the effect of time is illustrated by the Beckwourth and Ormsby soils. Both soils formed in sandy alluvium, a considerable part of which originated in material from granitic rock sources. The Beckwourth soils are on a sandy flood plain that is dissected by meandering stream courses. The channels and depressional areas were subsequently filled with more recent sandy alluvium. Ormsby soils are on the more recently deposited sediment. The Beckwourth soils have developed Bt horizons with some oriented silicate clays and have accumulated carbonates in their sola. The Ormsby soils have a prominent A horizon, but the underlying horizons are relatively unweathered.

Morphology of Soils

Because the influences of soil-forming factors vary greatly in the Area, many different kinds of soils have formed. The number of series and series variants totals 42, and each has relatively distinctive soil horizons. Many soils of the Area have several prominent horizons. Some have only one or several weak horizons. In places soils that have prominent horizons are adjacent to soils that have less distinct morphologic features. The processes that have had the greatest influence in forming soil horizons are weatherability and physical composition of parent material, accumulation of organic matter, formation and translocation of silicate clays, gains or losses of carbonates and sodium, and oxidizing or reducing of iron compounds.

The morphologic features of many of the soils are related to the degree of weathering of the parent materials. Where weathering has been slight, the soils have horizons inherited mainly from the material from which they formed. As the degree of weathering increases, horizon differences are less directly related to the parent material and are more directly related to the products of alteration.

All of the soils in the Area have accumulated enough organic matter to darken the surface and form an A horizon. The A horizon varies from thin and pale to thick and dark colored.

Not only does the organic matter affect soil color, but it has a great influence on the structure and consistence of the A horizons of soils in the Area. Most of the soils that have a high content of organic matter have strong granular structure and a soft consistence when dry. Soils low in organic matter are massive or have platy structure and are slightly hard to hard when dry.

Montmorillonite is the dominant mineral of the clay fraction of soils in the Area. Montmorillonite is formed under less advanced stages of weathering, and all the conditions favorable to developing montmorillonite prevail in the Area (*7*).

The Balman soils illustrate the movement of lime in the soil. Lime is carried upward by capillary action and concentrates in the upper horizons, giving the soil a gray or light color. The upward movement of lime inhibits the translocation of silicate clays.

Sodium has played an important role in the morphology of some soils in the Area. The source of sodium may have some relationship to deposition in old lake sediment or, in part, may come from mineralized thermal waters. The Loyalton soils are a good example.

Many of the soil color differences are related to oxidation or reduction of iron compounds. Well-drained soils, such as the Sierraville and Newlands, are high in iron. Their colors are reddish because ample oxygen is available to oxidize the iron. Wetter soils, such as the Ramelli, Pasquetti, and James Canyon, have low chroma, because oxygen is essentially excluded and iron compounds are reduced. Reduction is most intense in the lower horizons. These are continually saturated with water and have bluish-green colors.

Not all soils with water tables have low chromas or intense reduction. Where the water table moves laterally through sandy aquifers or varies in height seasonally, oxygen is not completely excluded. The soil in these areas has mottles, but the matrix lacks the low chromas or intense gleying characteristic of soils that are forming in stagnant water. Beckwourth soils have a fluctuating water table.

Laboratory Analyses

Soils from seven of the principal soil series in the Sierra Valley Area were sampled for laboratory analyses. Each series was sampled at two places, but since the results were similar, data are presented for only one in tables 7 and 8.

Clay mineralogy was determined for only two soils. In Lovejoy loam montmorillonite is moderate to dominant. A trace of vermiculite and a small amount of kaolinite are in this soil. In Loyalton fine sandy loam montmorillonite is abundant. A small amount of vermiculite and a trace of kaolinite are in this soil.

The methods and procedures used to obtain the laboratory analyses reported are as follows: All samples were collected from pits. Fragments larger than one inch were discarded. Samples were crushed and passed through a 2 mm round-hole screen. All data is on soil material passing sieve. Results are reported on an oven-dry soil basis. A blank column indicates that the determination was not made. Dashes indicate that the determination was made but that less than the minimum reportable was detected.

The following procedures are taken from Soil Survey Investigation Report No. 1 (*14*). The procedure or method used is identified by numbers and letter. An example is 3A1 for "Particle size distribution."

Particle size distribution.—Pipette method; dispersion with hexametaphosphate and mechanical shaking. (3A1)

pH.—Glass electrode, using soil-water ratios indicated (8C1a and 8C1b).

Organic carbon.—Wet combustion; modification of Walkley-Black method. (6A1a)

Cation exchange capacity.—Na+ saturation, displacement with NH_4OAc and determination of NA+ displaced. (5A1A)

Extractable cations (exchangeable cations in nonsaline, noncalcareous soils).—Displacement with 1 N NH_4OAc, Ca++ by titration, Mg++ gravimetrically, Na and K by flame photometry. (5B4a)

Extractable H+ (exchange acidity).—Triethanolamine at pH 8.2. (6H2a)

Ions in saturation extract.—Extraction by filtration of saturated (paste).

Sample:

Na+ and K+ by flame photometry. (6P1a, 6Q1a)

Ca^{++} and Mg^{++} by titration with versenate. (6N1a, 601a)

HCO_3—by titration with acid. (6J1a)

Cl—by titration with $AgNO_3$. (6K1a)

Electrical conductivity.—Electrical conductivity, mmhos per cm at 25° C, at saturation extract. (8A1a)

Base saturation.—Percent base saturation =

$$\frac{\text{Sum of extractable bases (Ca, Mg, Na, K, H) meg/100 g soil}}{\text{Sum of extractable bases (Ca, Mg, Na, K, H) meg/100 g soil}} \times 100$$

Exchangeable sodium percentage (ESP).—Exchangeable Na+ (NH_4OAc—extractable Na+ minus NA+ in saturation extract) × 100 divided by cation exchange capacity (NaOAc). (5D1)

Carbonate at $CaCO_3$.—Volume of CO_2 evolved on acidification. (6E1b)

Moisture held at 15 bar.—Pressure membrane apparatus; fragmented samples. (4B2)

Total Nitrogen.—Kjeldahl, modified A.O.A.C. method. (6B1a)

Extractable Iron.—Sodium dithionite in citrate buffer, Fe by orthophenanthropline; reported as percent iron. (6C2b)

Koolinite clay percent.—Differential thermal analyses; from area of characteristic DTA endotherms as compared to standards. (7A3)

Clay mineralogy.—From characteristic X-ray peaks; oriented clay; K+ saturated clay at room temperature and after heating to 250° C and 500° C, and Mg^{++} saturated clay with and without glycolation. (7A2)

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (*13*). Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (*9*).

The current system of classification has six categories. Beginning with broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 9, the soil series of the Sierra Valley Area are placed in four categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. The five soil orders in Sierra Valley Area are Entisols, Inceptisols, Aridisols, Mollisols, and Alfisols.

SUBORDER. Each order is subdivided into suborders that are based mainly on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the order. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation.

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder.

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order.

FAMILY. Soil families are separated within a subgroup mainly on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae (see table 9). An example is the coarse-loamy, mixed, mesic family of Xerollic Haplargids.

SERIES. The series consists of a group of soils that are forming from a particular kind of parent material that has genetic horizons that, except for texture of the surface soils, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, consistence, reaction, and mineral and chemical composition.

Entisols are soils that do not have natural genetic features. They are usually recently formed, so not enough time has elapsed for genetic horizons to form. They may be forming in materials resistant to weathering. Entisols have few morphologic features. Classified in this order are Glenbrook, Ormsby, Quincy, and Toiyabe soils. Glenbrook and Toiyabe soils are shallow over granitic rock, Quincy soils formed in windblown sands, and Ormsby soils formed in coarse-textured alluvium of recent origin. All the landscapes are geologically quite recent. Erosion has been active on the sloping Glenbrook and Toiyabe soils, and soil formation has barely exceeded soil losses. The windblown sands of the Quincy series have not been stabilized completely. Plant residues have never accumulated in sufficient quantities to appreciably darken the A horizon of the Quincy soils. The forces of weathering have not had sufficient time to alter the sands of the Ormsby soils, and there has been no opportunity for a significant accumulation of organic matter in the surface horizon. The Glenbrook, Ormsby, Quincy, and Toiyabe soils have no diagnostic features other than ochric epipedons. All are sandy and classified in the suborder of Psamments. Glenbrook soils are Xeric Torripsamments, and Ormby soils are Aquic Duorthidic Xeropsamments. Quincy soils are Xeric Torripsamments, and Toiyabe soils are Typic Xeropsamments.

Inceptisols have one or more diagnostic horizons that are formed in the early stages of weathering. They are in subhumid to humid climates and do not have significant eluviation or illuviation. They lack prominent morphologic features except that some may have a darkened epipedon. The most common diagnostic features associated with Inceptisols are ochric or umbric epipedons and cambic horizons. Inceptisols differ from Entisols in having some diagnostic horizon other than an ochric epipedon.

The Portola and Portola variant soils are classified as Inceptisols. They contain significant amounts of volcanic ash. They have a pale-colored surface horizon.

TABLE 7.—*Physical*

[Absence of information indicates that a quantity of less than the minimum

Soil name and sample number	Depth from surface	Size class and diameter of particles—				
		Total			Sand	
		Sand (2.0–0.05 mm)	Silt (0.05–0.002 mm)	Clay (<0.002 mm)	Very coarse (2.0–1.0 mm)	Coarse (1.0–0.5 mm)
	In	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*
Balman loam, 0 to 2 percent slopes. (S61 Calif-32-12)	0–2½	31.8	45.8	22.4	[1] 1.1	[1] 3.0
	2½–10	30.9	45.6	23.5	0.5	2.1
	10–17	32.4	40.7	26.9	0.4	2.8
	17–22	41.9	37.4	20.7	2.0	5.0
	22–30	49.0	26.8	24.2	2.8	6.2
	30–42	68.3	17.8	13.9	6.2	10.3
	42–53	76.6	14.7	8.7	6.2	10.6
	53–67	76.4	16.6	7.0	5.9	12.0
	67–71	90.0	5.7	4.3	11.4	31.5
	71–80	15.7	32.9	51.4	0.1	1.5
Beckwourth loamy coarse sand. (S61 Calif-32-15)	0–2½	81.2	11.4	7.4	13.6	27.9
	2½–15	84.5	9.0	6.5	13.5	25.6
	15–23	82.3	10.8	6.9	6.0	20.9
	23–34	77.0	11.6	11.4	6.2	21.9
	34–48	87.4	5.2	7.4	13.9	26.1
	48–58+	94.1	2.2	3.7	10.5	32.2
Calpine coarse sandy loam, 0 to 2 percent slopes. (S61 Calif-32-19)	0–3	79.5	11.5	9.0	9.5	27.5
	3–13	77.8	11.8	10.4	6.1	20.3
	13–21	78.7	10.9	10.4	5.8	21.1
	21–30	76.2	12.3	11.5	4.7	19.5
	30–46	81.2	11.0	7.8	7.0	21.9
	46–59	84.3	9.7	6.0	2.1	9.2
Lovejoy loam, 0 to 5 percent slopes. (S61 Calif-32-21)	0–2½	30.4	46.3	23.3	0.4	1.1
	2½–10	42.1	30.3	27.6	0.1	0.6
	10–16	52.2	30.6	17.2	1.7	4.1
	16–21	32.7	27.2	40.1	0.5	3.1
	21–41	52.0	35.5	12.5	2.5	6.4
	41–53	48.6	28.9	22.5	0.3	3.1
Loyalton fine sandy loam. (S61 Calif-32-11)	0–¼	78.7	18.5	2.8	5.5	16.1
	¼–5	72.2	23.1	4.7	4.5	11.4
	5–8	71.8	23.8	4.4	4.8	13.4
	8–12	58.7	18.9	22.4	5.0	10.2
	12–17	51.6	18.7	29.7	5.3	9.4
	17–23	43.5	20.6	35.9	3.3	7.8
	23–33	53.0	21.4	25.6	7.7	10.8
	33–53	83.0	8.2	8.8	20.5	24.6
	53–63	88.7	6.2	5.1	39.6	24.1
Ormsby loamy coarse sand, 0 to 2 percent slopes. (S61 Calif-32-17)	0–2	88.1	7.2	4.7	8.5	22.0
	2–14	84.4	9.8	5.8	6.3	19.0
	14–22	85.2	7.8	7.0	6.1	13.2
	22–33	85.7	7.8	6.5	5.3	13.4
	33–45	84.8	8.2	7.0	10.2	15.9
	45–58	92.0	4.2	3.8	18.2	21.3

See footnote at end of table.

analyses of selected soils

reportable value was detected. < means less than and > means greater than]

Size class and diameter of particles—Continued							
Sand—Continued			Silt		Int II (0.2–0.02 mm)	(2.0–0.2 mm)	(Gravel > 2 mm)
Medium (0.5–0.25 mm)	Fine (0.25–0.1 mm)	Very fine (0.1–0.05 mm)	(0.05–0.02 mm)	Int III (0.02–0.002 mm)			
Pct	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct of whole soil*
[1] 4.4	14.1	9.2	11.7	34.1	29.6	13.9	0
3.5	14.0	10.8	11.6	34.0	31.6	10.9	0
4.4	14.2	10.6	10.8	29.9	30.4	12.8	0
6.3	17.3	11.3	11.2	26.2	33.1	20.0	2
8.0	20.5	11.5	8.9	17.9	32.8	25.1	3
11.4	27.1	13.3	8.0	9.8	37.1	39.2	7
13.1	32.4	14.3	6.8	7.9	40.3	43.1	8
12.6	32.1	13.8	8.5	8.1	41.1	43.8	12
19.2	24.9	3.0	3.1	2.6	16.6	76.5	20
2.0	8.2	3.9	8.9	24.0	18.4	6.2	0
18.1	17.5	4.1	5.0	6.4	16.6	69.6	6
20.0	20.4	5.0	4.2	4.8	18.2	70.5	7
20.6	27.5	7.3	5.5	5.3	25.9	61.9	8
20.2	22.5	6.2	5.5	6.1	22.1	60.4	7
19.6	23.7	4.1	2.7	2.5	16.6	73.5	14
28.6	21.5	1.3	1.1	1.1	9.2	86.0	9
16.9	21.0	4.6	4.2	18.5	7.3	65.2	4
17.2	27.0	7.2	4.4	25.5	7.4	56.7	4
17.8	27.4	6.6	4.1	24.3	6.8	58.5	4
17.6	27.7	6.7	4.3	24.6	8.0	55.9	4
19.9	26.8	5.6	4.2	21.5	6.8	63.9	8
20.7	44.2	8.1	3.7	29.3	6.0	58.7	1
1.7	10.7	16.5	19.6	26.7	44.2	5.8	0
1.7	18.3	21.4	14.2	16.1	49.6	6.7	0
5.0	21.8	19.6	14.5	16.1	49.0	17.7	0
3.3	13.3	12.5	11.9	15.3	33.7	10.9	0
6.1	17.5	19.5	14.7	20.8	46.2	20.5	0
4.6	20.2	20.4	13.3	15.6	48.6	13.3	0
13.5	28.9	14.7	11.8	6.7	43.6	46.9	2
12.7	28.1	15.5	10.1	13.0	42.1	40.2	2
12.7	27.4	13.5	11.3	12.5	40.7	42.4	2
10.8	21.7	11.0	8.0	10.9	31.2	35.5	4
9.3	18.6	9.0	8.1	10.6	27.7	32.0	3
8.6	16.1	7.7	8.1	12.5	24.6	27.0	5
10.7	16.1	7.7	8.6	12.8	24.4	37.2	3
19.7	15.9	2.3	3.4	4.8	11.3	75.1	39
9.5	13.4	2.1	3.3	3.9	10.0	81.0	38
16.1	32.4	9.1	3.8	3.4	30.0	61.9	8
15.5	33.3	10.3	6.0	3.8	35.4	55.0	9
16.2	37.7	12.0	3.9	3.9	37.0	52.1	7
15.6	39.4	12.0	5.6	3.2	39.0	51.3	7
14.5	31.5	12.7	4.8	3.4	36.1	53.5	12
18.0	28.5	6.0	2.4	1.8	22.5	71.9	21

TABLE 7.—*Physical analyses*

Soil name and sample number	Depth from surface	Size class and diameter of particles—				
		Total			Sand	
		Sand (2.0–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	Very coarse (2.0–1.0 mm.)	Coarse (1.0–0.5 mm.)
Ramelli clay. (S61 Calif-32-14)	0–2	10.1	42.2	47.7	[2] 0.7	[2] 1.7
	2–7	15.2	37.3	47.5	0.9	2.5
	7–14	14.0	36.2	49.8	0.5	2.4
	14–18	27.0	26.7	46.3	1.2	5.8
	18–26	61.6	17.4	21.0	1.6	15.6
	26–28	76.7	11.9	11.4	3.3	28.5
	28–34	81.3	9.9	8.8	2.0	24.6
	34–45	71.7	16.9	11.4	5.1	13.9
	45–64	87.0	7.1	5.9	8.2	22.1
	64–77	94.0	2.8	3.2	23.2	41.0
	77–83	5.9	36.2	57.9	0.1	0.3

[1] Includes some organic matter.

They are underlain by horizons that are slightly redder than or contain a little more clay than the underlying substratum or have weak or moderate soil structure. Both soils have a cambic horizon, but little else differentiates them from Entisols. These soils are classified as Typic Vitran depths.

Aridisols are soils that have an environment such that no water is available for mesophytic plants for prolonged periods. They generally are found in arid areas, but they include soils that have shallow ground water and are salty and soils that are in moister areas marginal to arid regions. They all have ochric epipedons. They may have argillic horizons when accompanied by ochric epipedons that have distinct structure or are soft when dry. Other diagnostic features include a natric, cambic, gypsic, or salic horizon, or duripan. Balman, Bellavista, Lovejoy, Loyalton, Reba, Reno, Saralegui, and Trosi soils are classified as Aridisols.

Balman, Bellavista, and Loyalton soils have been influenced by shallow ground water. The Balman soils are characteristic of hydromorphic conditions where lime and salts accumulate above the wetting fringe by capillary action. They are more than 3 percent organic carbon in the upper 10 inches. Calcium carbonate has accumulated in the upper 30 inches, and exchangeable-sodium content is 14 percent near the surface, as compared to less than 1 percent below a depth of 17 inches. Balman soils are classified as Aquic Calciorthids.

The Bellavista soils formed where calcium carbonate carried by fluctuating ground waters concentrated at one or more levels in the regolith to form lime-silica duripans. Bellavista soils are moderately well drained. They are classified as Xerollic Durorthids.

Loyalton soils have a pale, soft, sandy loam A horizon that is underlain abruptly by a prominent, columnar, sandy clay loam B horizon enriched with sodium. The columnar B horizon is typical of natric horizons. The Loyalton soils are classified as Aquic Natrargids.

Lovejoy, Reba, Reno, Saralegui, and Trosi soils are not influenced by ground waters. These soils have accumulated more organic matter than typical Aridisols, but they do not contain enough to darken their epipedons sufficiently to qualify as a mollic epipedon. Dry values are mostly 6 in the epipedon. All of the soils have an argillic horizon, and some have a duripan underlying the argillic horizon. Saralegui soils have a weakly expressed argillic horizon, and the others have prominent argillic horizons. Lovejoy, Reba, and Reno soils have an abrupt, columnar, clayey Bt horizon. Lovejoy, Reno, and Trosi soils have a duripan. The Saralegui soils are Xerollic Haplargids, Reba soils are Xerollic Paleargids, Trosi soils are Xerollic Durargids, and Lovejoy and Reno soils are Abruptic Xerollic Durargids.

Mollisols are the dark-colored, base-rich soils of humid to semiarid regions. They formed mainly under grass vegetation. Their principal feature is a mineral soil, the surface of which is darkened by accumulation of organic matter. The epipedon is more than one percent organic matter to a specified depth and has structure or is soft to slightly hard when dry. Base saturation exceeds 50 percent.

Mollisols are the most extensive order in the Area. Soil and climatic conditions have been favorable for the accumulation of organic matter, even though part of the Area is marginally arid. Some of the Mollisols are forming under hydromorphic conditions subject to spring overflow and shallow ground water. All of them except the Badenaugh, poorly drained variant, lack an argillic horizon. James Canyon, Ramelli, and Pasquetti soils formed as flood-plain meadowland. They are poorly drained or very poorly drained; have a thick, dark A horizon; and are intensely mottled or gleyed in lower parts of the solum. These soils are

of selected soils—Continued

Size class and diameter of particles—Continued							
Sand—Continued			Silt		Int II (0.2–0.02 mm.)	(2.0–0.2 mm.)	(Gravel > 2 mm.)
Medium (0.5–0.25 mm.)	Fine (0.25–0.1 mm.)	Very fine (0.1–0.05 mm.)	(0.05–0.02 mm.)	Int III (0.02–0.002 mm.)			
[2] 1.6	3.4	2.7	6.5	35.7	11.1	5.5	2
3.4	5.6	2.8	6.7	30.6	12.5	9.4	0
2.9	4.8	3.4	7.5	28.7	13.4	8.1	0
6.0	10.1	3.9	7.6	19.1	16.8	17.8	0
17.2	21.8	5.4	6.6	10.8	21.6	46.6	0
18.6	20.8	5.5	4.9	7.0	20.0	61.6	0
21.7	26.9	6.1	4.3	5.6	22.5	63.1	0
13.4	28.2	11.1	8.1	8.8	34.7	45.1	3
17.5	31.9	7.3	3.7	3.4	27.9	62.8	11
18.3	10.6	0.9	1.3	1.5	5.9	89.4	24
0.3	1.6	3.6	9.2	27.0	13.9	1.2	0

[2] Mostly organic matter.

classified as Aquolls. The James Canyon soils have a very thick, dark surface layer. The Pasquetti soils formed in ashy deposits. The Ramelli soils are classified as Typic Hapalquolls, James Canyon soils are Cumulic Hapalquolls, and Pasquetti soils are Andaqueptic Hapalquolls. The Badenaugh variant soils are classified as Typic Argiaquolls.

In table 7 the mechanical composition for the Ramelli soils indicates deposition of clay and silt over a sandy substratum. Organic-carbon content is about 10 percent at the surface and decreases to about one percent at a depth of 14 to 18 inches—a depth coinciding with the rooting zone of most meadow species that grow on these soils. Base saturation exceeds 80 percent in all parts. The clay fraction is dominantly montmorillinite. The angular blocky structure of the A horizon is caused by shrinking and swelling of the clays.

Many of the soils formed when drainage was good or somewhat poor. They formed under conditions of long, dry periods during the summer when soil moisture is depleted but nevertheless have developed mollic epipedons. These soils are generally slightly acid or medium acid in the A horizon, and reaction remains about constant as depth increases. These soils are all classified in the suborder of Xerolls. Some Xerolls have few diagnostic features except a mollic epipedon. In these soils no significant weathering or illuviation has influenced the morphology at subsurface horizons.

The only diagnostic features are a mollic epipedon, with or without a cambic horizon. These soils are classified as Haploxerolls. Included in this great group are the Aldax, Calpine, Glean, Haypress, and Mottsville soils. The Aldax soils are shallow over bedrock and are Lithic Haploxerolls. Calpine soils are Aridic Haploxerolls, and Calpine, variant, soils are Aquic Haploxerolls. Glean soils have thicker mollic epipedons and are Pachic Haploxerolls. Haypress soils are Entic Haploxerolls. Mottsville soils are forming in sandy material and are less moist than is typical. They are classified as Torripsamentic Haploxerolls.

Soils classified in the Argixeroll great group are those of the Badenaugh, Beckwourth, Bidwell, Coolbrith, Correco, Dotta, Galeppi, Millich, Sattley, Smithneck, and Trojan series.

Several of the Argixerolls are influenced by a fluctuating ground-water table, but they are not so wet as the Aquolls. Ground water has deposited calcium carbonate and some sodium in the upper part of the solum or has inhibited the complete removal of bases. Beckwourth and Bidwell soils are so influenced.

Beckwourth soils formed in sandy alluvium, and Bidwell soils formed in loamy alluvium. Bidwell soils are classified as Aridic Calcic Argixerolls. Beckworth soils are classified as Aquic Argixerolls. In these soils there is about 4 to 6 percent more clay in the B2t horizon than there is in the A horizon. This forms a weakly expressed argillic horizon. Calcium carbonate has accumulated in the argillic horizon of Beckwourth soils along with exchangeable sodium. Exchangeable-sodium content exceeds 15 percent. These soils do not have columnar structure. The evidence of oriented clays suggests the genesis of an argillic rather than a natric horizon.

Badenaugh soils are Aridic Argixerolls. Coolbrith and Dotta soils have had a more moist condition than Badenaugh and have formed a thicker A horizon. They are Pachic Argixerolls. Correco, and Galeppi soils are Aridic Argixerolls. Millich soils are shallow over volcanic bedrock and are classified as Lithic Argixerolls. Sattley and Trojan soils formed under open stands of conifers and grass-shrub vegetation where the precipitation rate is somewhat higher than it is in areas of soils classified as Xerolls. Base saturation is less than 70 percent. The Sattley and Trojan soils are Ultic Argixerolls.

Some Xerolls have duripans in addition to argillic horizons and are classified in the great group of Durixerolls.

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TABLE 8.—*Physical and chemical*

[A blank column indicates that a determination was not made; dashes in column

Soil name and sample number	Depth from surface	Moisture held at tension of 15 bars	Moisture at saturation	Reaction		Extractable bases (meg per 100 gms of soil)				Extractable acidity	Cation exchange capacity NaOAc	Exchangeable sodium
				Saturation paste	In 1:10 soil/water suspension	Ca	Mg	Na	K			
	In	*Pct*	*Pct*	*pH*	*pH*					*Mega per 100 gms*	*Mega per 100 gms*	*Megs per 100 gms*
Balman loam, 0 to 2 percent slopes. (S61 Calif-32-12)	0–2½	23.1	79.5	8.7	9.4	23.8	8.5	10.0	4.8	—	38.5	0.0
	2½–10	23.2	71.4	8.9	9.7	19.0	11.8	17.1	2.5	—	38.6	14.3
	10–17	22.2	65.9	8.3	9.0	24.6	14.6	6.7	1.3	—	36.9	4.9
	17–22	18.2	56.5	8.3	8.7	28.7	8.2	0.8	0.4	—	29.6	0.7
	22–30	16.7	50.9	8.1	8.7	28.1	6.4	0.5	0.3	—	25.4	0.5
	30–42	10.0	31.7	8.1	8.8	21.5	4.6	0.3	0.2	—	19.7	0.3
	42–53	7.8	29.0	8.0	8.8	17.8	4.2	0.3	0.2	—	17.4	0.3
	53–67	7.6	25.7	7.9	8.7	16.4	4.1	0.3	0.1	0.1	17.0	0.3
	67–71	5.4	25.0	7.8	8.1	8.0	3.1	0.3	0.2	0.4	12.3	0.3
	71–80	26.3	70.0	7.3	8.1	27.0	13.6	0.6	0.6	1.6	42.9	0.5
Beckwourth loamy coarse sand. (S61 Calif-32-15)	0–2½	10.1	46.6	5.3	5.7	9.2	2.1	0.1	0.9	7.5	18.9	0.1
	2½–15	4.1	22.8	6.2	6.5	4.2	1.4	0.1	0.2	1.8	8.6	0.1
	15–23	4.1	19.3	6.8	7.0	4.0	2.0	0.3	0.1	1.2	8.2	0.3
	23–34	6.7	23.2	8.2	9.1	8.2	4.9	2.3	0.1	0.3	13.0	2.1
	34–48	4.6	22.7	8.4	8.7	5.0	2.8	1.4	0.1	0.4	10.2	1.3
	48–58+	2.8	22.1	8.3	8.2	3.4	1.8	0.6	0.1	0.2	5.9	0.5
Calpine coarse sandy loam, 0 to 2 percent slopes. (S61 Calif-32-19)	0–3	6.4		5.8	6.2	6.7	1.2	0.1	0.5	6.2	14.2	
	3–13	5.8		6.0	6.3	6.8	1.2	0.2	0.4	5.1	14.2	
	13–21	5.2		6.1	6.4	6.1	1.3	0.1	0.6	3.6	12.2	
	21–30	5.8		6.3	6.6	6.1	1.5	0.2	0.5	3.6	12.8	
	30–46	5.3		6.5	6.6	6.0	1.7	0.1	0.2	2.0	10.7	
	46–59	5.3		6.6	6.6	6.1	1.9	0.1	0.1	1.7	10.7	
Lovejoy loam, 0 to 5 percent slopes. (S61 Calif-32-21)	0–2½	10.4	34.5	5.8	6.5	10.8	4.6	0.3	0.3	5.1	22.8	0.3
	2½–10	11.2	34.4	5.7	6.7	12.6	5.2	0.6	0.1	4.5	25.0	0.5
	10–16	9.1	24.9	6.1	6.9	8.6	3.8	0.7	0.1	3.0	18.5	0.6
	16–21	18.4	46.2	5.8	7.0	18.1	8.6	1.8	0.2	4.5	33.5	1.6
	21–41	17.3	45.5	7.5	8.6	27.9	10.0	2.4	0.1	0.7	37.5	2.2
	41–53	17.4	42.4	7.1	7.9	19.5	7.5	1.4	0.3	1.5	30.6	1.3
Loyalton fine sandy loam. (S61 Calif-32-11)	0–¼	5.0	31.0	7.1	7.3	4.9	2.4	1.0	1.5	1.1	11.2	0.7
	¼–5	4.7	24.0	8.0	8.3	5.2	2.6	1.9	1.5	0.6	12.4	1.7
	5–8	4.8	25.5	8.6	8.7	4.4	2.6	3.8	0.8	0.4	13.5	3.5
	8–12	20.3	53.4	9.4	10.1	10.1	2.2	30.9	0.4	—	32.4	27.3
	12–17	23.1	81.7	9.8	10.2	10.5	2.4	33.3	0.3	—	32.9	27.0
	17–23	24.4	108.4	9.9	10.3	13.1	3.6	38.3	0.3	—	35.3	31.2
	23–33	20.9	65.4	9.5	10.2	12.8	4.4	29.0	0.2	—	31.0	26.0
	33–53	8.9	28.1	8.9	9.6	4.0	3.5	11.2	0.1	0.6	20.0	10.5
	53–63	7.1	27.1	8.5	9.0	4.6	4.3	8.4	0.1	0.8	18.4	7.8
Ormsby loamy coarse sand, 0 to 2 percent slopes. (S61 Calif-32-17)	0–2	3.8	25.6	5.7	6.3	3.7	1.9	0.1	0.7	2.9	8.8	0.1
	2–14	4.2	22.4	6.2	6.6	4.9	1.6	0.2	0.6	2.4	10.4	0.2
	14–22	4.2	21.9	6.7	6.7	4.6	1.9	0.1	0.6	1.7	10.0	0.1
	22–33	3.9	21.8	7.2	7.4	4.0	4.7	0.2	0.4	0.8	8.6	0.2
	33–45	4.3	20.9	8.2	8.8	8.4	4.7	0.2	0.3	—	9.1	0.2
	45–58	2.7	19.4	8.5	9.0	5.2	3.2	0.6	0.1	—	6.1	0.5
Ramelli clay. (S61 Calif-32-14)	0–2	33.0	—	6.3	6.8	31.0	11.8	0.7	1.8	9.8	54.8	0.7
	2–7	28.0	98.2	6.4	7.1	27.4	11.9	0.9	0.5	7.6	49.4	
	7–14	27.7	—	6.2	7.2	24.4	10.9	0.8	0.3	5.0	44.4	
	14–18	23.0	—	6.7	7.5	24.0	11.2	0.6	0.3	2.4	40.8	
	18–26	11.8	—	7.3	8.0	16.4	12.1	0.6	0.3	0.8	23.0	
	26–28	8.0	—	7.6	8.4	13.8	6.2	0.5	0.2	0.4	18.7	
	28–34	6.8	—	7.7	8.4	11.7	3.4	0.5	0.1	0.7	14.7	
	34–45	8.5	—	7.5	8.2	13.2	4.4	0.5	0.2	0.5	17.4	
	45–64	5.0	—	7.4	7.0	5.9	3.0	0.3	0.2	1.0	10.7	
	64–77	3.2		7.4	6.7	3.6	1.8	0.2	0.1	0.6	7.8	
	77–83	28.0		6.5	7.3	24.5	15.4	0.6	0.4	3.0	45.1	

analyses of selected soils

indicate that a quantity of less than the minimum reportable value was detected]

Ions in saturation extract (meg per liter)							Electrical conductivity (millimhos per cm)	Organic carbon	Nitrogen	C/N	Carbonate as CaCO3	Extractable iron as Fe	Exchangeable Na	Base saturation
Ca	Mg	Na	K	CO_3	HCO_3	Cl								
								Pct	Pct			Pct	Pct	Pct
1.5	1.5	17.7	0.8	1.3	15.6	0.6	1.59	5.78	0.390	15	13			
2.4	1.7	40.0	0.4	0.8	19.4	7.1	3.23	3.65	0.338	11	17			
3.9	7.4	26.4	0.2	—	7.2	10.8	3.09	2.70	0.248	11	22			
3.4	2.3	2.1	—	—	5.5	0.8	0.63	1.90	0.177	11	29			
2.4	1.7	1.3	—	—	4.1	0.3	0.41	1.07	0.100	11	24			
1.8	1.3	1.1	—	—	3.2	0.2	0.35	0.19			9			
1.5	0.9	0.9	0.1	—	2.7	0.2	0.29	0.05			1			
1.1	1.0	1.0	0.1	—	2.4	0.2	0.30	0.04			1			
1.2	0.8	0.9	—	—	2.1	0.3	0.25	0.02			—			
1.1	0.6	0.9	0.1	—	1.6	0.3	0.23	0.04			—			
10.7	5.7	0.5	2.8	—	2.8	0.5	2.08	4.60	0.305	15	—	0.4	<1	62
1.9	1.1	0.7	0.3	—	1.4	0.3	0.38	0.56	0.050	11	—	0.3	1	90
1.0	0.5	2.5	—	—	2.2	0.4	0.40	0.18			—	0.5	4	84
0.9	0.7	9.9	—	1.3	6.7	1.0	1.03	0.12				0.5	16	98
0.6	0.4	7.4	—	0.5	5.2	1.0	0.80	0.09				0.3	13	96
0.7	0.8	5.1	—	0.2	2.9	2.0	0.68	0.05				0.3	8	97
								2.30	0.144	16		0.8		58
								0.98	0.076	13		0.9		63
								0.63	0.048	13		0.9		59
								0.41	0.033	12		1.0		69
								0.15				0.8		80
								0.08				0.6		83
0.7	0.6	1.0	0.1	—	1.2	0.3	0.22	1.20	0.097	12.4	—	0.6		76
0.4	0.4	1.3	—	—	1.2	0.2	0.13	0.57	0.049	11.6	—	0.6		80
0.4	0.3	1.9	—	—	0.9	0.5	0.26	0.16			—	0.7		81
0.9	0.9	3.2	—	—	0.9	1.5	0.37	0.13			—	0.7		86
1.6	1.2	5.3	—	0.3	2.8	3.7	0.85	0.04			1	0.4		98
0.3	0.5	1.9	—	—	1.2	0.6	0.27	0.03			—	0.4		95
3.4	3.5	9.5	1.5	0.4	9.7	5.1	1.52	1.23	0.073	16.8	—		6	
0.5	0.4	7.6	0.3	0.4	5.8	2.4	0.88	0.66	0.056	11.8	—		14	
0.6	0.4	12.3	0.1	0.7	6.1	6.4	1.44	0.38	0.034	11.2	—		26	
0.8	0.6	66.5	0.1	4.6	14.8	30.9	5.54	0.37	0.035	10.6	1		84	
0.6	0.6	77.3	0.1	14.6	19.8	21.8	5.21	0.31			6		82	
0.8	0.5	68.5	0.1	16.3	18.1	17.0	6.25	0.19			9		88	
0.7	0.6	47.0	0.1	6.1	12.7	15.8	4.63	0.17			18		84	
0.7	0.4	26.4	—	1.6	6.1	9.8	2.70	0.02					52	
1.1	0.9	22.1	0.1	1.1	3.7	11.0	2.50	0.02					42	
4.4	3.2	0.3	1.9	—	1.7	0.1	1.16	1.02	0.081	13	—			69
1.0	0.6	0.4	0.4	—	0.8	0.1	0.26	0.57	0.049	12	—			75
1.0	0.6	0.7	0.3	—	1.0	—	0.24	0.43	0.036	12	—			81
1.0	1.1	0.6	0.2	—	1.2	—	0.16	0.16			—			92
0.9	2.2	1.5	0.1	0.2	3.1	0.1	0.10	0.09			t			100
0.6	1.1	4.6	—	0.5	3.1	0.5	0.60	0.05			t			100
3.0	2.3	1.9	—	—	5.5	0.5	0.61	10.40	0.800	13	—	0.4		82
								5.56	0.514	11	—	0.4		84
								2.25	0.208	11	—	0.4		88
								1.02	0.095	9	—	0.4		94
								0.23			t	0.6		97
								0.16			t	0.6		98
								0.10			t	0.7		96
								0.07			t	0.8		97
								0.03			—	0.7		90
								0.02			—	0.4		90
								0.02			—	1.0		93

TABLE 9.—*Classification of soil series according to the current system of classification*

Series	Family	Subgroup	Order
Aldax	Loamy-skeletal, mixed, frigid	Lithic Haploxerolls	Mollisols.
Badenaugh	Loamy-skeletal, mixed, mesic	Aridic Argixerolls	Mollisols.
Badenaugh variant	Clayey-skeletal, mixed, mesic	Typic Argiaquolls	Mollisols.
Balman	Fine-loamy, mixed, mesic	Aquic Calciorthids	Aridisols.
Beckwourth	Coarse-loamy, mixed, mesic	Aquic Argixerolls	Mollisols.
Bellavista	Fine-loamy, mixed, mesic	Xerollic Durorthids	Aridisols.
Bidwell	Fine-loamy, mixed, mesic	Aridic Calcic Argixerolls	Mollisols.
Bieber	Clayey, montmorillonitic, mesic, shallow	Aridic Durixerolls	Mollisols.
Bonta	Coarse-loamy, mixed, frigid	Typic Haploxeralfs	Alfisols.
Calpine	Coarse-loamy, mixed, mesic	Aridic Haploxerolls	Mollisols.
Calpine variant	Coarse-loamy over clayey, mixed, mesic	Aquic Haploxerolls	Mollisols.
Coolbrith	Fine-loamy, mixed, mesic	Pachic Argixerolls	Mollisols.
Correco	Fine, montmorillonitic, mesic	Aridic Argixerolls	Mollisols.
Delleker	Fine-loamy, mixed, frigid	Typic Haploxeralfs	Alfisols.
Dotta	Fine-loamy, mixed, mesic	Pachic Argixerolls	Mollisols.
Galeppi	Fine-loamy, mixed, mesic	Aridic Argixerolls	Mollisols.
Glean	Loamy-skeletal, mixed, frigid	Pachic Haploxerolls	Mollisols.
Glenbrook	Mixed, mesic, shallow	Xeric Torripsamments	Entisols.
Haypress	Sandy, mixed, frigid	Entic Haploxerolls	Mollisols.
James Canyon	Fine-loamy, mixed, mesic	Cumulic Haploquolls	Mollisols.
Lovejoy	Fine, montmorillonitic, mesic	Abruptic Xerollic Durargids	Aridisols.
Loyalton	Fine-loamy, mixed, mesic	Aquic Natrargids	Aridisols.
Martineck	Clayey-skeletal, montmorillonitic, mesic, shallow	Aridic Durixerolls	Mollisols.
Millich	Clayey, montmorillonitic, frigid	Lithic Argixerolls	Mollisols.
Mottsville	Sandy, mixed, mesic	Torripsammentic Haploxerolls	Mollisols.
Newlands [1]	Fine-loamy, mixed	Argic Cryoborolls	Mollisols.
Ormsby	Mixed, mesic	Aquic Durorthidic Xeropsamments	Entisols.
Ormsby variant	Coarse-loamy, mixed, mesic	Aquic Haplic Durixeralfs	Alfisols.
Pasquetti	Fine-loamy, mixed, mesic	Andaqueptic Haplaquolls	Mollisols.
Portola	Medial, frigid	Typic Vitrandepts	Inceptisols.
Portola variant	Ashy, mesic	Typic Vitrandepts	Inceptisols.
Quincy	Mixed, mesic	Xeric Torripsamments	Entisols.
Ramelli	Clayey over loamy, montmorillonitic, noncalcareous	Typic Haplaquolls	Mollisols.
Reba	Fine, montmorillonitic, mesic	Xerollic Paleargids	Aridisols.
Reno	Fine, montmorillonitic, mesic	Abruptic Xerollic Durargids	Aridisols.
Saralegui	Coarse-loamy, mixed, mesic	Xerollic Haplargids	Aridisols.
Sattley	Loamy-skeletal, mixed, frigid	Ultic Argixerolls	Mollisols.
Sierraville	Fine, montmorillonitic, frigid	Ultic Haploxeralfs	Alfisols.
Smithneck	Coarse-loamy, mixed, mesic	Pachic Argixerolls	Mollisols.
Toiyabe	Mixed, frigid, shallow	Typic Xeropsamments	Entisols.
Trojan	Fine-loamy, mixed, frigid	Ultic Argixerolls	Mollisols.
Trosi	Clayey-skeletal, montmorillonitic, mesic, shallow	Xerollic Durargids	Aridisols.

[1] These soils are taxadjuncts to the Newlands series in that they are several degrees warmer than is typical for the series.

The Bieber and Martineck soils have thin argillic horizons underlain by lime-silica pans at shallow depths. They are classified as Aridic Durixerolls.

Mollisols that have cold summer temperatures are classified as Cryoborolls. Usually they lack an argillic horizon, but some have an argillic horizon and are classified as Argic Cryoborolls. The Newlands soils are classified within this subgroup. The soils in Sierra Valley named for the Newland series are a taxadjunct because they are a few degrees warmer than characteristic for the series.

Alfisols lack a mollic epipedon. They have an argillic horizon with medium or high base status. Some horizons of the soil dry out, but the soil rarely becomes seasonally dry to a depth of 60 inches or throughout the solum for very long. The Alfisols are similar in some respects to the Argids of the Aridisols but differ by being influenced by more moisture. They are also similar to the Argixerolls of the Mollisols, but lack a mollic epipedon.

Bonta, Delleker, Ormsby variant, and Sierraville soils are in this great group. The Alfisols that are dry for extended periods during the summer but have moisture moving through them in the winter are classified in the great group of Xeralfs.

The Bonta, Delleker, and Sierraville soils are forming under an open conifer cover. The pale-colored A horizon grades into a medium acid B2t horizon that has a base saturation of more than 50 percent. The Bonta soils are forming in material weathered from granitic rock, and Delleker soils are forming in material from volcanic tuff. Both have a weakly expressed argillic horizon with a base saturation of more than 75 percent. They are classified as Typic Haploxeralfs. Ormsby variant soils have a loamy argillic horizon overlying a iron-silica cemented duripan, and are influenced by high water tables. They are classified as Aquic Haplic Durixeralfs. The Sierraville soils are forming in material weathered from volcanic rock. They have a base saturation of less than 75 percent and are classified as Ultic Haploxeralfs.

General Nature of the Area

This section provides information about physiography, relief, and drainage; climate; history; land and ownership; development and population; community facilities and transportation industries; and recreation.

Physiography, Relief, and Drainage

The Sierra Valley Area lies mostly in the Sierra Nevada Province (*4*). It is bordered by the Sierra Nevada mountain range on the east, and by the most southerly extension of the Cascade Range on the north. Sierra Valley, the most prominent feature, occupies about 110,000 acres and is an example of a down-faulted basin, which, in ancient times, was a lake comparable in size to Lake Tahoe. Sediment that presently fills the basin ranges up to 2,000 feet in thickness (*2*).

The mountains surrounding the lake basin are fairly rugged. They range in elevation from 6,000 to 8,000 feet. The rock mantle is principally of volcanic origin, consisting of flows, tableland, and conspicuous plugs and buttes that overlie granitic rock. The granitic rock crops out on the western and northern boundaries of the Area. Long Valley, a narrow, trough-shaped valley, lies in the Basin and Range Province and borders the Area on the east.

Long Valley is narrow and long, and it is rolling and mostly sloping. Its eastern and western boundaries are delineated by steep mountains. The lowest part of the valley trough has a narrow flood plain and is traversed by a meandering stream known as Long Valley Creek. This stream sometimes becomes dry during the summer months.

The drainage of the survey area is well developed. About ¾ of the surface, including Sierra Valley, drains westward to the Pacific. Several live streams flow into the valley and combine and exit through a narrow defile in the mountains near the town of Portola in the northwest corner. This main stream is the Middle Fork of the Feather River. The major streams flowing into the valley basin include Last Chance, Smithneck, Cold Stream, Bonta, Hamlin, Turner, and Grizzly Creeks. Some water is exported from the Truckee River drainage to the south, by ditch, and brought into Sierra Valley near the village of Sierraville. Long Valley and the uplands drained by Long Valley Creek drain northward into the trapped basin of Honey Lake.

Climate [9]

The climate of the Area is typical of the high plateau region of northeastern California and northwestern Nevada. Climatic conditions are influenced to a great extent by landward movement of warm moisture-laden air from the central and northern Pacific Ocean, which is cooled in its ascent of the western slope of the Sierra Nevada mountains. Abrupt changes in topography (in elevation as well as configuration) cause sudden changes in seasonal precipitation as well as temperature. One of the greatest contrasts in precipitation within a short distance in the United States occurs between the western or California slopes of the Sierras and the contiguous valleys of the survey area and the adjoining western part of the State of Nevada. Seasonal precipitation is more than 70 inches less than 15 miles southwest of the survey area near the Sierran crest. In the Sierra Valley basin, annual precipitation is around 15 to 20 inches and in Long Valley seasonal totals drop off to 8 to 12 inches. In years when precipitation is at a maximum in winter, much of the moisture falls in the form of snow, which usually remains on the surrounding mountains until well into the spring and early in summer (fig. 29).

The high elevation and the flat-basin characteristic of Sierra Valley result in a continental temperature regime with extremes ranging from maxima about 100° F to minima of 20° to 30° F below zero or lower. Temperatures, however, remain within equable limits seasons. Heating requirements are high, and the growing season is short.

Humidity is low during the summer but high throughout the winter period, with intermediate values in the spring and fall. Winds are generally light and variable, though windspeeds can become strong at times, especially during winter storms or in connection with local thunderstorms in summer. Sunshine is abundant in summer and is fairly abundant during spring, fall, and winter.

Estimates for temperature are based on records taken at Sierraville Ranger Station from 1931 to 1960. They are partly supplemented by soil temperature measurements and local observations. The average annual temperature of the survey area ranges from 42° to 50° F. In January the minimum temperature aver-

***Figure 29.*—Snow is the form in which most precipitation falls in the Sierra Valley Area.**

[9] By C. ROBERT ELFORD, climatologist for California, National Weather Service, U.S. Department of Commerce.

ages around 12° to 15° F, and extremely low readings are 25° to 30° F below zero. Maximum temperatures in January, however, average in the lower 40's.

Midsummer readings are generally warm. The average maximum in July is in the middle 80's, and record highs exceed 100° F. Minimum readings in July average about 40° F.

The seasonal total heating degree day figure (computed from a base of 65° F) is around 7,000, a figure approximating that found at Flint, Michigan.

The average seasonal precipitation is less than 20 inches in most of the Sierra Valley basin. Totals vary considerably from year to year. One year in 20 receives more than 20 inches, and, to the other extreme, one year in twenty receives less than 10 inches. The Long Valley trough in the eastern part of the survey area has an average seasonal precipitation of less than 12 inches.

In the Sierra Valley Area the total seasonal snowfall averages less than 50 inches. The maximum snow depth on the ground builds up to 50 inches or a little more in one year out of fifty.

Temperature and precipitation data taken at Sierraville are presented in table 10, and probabilities of last freezing temperatures in spring and first in fall are given in table 11.

TABLE 10.—*Temperature and precipitation data*

[Data from Sierraville. Period of record, 1931–60]

Month	Temperature				Precipitation				
	Average daily—		2 years in 10 will have at least 4 days with—		Average total	1 year in 10 will have—		Days with snow cover	Average depth of snow on days that have snow cover
	Maximum	Minimum	Maximum equal to or higher than—	Minimum equal to or lower than—		Less than—	More than—		
	°F	°F	°F	°F	*Inches*	*Inches*	*Inches*		*Inches*
January	42	15	59	−5	4.9	1.3	12.0	16	6
February	46	18	61	−1	4.2	.4	9.3	15	7
March	52	23	65	9	2.8	.4	5.6	12	6
April	61	29	74	18	1.6	.6	5.0	3	3
May	68	34	80	28	1.3	.1	3.3	(1)	2
June	76	39	90	31	.5	0	1.4	0	0
July	86	42	95	34	.2	0	1.2	0	0
August	85	39	94	31	.2	0	1.8	0	0
September	81	35	90	26	.4	0	1.8	0	0
October	69	29	82	20	1.8	0	5.8	(1)	2
November	55	22	68	13	2.8	0	10.5	1	3
December	46	17	59	4	4.5	.5	17.0	9	5
Year	64	28	[2] 97	[3] −10	25.4	16.7	37.2	56	4

[1] Less than one-half day.
[2] Average annual highest temperature.
[3] Average annual lowest temperature.

TABLE 11.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data from Sierraville. Period of record, 1931–60]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	Apr. 23	May 12	June 4	June 17	June 30
2 years in 10 later than	Apr. 13	May 3	May 25	June 11	June 25
5 years in 10 later than	Mar. 24	Apr. 15	May 7	May 30	June 17
Fall:					
1 year in 10 eralier than	Oct. 7	Sept. 29	Sept. 15	Aug. 15	July 1
2 years in 10 earlier than	Oct. 15	Oct. 5	Sept. 20	Aug. 23	July 11
5 years in 10 earlier than	Oct. 30	Oct. 19	Sept. 30	Sept. 9	Aug. 1

History

Members of the Washoe tribe of Indians were the first inhabitants in Sierra Valley. These were probably descendants of the "Pah Utes" of the Ute Nation (later known as the "Paiutes"). The Ute Indians were nomadic and roamed westward from Utah and Colorado. Indian hunting artifacts can be found near the basin area of the valley today. The first verified report of white settlers in the Area dates back to about 1850. James P. Beckwourth, an old "mountain man" and trapper, is said to have visited the valley in 1850 (*5*).

Other reports of searchers for the "Gold Lake" had seen the valley in June of 1850. A. P. Chapman and two others built a cabin and staked land claims in the valley in 1852. Beckwourth is said to have built the first house in the spring of 1852 and later a trading post and a hotel. The Area was largely settled by gold seekers pushing eastward up the major rivers and streams of the western slope of the Sierras. Some of the emigrants, exhausted after a long hard trek over the barren desert waste of the territories of Nevada and Utah, were so taken by the verdant meadowland and wooded hillsides that they stayed and built homes in the valley. An important wagon road over the Sierras was established through Sierra Valley by James Beckwourth. Beckwourth Pass, on the eastern perimeter of Sierra Valley, is said to be the lowest pass over the Sierra Nevada range. Wagon travel on the route was heavy. The early settlers prospered by trading with the emigrants and supplying feed, animals, and food to the gold miners. Many of the early settlers were of Italian-Swiss extraction.

In 1870 the State of California and the ranchers in the valley became embroiled in disputes over land titles (*6*). The State claimed large tracts of Sierra Valley as swamp and overflow land, stating that much of the Area was so wet that it was unsuited for farming. The settlers, holding land by preemptory claim, were called upon to prove with deposition and affidavit that the land had been used and was capable of producing crops. In the documented statements it was pointed out that wheat, oats, and barley could be raised, and the average yield of oats and barley was 67 bushels per acre. Also noted was that 100 acres of meadow produced 75 tons of hay, that a mowing machine had been used, and that soil had to be irrigated to get a good stand of hay. In addition to this, it was noted that 1½ tons of clover and timothy hay per acre had been harvested, and the average depth of water in wells was 12 to 16 feet. The settlers found that by applying irrigation water the hay yields could be increased 3 to 4 times. Most of the preemptors claimed that it was more profitable to raise hay than grain because of the frost hazard and the irrigation that was necessary. Dairy farming and butter and cheese manufacturing became important sources of income. Such vegetables as onions, cabbage, turnips, lettuce, beans, and peas were raised, except where they were killed by frost. The State's claim was declared invalid. Many of these statements are true of the Area today.

The first passenger train of the Western Pacific Railroad came through the northern part of Sierra Valley in about 1910. Around the turn of the century, in 1901, it is stated that five sawmills were in operation, one of which produced 35,000 board feet of lumber a day. An extensive network of railroad track was laid to harvest the forests north of Sierra Valley. One railroad connected Verdi in Nevada with the town of Loyalton and partly encircled the Sierra Valley to connect with Mohawk Valley on the west.

Land and Ownership

There are about 150 ranches in the Area. The average-sized ranching unit is about 1,400 acres. About 10 percent of the ranches are operated under lease. Many of the leases are for grazing rights only and are made on a year-to-year basis. The trend in land ownership is toward consolidation. Smaller ranches are being bought and combined into existing large cooperation-operated units. Some properties are being bought by business or professional people who generally lease them to others. These properties are held as speculative investments.

The United States Forest Service administers 8,320 acres of land within the boundaries of the survey area. These lands are part of the Plumas, Tahoe, and Toiyabe National Forests. About 13,000 acres, mostly in Long Valley, is administered by the United States Bureau of Land Management. Most of this land is brush-covered, sloping range.

Development and Population

The Sierra Valley Area is situated in parts of three counties. It is mainly in Plumas and Sierra Counties, but partly in Lassen County. The valley was settled in the gold-rush period, beginning about 1850. The valley was once known as Beckwourth Valley, named after its discoverer, James P. Beckwourth. Beckwourth Pass, in the northeastern corner of the valley and at an elevation of 5,221 feet, provided an easier access across the Sierras and is presently traversed by the Western Pacific Railroad and State Highway No. 49. Loyalton is the largest town in the Area and has a population of about 1,000. It grew largely from farming and lumbering interests that began about 1863. The name reflected the population's strong Union sentiment.

Portola, a town with a population of about 2,200, is about three miles outside the northwest corner of the Area and is a division terminus of the Western Pacific Railroad. Portola and Loyalton are the only incorporated cities. Some of the smaller villages in Sierra Valley include Vinton; Chilcoot, in the northeast; Beckwourth, in the northwest; Sattley and Calpine, in the west; and Sierraville, in the southwest. The population density of the Area is estimated to be about three people per square mile.

Facilities and Transportation

In most places in the Area, electricity, telephones, heating fuels, and television and radio reception are available and stores are nearby. Major shopping facili-

ties are in Reno, Nevada. The Area has a good school system centered around facilities in Loyalton. Elementary schools are in Sierraville and Loyalton, and a junior-senior high school is in Loyalton. Schoolbuses transport students within a radius of 22 miles. A modern hospital is in Loyalton. Churches of many denominations and several social and business groups are in the Area.

The main line of the Western Pacific Railroad crosses the northern part of the survey area. A spur line runs to Loyalton, and the main line turns north in Long Valley; but a trunk line connects Reno to the Southern Pacific Railroad in the south. Most transportation is by automobile and truck. All communities are connected by highways, most of which have two lanes and are macadamized. Year-round accessibility to ranches is possible on county and secondary roads. Several logging and dirt roads are in the mountainous country. The Greyhound Bus and Reno-Loyalton-Calpine Stage operates on a daily schedule. Both carry passengers and freight. A county airport is near the village of Beckwourth, and secondary flight strips are in Loyalton and Sierraville.

Industry

Four sawmills that have a combined output of 62 million board feet per year constitute the main industry in the Area. A planing mill and a box-shook factory are located in Loyalton. Expansion plans of the major mills includes the production of wood chips and wood-fiber products. Manufacturing articles of wood such as toy stock is also being considered at the present time. A railroad spur line, a paved State highway, an ample supply of water, and other facilities make the town of Loyalton a favored site for industry. The lumber industry employs about 300 workers at present. Timber is harvested principally from federally administered national forests. Logging is on a "sustained yield basis," and in the future it is expected that lumber production will be maintained near the present levels.

Mining in the Area is at a low ebb at present. A small amount of granite is quarried for stone, and some sand and gravel deposits are worked, mainly for roadbuilding material. A few mines are sporadically worked in the eastern part of the Area.

Recreation

Recreational activity in the high mountain and high desert country in and surrounding the survey area is becoming an important part of the general economy. Campgrounds and picnic areas are in several areas. Development of several large reservoirs as part of the State Water Plan has produced excellent fishing and camping sites for the local and general public. More than ten organized clubs or groups are in the Area, and they have leases on land for hunting and other recreational purposes. About 700 sportsmen use these facilities. This type of land use is becoming more popular and is expected to increase. Hunting-privilege leases are being considered for land on the valley floor.

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Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Amendment. Any material, such as lime, gypsum, sawdust, or synthetic conditioner, that is worked into the soil to make it more productive. A fertilizer is also an amendment, but the term "amendment" is used most commonly for material other than fertilizer that is added to soil.

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

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use

by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other nonconsolidated material or that is exposed at the surface.

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

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

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

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.

Coarse fragments. Mineral or rock particles more than 2 millimeters in diameter.

Coarse-textured soil. Sand and loamy sand.

Cobblestone. A rounded or partly rounded fragment of rock, 3 to 10 inches in diameter.

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

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

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

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

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

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

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

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

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

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

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Eluviation. The movement of material from one place to another within the soil, in either true solution or colloidal suspension. Soil horizons that have lost material through eluviation are said to be eluvial; those that have received material are illuvial.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine-textured soils. *Moderately fine textured:* Clay loam, sandy clay loam, silty clay loam. *Fine-textured:* Sandy clay, silty clay, and clay. Roughly, soil that has a clay content of 35 percent or more.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artifically.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.

Ground water (geology). Water that fills all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Heavy soil. An old term formerly used for clayey, or fine-textured, soils.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

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 some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

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

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

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Lacustrine deposit (geology). Material deposited in lake water and exposed by lowering of the water level or elevation of the land.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Light soil. An old term formerly used for sandy, or coarse-textured, soils.

Lime concretion. An aggregate cemented by the precipitation of calcium carbonate ($CaCO_3$).

Metamorphic rocks. Rocks of any origin that have been completely changed physically by heat, pressure, and movement. Such rocks are nearly always crystalline.

Microrelief. Minor surface configurations of the land.

Mineral soil. Soil composed mainly of inorganic (mineral) material and low in content of organic material. Its bulk density is greater than that of organic soil.

Montmorillonite. A fine, platy, alumino-silicate clay mineral that expands and contracts with the absorption and loss of water. It has a high cation-exchange capacity and is plastic and sticky when moist.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 milimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Porosity, soil. The degree to which the soil mass is permeated with pores or cavities.

Profile, soil. A vertical section of the soil through all its horizons and extending 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 precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Only the upper part of this, modified by organisms and other soil-building forces, is regarded by soil scientists as soil. Most American engineers speak of the whole regolith, even to great depths, as "soil."

Residual material. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material in which a soil has formed.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. 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 groundwater runoff or seepage flow from ground water.

Sedimentary rock. A rock composed of particles deposited from suspension in water. The chief sedimentary rocks are conglomerate, from gravel; sandstone, from sand; shale, from clay; and limestone, from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sands have been consolidated into sandstone.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

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

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

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

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Tuff. Deposited volcanic ash, normally more or less stratified and consolidated.

Variant, soil. A soil that has properties sufficiently different from other known soils to justify a new series name, but making up such a limited geographic area that establishing a new series is not justified.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. When referring to a capability unit, a range site, or a woodland suitability group, read the introduction to its section for general management information. Absence of a rating in the range site column or the woodland suitability group column means that the soil is not used for range or woodland. Other information is given in tables as follows:

Acreage and extent, table 1, page 9.
Estimated yields, table 2, page 66.
Wildlife, table 3, page 76.
Engineering uses of the soils, tables 4, 5, and 6, pages 80 through 103.

Map symbol	Mapping unit	Page	Capability unit		Range site	Woodland suitability group	Wildlife suitability group	Storie index rating
			Symbol	Page				
AcG	Acidic rock land	8	VIIIs-1	63	----	-----	8	< 5
AkG	Aldax-Rock outcrop complex, 15 to 75 percent slopes	10	VIIs-1	62	----	-----	8	-----
	Aldax part	----	------	----	3	-----	-----	5
	Rock outcrop part	----	------	----	----	-----	-----	< 5
AmE	Aldax-Millich complex, 5 to 30 percent slopes	11	VIIs-1	62	3	-----	8	-----
	Aldax part	----	------	----	----	-----	-----	12
	Millich part	----	------	----	----	-----	-----	16
AmG	Aldax-Millich complex, 30 to 75 percent slopes	11	VIIs-1	62	3	-----	8	-----
	Aldax part	----	------	----	----	-----	-----	< 5
	Millich part	----	------	----	----	-----	-----	5
BaE	Badenaugh very cobbly sandy loam, 2 to 30 percent slopes	12	VIIs-1	62	1	-----	5	32
BbB	Badenaugh extremely cobbly clay loam, poorly drained variant, 2 to 5 percent slopes	13	VIw-1	62	8	-----	1	17
BcA	Balman loam, 0 to 2 percent slopes	14	IIIs-6	59	----	-----	3	65
BcB	Balman loam, 2 to 5 percent slopes	14	IIIs-6	59	----	-----	3	73
BdA	Balman-Ramelli complex, 0 to 2 percent slopes	14	IIIw-5	59	----	-----	-----	-----
	Balman part	----	------	----	----	-----	3	65
	Ramelli part	----	------	----	----	-----	1	32
BeG	Basic rock land	14	VIIIs-1	63	----	-----	8	< 5
Bf	Beckwourth loamy coarse sand	15	IVw-4	61	----	-----	4	57
Bh	Beckwourth loamy coarse sand, clayey substratum	15	IVw-4	61	----	-----	4	54
Bk	Beckwourth sandy loam	15	IIIw-2	58	----	-----	4	73
BmA	Beckwourth-Loyalton complex, saline-alkali, 0 to 2 percent slopes	16	IVs-6	61	----	-----	-----	-----
	Beckwourth part	----	------	----	----	-----	4	57
	Loyalton part	----	------	----	----	-----	3	18
Bn	Beckwourth-Ormsby loamy coarse sands	16	IVw-4	61	----	-----	4	-----
	Beckwourth part	----	------	----	----	-----	-----	57
	Ormsby part	----	------	----	----	-----	-----	39
BoA	Bellavista loam, 0 to 2 percent slopes	17	IVs-6	61	----	-----	3	30
BoB	Bellavista loam, 2 to 5 percent slopes	17	IVs-6	61	----	-----	3	28
BrA	Bidwell sandy loam, 0 to 2 percent slopes	17	IIIc-1	59	----	-----	4	73
BrB	Bidwell sandy loam, 2 to 5 percent slopes	18	IIIe-1	58	----	-----	4	69
BsA	Bidwell sandy loam, sandy substratum, 0 to 2 percent slopes	18	IIIs-0	59	----	-----	4	58
BtA	Bidwell loam, 0 to 2 percent slopes	18	IIIc-1	59	----	-----	4	77
BuB	Bieber gravelly sandy loam, 0 to 5 percent slopes	19	VIs-1	62	4	-----	6	15
BwA	Bieber sandy loam, moderately deep, 0 to 2 percent slopes	19	IVe-3	60	4	-----	6	28
CaA	Calpine coarse sandy loam, 0 to 2 percent slopes	21	IIIs-4	59	----	-----	4	60
CaB	Calpine coarse sandy loam, 2 to 5 percent slopes	21	IIIe-1	58	----	-----	4	57

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Range site	Woodland suitability group	Wildlife suitability group	Storie index rating
			Symbol	Page				
CaC	Calpine coarse sandy loam, 5 to 9 percent slopes	21	IVe-1	60	----	-----	4	54
CgB2	Calpine-Lovejoy complex, 0 to 5 percent slopes, eroded	21	IVe-3	60	----	-----	-----	-----
	Calpine part	----	------	----	----	-----	4	57
	Lovejoy part	----	------	----	----	-----	6	38
CmA	Calpine coarse sandy loam, clayey variant, 0 to 2 percent slopes	22	IVe-3	60	----	-----	4	48
CnA	Coolbrith silt loam, 0 to 2 percent slopes	23	IIIc-1	59	----	-----	4	68
CnB	Coolbrith silt loam, 2 to 5 percent slopes	23	IIIe-1	58	----	-----	4	68
CoB	Correco sandy loam, 2 to 5 percent slopes	24	IIIe-3	58	----	-----	4	46
CoD	Correco sandy loam, 5 to 15 percent slopes	24	IVe-3	60	----	-----	4	39
CpE	Correco very cobbly sandy loam, 2 to 30 percent slopes	24	VIs-1	62	1	-----	5	21
DdD2	Delleker sandy loam, 2 to 15 percent slopes, eroded	25	IVe-1	60	----	1	9	52
DeE	Delleker cobbly sandy loam, 2 to 30 percent slopes	25	VIe-1	61	----	1	9	35
DfA	Dotta sandy loam, 0 to 2 percent slopes	27	IIIc-1	59	----	-----	4	65
DfC	Dotta sandy loam, 2 to 9 percent slopes	27	IIIe-1	58	----	-----	4	59
DgE	Dotta gravelly sandy loam, 9 to 30 percent slopes	27	VIe-1	61	1	-----	4	40
DhE	Dotta cobbly sandy loam, 2 to 30 percent slopes	27	VIe-1	61	1	-----	5	39
DmC	Dotta-Lovejoy complex, 0 to 9 percent slopes	27	IVe-3	60	----	-----	-----	-----
	Dotta part	----	------	----	1	-----	4	59
	Lovejoy part	----	------	----	5	-----	6	38
GaB	Galeppi loamy coarse sand, 2 to 5 percent slopes	28	IVe-1	60	----	-----	3	48
GaE	Galeppi loamy coarse sand, 5 to 30 percent slopes	28	VIe-1	61	2	-----	7	40
GdE	Galeppi cobbly loamy coarse sand, 5 to 30 percent slopes	28	VIe-1	61	2	-----	7	32
GpF	Glean extremely stony sandy loam, 9 to 50 percent slopes	29	VIIs-1	62	1	-----	5	20
GrF	Glenbrook-Rock outcrop complex, 5 to 50 percent slopes	30	VIIs-1	62	----	-----	-----	-----
	Glenbrook part	----	------	----	3	-----	5	9
	Rock outcrop part	----	------	----	----	-----	8	< 5
HtE	Haypress-Toiyabe loamy coarse sands, 2 to 30 percent slopes	31	VIIs-1	62	----	-----	9	-----
	Haypress part	----	------	----	----	1	-----	32
	Toiyabe part	----	------	----	----	2	-----	12
HtG	Haypress-Toiyabe loamy coarse sands, 30 to 75 percent slopes	31	VIIs-1	62	----	-----	9	-----
	Haypress part	----	------	----	----	1	-----	12
	Toiyabe part	----	------	----	----	2	-----	< 5
JbB	James Canyon gravelly loam, 2 to 5 percent slopes	32	IIIw-2	58	----	-----	2	46
JcA	James Canyon silt loam, 0 to 2 percent slopes	32	IIIw-2	58	----	-----	2	63
LaB	Lovejoy loam, 0 to 5 percent slopes	33	IVe-3	60	5	-----	6	38
Lo	Loyalton fine sandy loam	35	IVs-6	61	----	-----	3	18
Lp	Loyalton silt loam	35	IVs-6	61	----	-----	3	20
MaE	Martineck very stony sandy loam, 2 to 30 percent slopes	36	VIIs-1	62	6	-----	6	10
MdB	Mixed alluvial land	37	VIw-1	62	8	-----	1	15-25
MrC	Mottsville loamy sand, 2 to 9 percent slopes	38	IVe-4	60	----	-----	5	40

Map symbol	Mapping unit	Page	Capability unit		Range site	Woodland suitability group	Wildlife suitability group	Storie index rating
			Symbol	Page				
NaE	Newlands-Rock outcrop complex, 2 to 30 percent slopes	39	VIs-1	62	----	-----	-----	-----
	Newlands part	----	------	----	1	-----	5	38
	Rock outcrop part	----	------	----	----	-----	8	< 5
OrA	Ormsby loamy coarse sand, 0 to 2 percent slopes	39	IVw-4	61	----	-----	4	39
OrB	Ormsby loamy coarse sand, 2 to 5 percent slopes	40	IVw-4	61	----	-----	4	45
OtA	Ormsby coarse sandy loam, poorly drained, 0 to 2 percent slopes	40	IVw-4	61	----	-----	4	37
OtB	Ormsby coarse sandy loam, poorly drained, 2 to 5 percent slopes	40	IVw-4	61	----	-----	4	35
OuA	Ormsby loamy sand, hardpan variant, 0 to 2 percent slopes	41	VIw-1	62	8	-----	3	8
Pa	Pasquetti mucky silty clay	42	VIw-1	62	8	-----	1	34
Pd	Pasquetti mucky silty clay, thick surface	42	VIw-1	62	8	-----	1	21
PrE	Portola cobbly coarse sandy loam, 9 to 30 percent slopes	43	VIe-1	61	----	1	9	39
PrF	Portola cobbly coarse sandy loam, 30 to 50 percent slopes	43	VIIe-1	62	----	1	9	19
Ps	Portola loam, moderately well drained variant	44	VIe-1	61	1	-----	3	69
QuD	Quincy sand, 2 to 15 percent slopes	45	VIIe-1	62	7	-----	5	31
Ra	Ramelli clay	47	IIIw-5	59	----	-----	2	32
Rb	Ramelli clay, very poorly drained	47	VIw-1	62	8	-----	1	21
Rc	Ramelli clay, very poorly drained, channeled	47	VIw-1	62	8	-----	1	16
ReE	Reba sandy loam, 2 to 30 percent slopes	49	VIe-1	61	5	-----	7	32
RtD	Reno sandy loam, 2 to 15 percent slopes	49	VIs-1	62	4	-----	7	13
Rw	Riverwash	50	VIIIw-1	63	----	-----	Variable	< 5
RyF	Rough broken land	50	VIIIs-1	63	----	-----	7	< 5
SaD	Saralegui sandy loam, 2 to 15 percent slopes	50	IVe-1	60	2	-----	7	62
StF	Sattley extremely stony sandy loam, 2 to 50 percent slopes	51	VIIs-1	62	----	2	9	18
SvE	Sierraville stony sandy loam, 2 to 30 percent slopes	52	VIe-1	61	----	1	9	35
Sw	Smithneck sandy loam	53	IIIc-1	59	----	-----	4	54
TbE	Toiyabe-Bonta loamy coarse sands, 2 to 30 percent slopes	54	VIIe-1	62	----	-----	9	-----
	Toiyabe part	----	------	----	----	2	-----	12
	Bonta part	----	------	----	----	1	-----	34
TbG	Toiyabe-Bonta loamy coarse sands, 30 to 75 percent slopes	54	VIIe-1	62	----	-----	9	-----
	Toiyabe part	----	------	----	----	2	-----	< 5
	Bonta part	----	------	----	----	1	-----	11
TrE	Trojan stony sandy loam, 2 to 30 percent slopes	55	VIe-1	61	----	1	9	40
TrF	Trojan stony sandy loam, 30 to 50 percent slopes	55	VIIe-1	62	----	1	9	13
TsD	Trosi very stony sandy loam, 2 to 15 percent slopes	56	VIs-1	62	4	-----	6	11
TtD	Trosi extremely stony sandy loam, 2 to 15 percent slopes	56	VIIs-1	62	6	-----	6	6
TuF2	Trosi-Saralegui complex, 15 to 50 percent slopes, eroded	56	VIIs-1	62	----	-----	-----	-----
	Trosi part	----	------	----	6	-----	6	6
	Saralegui part	----	------	----	2	-----	7	27

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