SOIL SURVEY

Tahoe Basin Area California and Nevada

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

Issued March 1974

Major fieldwork for this soil survey was done in the period 1967-70. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1970. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, the University of California Agricultural Experiment Station, and the Nevada Agricultural Experiment Station. It is part of the technical assistance furnished to public agencies in the Tahoe Basin Area that are active in soil and water conservation programs.

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

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing woodland; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for industry, recreation, and general land use planning.

Locating Soils

All the soils of the Tahoe Basin Area are shown on the 11 sheets of the detailed soil map. 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 by map symbol and gives the capability classification of each. It also shows the page where each soil is described.

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. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. 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.

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

Community planners and others concerned with soil resources development can read about soil properties that affect the choice of homesites, industrial sites, schools, and parks in the section "Soil Resource Interpretations."

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

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

Newcomers in the Tahoe Basin 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 at the beginning of the publication.

Cover: Cascade Lake in the Tahoe Basin.

CONTENTS

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SOIL SURVEY OF THE TAHOE BASIN AREA, CALIFORNIA AND NEVADA

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THE TAHOE BASIN AREA is in California and Nevada, between the Carson and the Sierra Nevada Mountain Ranges. It consists of parts of Alpine, El Dorado, and Placer Counties in California, and Douglas and Washoe Counties and Carson City in Nevada (fig. 1). The total land area in the Basin is about 207,430

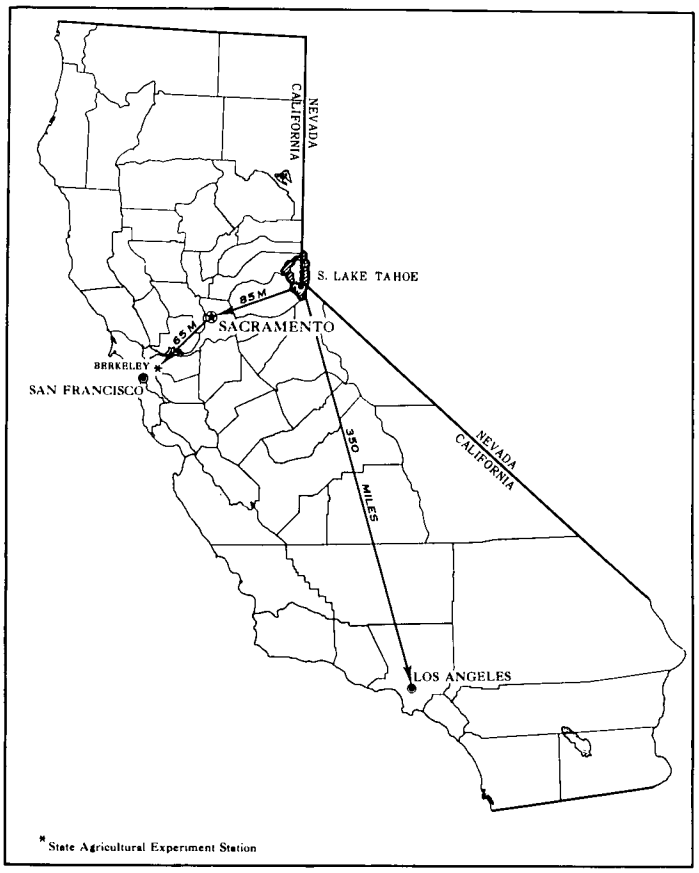


Figure 1.--Location of the Tahoe Basin Area in California and Nevada.

acres, of which approximately 110,000 acres is privately owned and 97,400 acres publicly owned. The public lands include parts of the Eldorado, Tahoe, and Toiyabe National Forests.

Lake Tahoe is one of the clearest and most beautiful lakes in the world (9) 1/. It has a surface area of 193 square miles and a 71-mile shoreline. The maximum depth is 1,645 feet, and the average depth is 989 feet. The lake has a volume of 122 million acre-feet of water. The water is of such clarity that light can penetrate to a depth of more than 400 feet.

Lake Tahoe was discovered in 1844 by John Fremont and Charles Preuss. Because the rise of the Carson Range from the floor of Carson Valley was so abrupt, most of the westward-moving emigrants skirted the Basin. Between 1844 and 1859, few people ventured to Lake Tahoe. The discovery of the Comstock Lode in Virginia City, Nevada, in 1859, resulted in a major movement of traffic eastward along the south Basin corridor. By the early 1860's, many toll roads and stations had been constructed. Along with the small settlements that grew around the prominent toll stations was the beginning of agricultural activity.

Lumbering first became important to the Basin in 1873 and remained active until 1890. Most of the lumber was taken to the Comstock Lode and used for fuel or for shoring the mines. The lumber companies stripped the timber, first from the east-central slopes and then from the south Basin. As much as 72 million board feet of lumber was cut during the period of 1 year. Most of the prime accessible timber in the Basin was logged. Logging activities came to an end with the end of the Comstock Lode, and the Basin was allowed to revegetate.

Lumbering operations and the associated railroads, flumes, sawmills, and steamers constituted a tourist attraction. Lake Tahoe has been a tourist attraction ever since. After the Comstock period, the basic pattern in the Basin was a mixture of commercial resorts and farms. Farm produce supplied food for the resorts and estates.

Weekend and summer cottages were in demand in the mid-1950's. Gambling casinos increased in number and started a year-round operation. Thus, the number of year-round residences increased. Most of the

1/ Underscored numbers in parentheses refer to Literature Cited, p. 80.

private land is now oriented to suburban development. Almost all agricultural activity has ceased, except for lumbering and limited grazing.

Man's activity in the Tahoe Basin is threatening the clarity of Lake Tahoe. Sediment from accelerated erosion on disturbed land in subdivisions and also nutrients are being deposited into the Lake. This survey will help in making the sound land-use decisions needed to protect the unique qualities of Lake Tahoe.

HOW THIS SURVEY WAS MADE

Soil scientists made this survey to learn what kinds of soil are in the Tahoe Basin 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 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, the major horizons of all the soils of one series 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. Elmira and Jabu, 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 soil 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, Jabu coarse sandy loam, 0 to 9 percent slopes, is one of two phases within the Jabu 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 timber lots, buildings, roads, streams, lakes, and other details that help in drawing boundaries accurately. The soil map for the Tahoe Basin Area was prepared from the aerial photographs.

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

Some mapping units are made up of soils of different series, or of different phases within one series. Only one such kind of mapping unit is shown on the soil map of the Tahoe Basin Area: a soil complex.

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

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

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled.

Soil scientists observe how soils behave when used as a growing medium for 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 permeability, a water table, or some other soil quality. They see that streets, road pavements, and foundations for houses crack on a given kind of soil, and they relate this failure to shrink-swell potential. Thus, they use observation and knowledge of soil properties, together with available research data, to predict the limitations or suitability of a soil 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 study 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 Tahoe Basin 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 detailed soil interpretations because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The three major groups and 10 soil associations in the Tahoe Basin Area are described in the following paragraphs.

Nearly Level to Gently Sloping Soils Along Streams, on Fans, and in Meadows

The soils in this group are somewhat poorly drained and poorly drained. They formed in material derived from different kinds of rock. The texture of the surface layer is gravelly loamy coarse sand, loamy coarse sand, sandy loam, or silt loam. Slopes are 0 to 5 percent.

These soils occur throughout the Tahoe Basin Area. Elevations are mostly 6,200 to 6,500 feet. The annual precipitation is 20 to 35 inches, and the frost-free growing season is 50 to 80 days. Only one soil association is in this group. It makes up 5 percent of the survey area.

1. Loamy Alluvial Land-Elmira, Wet Variant-Celio Association

Nearly level to gently sloping, somewhat poorly drained to poorly drained gravelly loamy coarse sands and loamy coarse sands to silt loams

The soils of this association are subject to occasional flooding and ponding. They are along streams, on outwash fans, and in meadows, throughout the survey area. They have slopes of 0 to 5 percent. Elevations are mostly 6,200 to 6,500 feet; the few scattered meadows are at higher elevations. The annual precipitation is 20 to 35 inches, the annual air temperature is 42° to 43° F., and the frost-free growing season is 50 to 80 days. The vegetation is lodgepole pine, meadow grasses, perennial grasses, forbs, and brush.

This association makes up about 5 percent of the Tahoe Basin Area. It is about 50 percent Loamy alluvial land; 20 percent Elmira wet variant; 20 percent Celio soils; and 10 percent Beaches and Marsh.

Loamy alluvial land is somewhat poorly drained and poorly drained. Its surface layer is dark grayish brown to dark brown and ranges from sandy loam to silt loam. Below this is mottled, stratified sandy loam to silty clay loam. The substratum is gravel, lake sediments, or loose alluvium.

Elmira soils, wet variant, are poorly drained. Their surface layer is brown loamy coarse sand. Below this is pale-brown, slightly hard loamy coarse sand over light-gray clay loam and variegated, stratified material.

Celio soils are poorly drained. Their surface layer is brown gravelly loamy coarse sand. It is underlain by strong-brown, soft gravelly loamy coarse sand and dusky red, loose very gravelly coarse sand. Below a depth of 40 to 60 inches is a hardpan strongly cemented with silica.

The depth to the water table is 12 to 24 inches in Loamy alluvial land and Elmira soils, wet variant, and 12 to 60 inches in Celio soils.

The soils of this association are used for recreation, range, homesites, and related uses.

Nearly Level to Steep Soils on Moraines, Glacial Outwash Terraces, and Fans

The soils in this group are somewhat excessively drained to moderately well drained. They formed in alluvium derived from granitic and metamorphic rock. The texture of the surface layer is loamy coarse sand, gravelly loamy coarse sand, and coarse sandy loam and in places is stony to extremely stony. Slopes are 0 to 60 percent.

These soils are around Lake Tahoe, at elevations of 6,200 to 8,600 feet. The annual precipitation is 20 to 45 inches, and the frost-free growing season is 30 to 80 days.

Three soil associations are in this group. They make up about 24 percent of the Tahoe Basin Area.

2. Elmira-Gefo Association

Nearly level to moderately steep, somewhat excessively drained gravelly loamy coarse sands

The soils of this association formed in granitic material on glacial outwash fans and moraines. They have slopes of 0 to 30 percent. Elevations are 6,200 to 6,500 feet. The annual precipitation is 20 to 35 inches, the annual air temperature is 40° to 43° F., and the frost-free growing season is 50 to 80 days. The vegetation is sagebrush, bitterbrush, conifers, and perennial grasses.

This association borders South Lake Tahoe and extends from Tahoe Valley to the State line. It makes up about 4 percent of the survey area. It is about 65 percent Elmira soils, 25 percent Gefo soils, and 10 percent Jabu soils.

The surface layer of Elmira soils is grayish-brown and brown gravelly loamy coarse sand. It is underlain by pale-brown, light yellowish-brown, and light-gray, soft to hard gravelly loamy coarse sand, gravelly coarse sand, and very gravelly coarse sand.

The surface layer of Gefo soils is brown gravelly loamy coarse sand. It is underlain by light yellowish-brown, very pale brown, and light-gray, soft gravelly coarse sand. In some areas these soils are stony.

The soils of this association are used for homesites, timber, and limited grazing.

3. Inville-Jabu Association

Nearly level to moderately steep, well drained and moderately well drained coarse sandy loams that are deep to very deep over a pan

The soils of this association formed in mixed, dominantly granitic, material on alluvial fans and glacial outwash terraces. They have slopes of 0 to 30 percent. Elevations are 6,200 to 7,000 feet. The annual precipitation is 20 to 35 inches, the annual air temperature is 41° to 42° F., and the frost-free growing season is 50 to 80 days. The vegetation is mostly coniferous woodland and an understory of shrubs.

This association is at the south end of Lake Tahoe, along Pioneer Trail Road, and extends from Meyers eastward to the State line. It is also at the north end of the lake near Tahoe City, Kings Beach, and Incline Village. Jabu soils are dominant at the south end of the Lake, and Inville soils are dominant near Incline Village.

This association occupies about 3 percent of the Tahoe Basin Area. It is about 40 percent Inville soils, 35 percent Jabu soils, and 25 percent Jabu shallow variant and Jabu moderately fine subsoil variant.

Inville soils are well drained. Their surface layer is brown stony and gravelly coarse sandy loam. The subsoil is brown and reddish-brown, soft to hard cobbly and gravelly sandy loam. The substratum is brown, soft cobbly and very gravelly loamy coarse sand. In places, there is a hardpan weakly cemented with silica at a depth of 40 inches or more.

Jabu soils are well drained and moderately well drained. Their surface layer is brown coarse sandy loam. The subsoil is brown and strong-brown, slightly hard and hard coarse sandy loam and gravelly coarse sandy loam. It is underlain by a variegated fragipan at a depth of 40 to 80 inches.

The soils in this association are used chiefly for homesites. Small areas are used for timber and limited grazing.

4. Meeks-Tallac Association

Nearly level to steep, moderately well drained to somewhat excessively drained gravelly to extremely stony loamy coarse sands that are deep to very deep over a pan

The soils of this association formed on glacial moraines and outwash fans in glacial deposits derived from basic igneous, metamorphic, and granitic rock. They have slopes of 0 to 60 percent. Elevations are 6,200 to 8,600 feet. The annual precipitation is 30 to 45 inches, the annual air temperature is about 41° F., and the frost-free growing season is 30 to 50 days. The vegetation is a sparse to dense coniferous forest and an understory of brush and perennial grasses.

This association is mainly on the California side of the Area. It extends from the southern end northward to Ward Creek. It makes up about 17 percent of the survey area. It is about 50 percent Meeks soils; 40 percent Tallac soils; and 10 percent Tallac soils, shallow variant, and Rock outcrop and Rubble land.

Meeks soils are somewhat excessively drained. Their surface layer, 1 to 50 percent of which is covered with stones and boulders, is grayish-brown and brown gravelly loamy coarse sand. The next layers are pale-brown, soft gravelly and very gravelly loamy coarse sand. They are underlain by a light-gray hardpan weakly cemented with silica at a depth of 41 to 70 inches.

Tallac soils are well drained and moderately well drained. Their surface layer is dark grayish-brown and dark-brown gravelly coarse sandy loam. From 1 to 15 percent of it is covered with stones. The next layer is yellowish-brown, soft very cobbly or very gravelly coarse sandy loam. It is underlain by a yellowish-brown and brown hardpan weakly cemented with silica at a depth of 40 to 70 inches.

These soils are used for homesites, timber, and limited grazing.

Gently Sloping to Very Steep Soils of the Mountains

The soils in this group are somewhat excessively drained to moderately well drained. They formed in material weathered from granitic, andesitic, and metamorphic rock. The texture of the surface layer ranges from coarse sand to loam and in places is gravelly to very stony. Rock outcrops are numerous in many areas. Slopes are 2 to 70 percent.

These soils are in the mountains surrounding Lake Tahoe, at elevations of 6,200 to 10,000 feet. The annual precipitation is 25 to 70 inches, and the frost-free growing season is 30 to 50 days.

Six soil associations are in this group. They make up about 71 percent of the Tahoe Basin Area.

5. Cagwin-Toem Association

Gently rolling to very steep, somewhat excessively drained and excessively drained loamy coarse sands and gravelly coarse sands that are shallow to deep over granitic rock

The soils in this association formed in weathered granitic material, or grus. Slopes are 5 to 70 percent. Elevations are 6,500 to 9,500 feet. The annual precipitation is 35 to 50 inches, the annual air temperature is 40° to 42° F., and the frost-free growing season is 30 to 50 days. The vegetation is an open to dense stand of conifers and an understory of shrubs.

This association extends from the Upper Truckee watershed, south of Meyers, northeastward past the State line to Incline Village. It is also in the Rubicon Creek watershed north of Emerald Bay.

This association occupies about 25 percent of the Tahoe Basin Area. It is about 50 percent Cagwin soils, 40 percent Toem soils, and 10 percent Rock land and Graylock and Meeks soils.

Cagwin soils are somewhat excessively drained. Their surface layer is dark grayish-brown and grayish-brown loamy coarse sand. Below this is pale-brown, soft coarse sand underlain by weathered granitic rock, or grus. The depth to the grus is 20 to 40 inches.

Toem soils are excessively drained, grayish-brown and pale-brown gravelly coarse sands underlain by weathered granodiorite, or grus. The grus is at a depth of 8 to 20 inches.

Rock outcrop covers 5 to 50 percent of this association.

The soils in this association are used for watershed, wildlife, recreation, and timber.

6. Tahoma-Jorge Association

Gently sloping to steep, well-drained gravelly to very stony sandy loams that are deep to very deep over latite and andesitic conglomerate

The soils in this association formed in material weathered from volcanic rock. Slopes are 2 to 50 percent. Elevations range from 6,200 to 9,000 feet. The annual precipitation is 35 to 45 inches, the annual air temperature is about 40° F., and the frost-free growing season is 30 to 50 days. The vegetation is conifers and an understory of mountain shrubs.

This association is north of Tahoe City and extends eastward to near Incline Village. It makes up about 5 percent of the survey area. It is about 50 percent Tahoma soils, 40 percent Jorge soils, and 10 percent Fugawee and Umpa soils.

The surface layer of Tahoma soils is brown and slightly hard gravelly sandy loam. From 1 to 15 percent of it is covered with stones and cobblestones. The subsoil is brown, slightly hard and hard gravelly loam, gravelly light clay loam, and light clay loam. It is underlain by olivine latite at a depth of 43 inches or more.

The surface layer of Jorge soils is brown sandy loam and very gravelly sandy loam. Stones cover 5 to 15 percent of the surface, and cobblestones 15 to 30 percent. The subsoil is brown, soft and slightly hard very gravelly loam. The substratum is dark yellowish-brown, soft very gravelly sandy loam. It is underlain by andesitic conglomerate. The depth to the parent rock is more than 60 inches.

These soils are used for timber, homesites, and watershed.

7. Umpa-Fugawee Association

Gently sloping to steep, well-drained very stony sandy loams that are moderately deep over andesite and andesitic conglomerate

The soils of this association formed in material weathered from latite, andesite, and andesitic conglomerate. Slopes are 2 to 50 percent. Elevations are 6,400 to 9,000 feet. The annual precipitation is 35 to 45 inches, the annual air temperature is about 40° F., and the frost-free growing season is 30 to 50 days. The vegetation is a coniferous forest and an understory of mountain shrubs.

This association is in the mountains. It is north of Tahoe City and extends eastward to Incline Village. It makes up about 7 percent of the survey area. It is about 75 percent Umpa soils, 10 percent Fugawee soils, and 15 percent Rock land and Tahoma and Jorge soils.

The surface layer of Umpa soils, 5 to 10 percent of which is covered with stones and boulders, is dark grayish-brown and pale-brown gravelly sandy loam. The subsoil is very pale brown and light-gray, soft to hard very gravelly sandy loam underlain by hard, fractured andesite. The depth to rock ranges from 20 to 40 inches.

The surface layer of the Fugawee soils is dark grayish-brown and brown gravelly sandy loam. From 3 to 15 percent of it is covered with stones. The subsoil is light-brown and light yellowish-brown, slightly hard and hard gravelly loam and gravelly clay loam. This layer is underlain by weathered andesitic conglomerate. The depth to the parent rock ranges from 23 to 40 inches.

The soils of this association are used for timber and homesites.

8. Waca-Meiss Association

Strongly sloping to steep, well-drained and excessively drained cobbly coarse sandy loams and cobbly loams that are moderately deep to shallow over andesite or andesitic tuff

The soils of this association formed in material weathered from andesite and andesitic tuff. Slopes are 9 to 50 percent. Elevations are 6,500 to 10,000 feet. The annual precipitation is 35 to 70 inches, the annual air temperature is 40° to 42° F., and the frost-free growing season is 30 to 50 days. The vegetation is a dense to semidense stand of conifers on Waca soils and scattered big sagebrush, conifers, wyethia, and grass on Meiss soils.

This association is mainly in the Blackwood Canyon, Ward Creek, and Meiss Meadows vicinity. It makes up about 4 percent of the Tahoe Basin Area. It is about 50 percent Waca soils, 40 percent Meiss soils, and 10 percent Rock land.

Waca soils are well drained. Their surface layer is brown cobbly coarse sandy loam and gravelly coarse sandy loam. Below this is pale-brown, soft very gravelly coarse sandy loam underlain by weathered andesitic tuff. The depth to the parent rock ranges from 21 to 40 inches.

Meiss soils are excessively drained. They are brown and yellowish-brown cobbly loams and sandy loams over hard andesite. The depth to rock ranges from 10 to 20 inches. In some areas, rock outcrop covers 5 to 25 percent of the area.

These soils are used for timber, wildlife, recreation, watershed, and limited grazing.

9. Shakespeare-Rock Land Association

Strongly sloping to steep, moderately well drained gravelly loams or stony loams that are deep to very deep over metamorphic rock, and undulating to very steep land that is 50 to 90 percent rock outcrop

The soils in this association formed in material weathered from metamorphic rock. Slopes are 5 to 75 percent. Elevations are 7,000 to more than 10,000 feet. The annual precipitation is 25 to 30 inches, the annual air temperature is about 41° F., and the frost-free growing season is 30 to 50 days. The vegetation is coniferous forest on Shakespeare soils and an open stand of shrubs and scattered conifers on Rock land.

This association is near Genoa Peak. It makes up 1 percent of the survey area. It is about 75 percent Shakespeare soils, 10 percent Rock land, and 15 percent Toem, Umpa, and Waca soils.

The surface layer of Shakespeare soils is brown and pale-brown silt loam and gravelly loam. The subsoil is pale-brown and grayish-brown, slightly hard and hard gravelly loam and gravelly clay loam. It is underlain by yellowish-red, very hard silty clay loam. In some areas stones cover 1 to 5 percent of the surface. The depth to metamorphic rock is 48 inches or more.

Rock land is about 50 to 90 percent rock outcrop. The soil material between the rocks is less than 10 inches deep.

Shakespeare soils are used for timber, wildlife, and watershed. Rock land is used for watershed and wildlife.

10. Rock Land-Stony Colluvial Land Association

Gently sloping to very steep land that is 50 to 90 percent rock outcrop, cobblestones, stones, and boulders

This association consists of Rock land, Rock outcrop, talus slopes, volcanic rubble, and Stony colluvial land in areas of granitic, metamorphic, and volcanic rock. It is essentially barren except for an open stand of mountain shrubs and scattered conifers. This association is extensive at the higher elevations throughout the survey area. Large acreages in the southwestern part of the Area are a product of glaciation.

This association occupies about 29 percent of the survey area. It is about 85 percent Rock land, 5 percent Stony colluvial land, and 10 percent Meiss, Toem, Umpa, and Waca soils.

The surface area of Rock land is 50 to 90 percent rock outcrop, rubble, and stones. There is a thin mantle of soil material in the crevices between the rock outcrops and the stones. It is generally less than 10 inches deep. Stony colluvial land is excessively drained. The surface area is 50 to 90 percent large cobblestones, stones, and boulders. The material below the surface is more than 50 percent coarse fragments. The depth to bedrock is more than 30 inches.

This association is used for watershed and wildlife, and to a limited extent, for homesites.

DESCRIPTIONS OF THE SOILS

This section describes the soil series and mapping units in the Tahoe Basin Area. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. 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 important 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, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil, and the percentage of coarse fragments is a volume measurement.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Rock land, for example, does not belong to a soil series, but nevertheless, 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 subclass in which the mapping unit has been placed.

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 at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (14).

TABLE 1.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Mapping unit	Area	Extent	Mapping unit	Area	Extent
	Acres	Percent		Acres	Percent
Beaches	275	0.1	Inville gravelly coarse sandy loam, 0 to 5 percent slopes	250	0.1
Cagwin-Rock outcrop complex, 5 to 15 percent slopes	2,125	1.0	Inville stony coarse sandy loam, 2 to 9 percent slopes	1,725	.8
Cagwin-Rock outcrop complex, 15 to 30 percent slopes	9,110	4.4	Inville stony coarse sandy loam, 9 to 15 percent slopes	560	.3
Cagwin-Rock outcrop complex, 30 to 50 percent slopes	15,195	7.2	Inville stony coarse sandy loam, 15 to 30 percent slopes	280	.1
Celio gravelly loamy coarse sand	1,310	.6	Jabu coarse sandy loam, 0 to 9 percent slopes	1,720	.8
Elmira gravelly loamy coarse sand, 0 to 9 percent slopes	420	.2	Jabu coarse sandy loam, 9 to 20 percent slopes	825	.4
Elmira gravelly loamy coarse sand, 9 to 30 percent slopes	685	.3	Jabu coarse sandy loam, seeped, 2 to 15 percent slopes	275	.1
Elmira stony loamy coarse sand, 9 to 30 percent slopes	330	.2	Jabu coarse sandy loam, shallow variant, 0 to 5 percent slopes	500	.2
Elmira-Gefo loamy coarse sands, 0 to 5 percent slopes	3,125	1.5	Jabu coarse sandy loam, shallow variant, 5 to 15 percent slopes	355	.2
Elmira loamy coarse sand, wet variant	2,170	1.0	Jabu sandy loam, moderately fine subsoil variant, 0 to 9 percent slopes	790	.4
Fill land	500	.2	Jabu stony sandy loam, moderately fine subsoil variant, 2 to 9 percent slopes	1,110	.5
Fugawee very stony sandy loam, 2 to 15 percent slopes	1,280	.6	Jorge-Tahoma cobbly sandy loams, 2 to 15 percent slopes	300	.1
Fugawee very stony sandy loam, 15 to 30 percent slopes	315	.1	Jorge-Tahoma very stony sandy loams, 2 to 15 percent slopes	3,195	1.5
Gefo gravelly loamy coarse sand, 2 to 9 percent slopes	1,335	.7	Jorge-Tahoma very stony sandy loams, 15 to 30 percent slopes	3,455	1.7
Gefo gravelly loamy coarse sand, 9 to 20 percent slopes	300	.1			
Gravelly alluvial land	1,805	.9			
Graylock extremely stony loamy coarse sand, 30 to 50 percent slopes	2,740	1.3			

TABLE 1.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Mapping unit	Area	Extent	Mapping unit	Area	Extent
	Acres	Percent		Acres	Percent
Jorge-Tahoma very stony sandy loams, 30 to 50 percent slopes	1,995	1.0	Tahoma very stony sandy loam, 2 to 15 percent slopes	690	0.3
Loamy alluvial land	3,145	1.5	Tallac gravelly coarse sandy loam, seeped, 0 to 5 percent slopes	2,325	1.4
Marsh	1,310	.6	Tallac gravelly coarse sandy loam, seeped, 5 to 9 percent slopes	1,315	.6
Meeks gravelly loamy coarse sand, 0 to 5 percent slopes	635	.3	Tallac stony coarse sandy loam, 5 to 15 percent slopes	2,940	1.4
Meeks gravelly loamy coarse sand, 5 to 15 percent slopes	230	.1	Tallac very stony coarse sandy loam, 15 to 30 percent slopes	3,515	1.7
Meeks stony loamy coarse sand, 0 to 5 percent slopes	725	.4	Tallac very stony coarse sandy loam, 30 to 60 percent slopes	1,800	.9
Meeks very stony loamy coarse sand, 5 to 15 percent slopes	1,645	.8	Tallac very stony coarse sandy loam, seeped, 2 to 9 percent slopes	875	.4
Meeks very stony loamy coarse sand, 15 to 30 percent slopes	2,555	1.2	Tallac gravelly coarse sandy loam, shallow variant, 9 to 30 percent slopes	980	.5
Meeks very stony loamy coarse sand, 30 to 60 percent slopes	2,440	1.2	Tallac gravelly coarse sandy loam, shallow variant, 30 to 50 percent slopes	1,020	.5
Meeks extremely stony loamy coarse sand, 15 to 30 percent slopes	3,485	1.7	Toem-Rock outcrop complex, 9 to 30 percent slopes	915	.5
Meeks extremely stony loamy coarse sand, 30 to 60 percent slopes	3,200	1.5	Toem-Rock outcrop complex, 30 to 50 percent slopes	5,775	2.8
Meiss cobbly loam, 9 to 30 percent slopes	735	.4	Umpa very stony sandy loam, 5 to 15 percent slopes	1,780	.9
Meiss cobbly loam, 30 to 50 percent slopes	5,045	2.4	Umpa very stony sandy loam, 15 to 30 percent slopes	3,825	1.8
Pits and dumps	350	.2	Umpa very stony sandy loam, 30 to 50 percent slopes	6,565	3.3
Rock land	26,125	12.6	Waca cobbly coarse sandy loam, 9 to 30 percent slopes	1,880	.9
Rock outcrop-Cagwin complex, 30 to 50 percent slopes	4,740	2.3	Waca cobbly coarse sandy loam, 30 to 50 percent slopes	690	.3
Rock outcrop-Cagwin complex, 50 to 70 percent slopes	2,550	1.2	Waca-Rock outcrop complex, 9 to 30 percent slopes	635	.3
Rock outcrop-Toem complex, 30 to 50 percent slopes	11,155	5.4	Waca-Rock outcrop complex, 30 to 50 percent slopes	3,475	1.7
Rock outcrop-Toem complex, 50 to 70 percent slopes	5,160	2.5			
Rock outcrop and Rubble land	23,780	11.5			
Shakespeare gravelly loam, 9 to 30 percent slopes	1,385	.7			
Shakespeare stony loam, 30 to 50 percent slopes	230	.1			
Stony colluvial land	3,850	1.8			
Tahoma stony sandy loam, 2 to 15 percent slopes	1,600	.8	Total	207,430	100.0

Beaches

Beaches (Be) is adjacent to the lake shore, mainly the south shore near Kings Beach. It is coarse sand derived mainly from granitic alluvium. The entire acreage is used for recreation. Capability subclass VIIIw.

Cagwin Series

The Cagwin series consists of gently rolling to very steep, somewhat excessively drained soils that are 20 to 40 inches deep over granitic material, or grus. These are soils of the mountainous uplands. Slopes range from 5 to 70 percent. Elevations are 6,500 to 9,000 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is about 42° F., and the frost-free season is 30 to 50 days. The vegetation is a semidense to dense stand of conifers, mostly red fir, white fir, and western white pine and, in many places, a shrub understory of pinemat manzanita and huckleberry oak.

In a representative profile the surface layer is dark grayish-brown and grayish-brown, medium acid and strongly acid loamy coarse sand about 12 inches thick. The next layer is pale-brown, medium acid coarse sand about 14 inches thick. At a depth of 26 inches is the decomposed granitic parent material (pl. I, left).

Permeability is rapid. The available water capacity is 1.5 to 2.5 inches.

Cagwin soils are used for watershed, wildlife, recreation, and timber.

Representative profile: 80 feet north of High Meadow Road, SW1/4 sec. 12, T. 12 N., R. 18 E.

O1&O2--1 inch to 0, pine litter and duff; abrupt, smooth boundary.

A11--0 to 4 inches, dark grayish-brown (10YR 4/2) loamy coarse sand, very dark brown (10YR 2/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; 5 percent gravel; strongly acid; clear, smooth boundary. 2 to 4 inches thick.

A12--4 to 8 inches, grayish-brown (10YR 5/2) loamy coarse sand, very dark brown (10YR 2/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots and few medium and coarse roots; many very fine and fine interstitial pores; 10 percent gravel; medium acid; clear, wavy boundary. 3 to 5 inches thick.

AC--8 to 12 inches, grayish-brown (10YR 5/2) loamy coarse sand, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots and few medium and coarse roots; many very fine and fine interstitial pores; 5 percent gravel; medium acid; clear, wavy boundary. 4 to 10 inches thick.

C1--12 to 26 inches, pale-brown (10YR 6/3) coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots and few fine and medium roots; many very fine and fine interstitial pores; 10 percent gravel; medium acid; clear, smooth boundary. 12 to 21 inches thick.

C2--26 inches, white and gray (10YR 8/2, 5/1) grus; very few very fine roots; strongly acid.

The depth to grus ranges from about 20 to 40 inches. The O horizon is no more than 2 inches thick.

The A horizon ranges from dark grayish brown to brown in 10YR hue, value of 4 to 5, and chroma of 2 or 3; in moist soil the chroma below a depth of 9 inches is more than 3.5. This horizon ranges from loamy coarse sand to coarse sand, is 5 to 25 percent gravel, and is slightly acid to strongly acid.

The C1 horizon ranges from very pale brown to light yellowish brown in 10YR hue, value of 6 or 7, and chroma of 3 or 4. It ranges from loamy coarse sand to coarse sand, is 5 to 30 percent gravel, and is medium acid to strongly acid.

Cagwin soils are similar to Graylock, Meeks, Toem, and Waca soils. They are not so deep as Graylock soils and have fewer coarse fragments in their subsoil. They have fewer coarse fragments in their profile than Meeks soils and they formed in grus, whereas those soils formed in glacial deposited material. They are deeper over grus than Toem soils. They are sandier than the cindery Waca soils, which formed in weathered andesitic tuff.

The Cagwin soils in the Tahoe Basin Area are mapped only with Rock outcrop.

Cagwin-Rock outcrop complex, 5 to 15 percent slopes (CaD).--This complex consists of rolling soils on foot slopes along the fringe of the granitic uplands. It is about 85 to 95 percent soil material and 5 to 15 percent granitic outcrop. The soil material is about 65 percent Cagwin soil; 5 percent Toem coarse sand; and about 30 percent a soil that is similar to the Cagwin soil, but has a thick, dark-colored surface layer and is deeper than 40 inches over weathered granitic rock.

Along the contact with the glacial outwash deposits are scattered inclusions of Inville gravelly coarse sandy loam, Jabu coarse sandy loam, and Jabu coarse sandy loam, shallow variant.

Runoff is slow in undisturbed areas of the Cagwin soil and medium in disturbed areas. The erosion hazard is moderate.

Rock outcrop has very rapid runoff, but the erosion hazard is only slight.

This complex is used for timber production and urban development. Capability subclass VIs.

Cagwin-Rock outcrop complex, 15 to 30 percent slopes (CaE).--This complex consists of hilly soils on granitic uplands. It is about 75 to 95 percent soil material and 5 to 25 percent granitic outcrop. The soil material is about 70 percent Cagwin soil; 5 percent Toem coarse sand; and about 25 percent a soil that is similar to the Cagwin soil, but is deeper than 40 inches over weathered granitic rock.

The surface layer of the Cagwin soil does not absorb water readily. In disturbed areas, runoff is rapid and the erosion hazard is high.

Rock outcrop has very rapid runoff, but the erosion hazard is only slight.

This complex is used for watershed, timber, and recreation. Capability subclass VIs.

Cagwin-Rock outcrop complex, 30 to 50 percent slopes (CaF).--This complex consists of soils on granitic uplands, mainly in the southern and eastern parts of the survey area. It is about 75 to 95 percent soil material and 5 to 25 percent granitic Rock outcrop. The soil material is about 60 percent Cagwin soil; 10 percent Toem coarse sand; 5 percent Graylock extremely stony loamy coarse sand; and about 25 percent a soil similar to the Cagwin soil, but deeper than 40 inches over weathered rock.

This Cagwin soil has the profile described as representative of the Cagwin series. The surface layer does not absorb water readily. If the soil is bare of vegetation, runoff is rapid and the erosion hazard is high. Under natural conditions, runoff is medium.

Rock outcrop consists of slightly weathered to hard granitic rock. The outcrops range from scattered rocks 1 to 5 feet in diameter to expanses of rock 100 to 500 square feet. Runoff is very rapid, and the erosion hazard is slight.

This complex is used for watershed, timber, and recreation. Capability subclass VIIs.

Celio Series

The Celio series consists of poorly drained soils that are 40 to 60 inches deep over a very gravelly hardpan strongly cemented with silica. These soils formed in glacial outwash of Quaternary age. The parent material is mixed, but is dominantly of granitic origin. Slopes are 0 to 5 percent. Elevations are 6,200 to 6,400 feet. The average annual precipitation is 30 to 35 inches, the average annual air temperature is about 42° F., and the frost-free season is 50 to 80 days. The vegetation is a dense stand of lodgepole pine and an understory of brush and perennial grasses.

In a representative profile the surface layer is brown, medium acid gravelly loamy coarse sand about 16 inches thick. The next layers are strong-brown and dusky-red, slightly acid gravelly loamy coarse sand and very gravelly coarse sand that extend to a depth of 45 inches. The lower layer contains many, large, prominent, reddish-yellow and strong-brown mottles. Below a depth of 45 inches is a yellowish-red, slightly acid hardpan, strongly cemented with silica, that has many, medium, prominent, reddish-yellow and strong-brown mottles (pl. I, right). Below the pan is loose, white, stratified coarse sand and gravel.

Permeability is rapid above the pan and slow in the pan. The water table fluctuates between depths of 24 and 60 inches in summer and between depths of 12 and 30 inches the rest of the year. The available water capacity is 1.5 to 2.5 inches, but the soil is continually recharged because of its drainage pattern and position on the landscape. Some areas are subject to flooding. The effective depth is 40 to 60 inches, depending on the depth to the hardpan.

Celio soils are used for homesites and recreation.

Representative profile: 0.25 mile west of Meyers checking station, west side of California Highway 89 extension, and 0.1 mile north of southeast corner of sec. 30, T. 12 N., R. 18 E.

A11--0 to 8 inches, brown (10YR 4/3) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine interstitial pores; thin gravel pavement on surface; hydrophobic (resistant to wetting); medium acid; diffuse, wavy boundary. 7 to 9 inches thick.

A12--8 to 16 inches, brown (7.5YR 5/4, 4/4) gravelly loamy coarse sand, dark reddish brown (5YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine interstitial pores; 20 percent gravel and 10 percent cobblestones; medium acid; diffuse, wavy boundary. 7 to 10 inches thick.

C1--16 to 23 inches, strong-brown (7.5YR 5/8) gravelly loamy coarse sand, dark reddish brown (5YR 3/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots and common medium roots; many very fine and fine interstitial pores; 20 percent gravel and 10 percent cobblestones; slightly acid; clear, wavy boundary. 7 to 18 inches thick.

IIC2--23 to 45 inches, dusky-red (10R 3/3) very gravelly coarse sand, dusky red (10R 3/4) moist; many, large, prominent, reddish-yellow and strong-brown (7.5YR 6/8, 5/8) mottles, brownish yellow and yellowish brown (10YR 6/6, 5/6) moist; single grain; loose, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; dusky red color grades to yellowish red with increasing depth; bands of dusky red in lower part; 60 percent gravel and 10 percent cobblestones; slightly acid; abrupt, wavy boundary. 16 to 24 inches thick.

IIC3m--45 to 56 inches, yellowish-red (5YR 5/6) strongly cemented, gravelly duripan consisting of a very thin (less than 2 millimeters), almost continuous coating of indurated silica laminae on the surface of this horizon and very thin, discontinuous, randomly oriented, but mostly horizontal bands of silica laminae throughout the horizon; duripan is dark reddish brown (2.5YR 3/4) moist; many, medium, prominent, reddish-yellow and strong-brown (7.5YR 6/8, 5/8) mottles, reddish yellow (7.5YR 6/6) moist; massive; roots matted on surface; common very fine pores; massive;

60 percent gravel and 10 percent cobblestones; slightly acid; abrupt, wavy boundary. 5 to 11 inches thick.

IIC4--56 to 67 inches, white (N 8/0, 10YR 8/1) very gravelly coarse sand, light gray (10YR 7/2) moist; few, fine, prominent mottles of yellowish brown (10YR 5/6) moist; single grain; loose, nonsticky and nonplastic; no roots; many very fine interstitial pores; 60 percent gravel and 2 percent cobblestones; slightly acid; abrupt, wavy boundary. 10 to 20 inches thick.

IIC5--67 to 80 inches, white (N 8/0, 10YR 8/1) coarse sand, light gray (N 7/0) moist; thin, horizontal bands, black (N 2/0) dry and moist; single grain; loose, nonsticky and nonplastic; no roots; many very fine interstitial pores; becomes very gravelly with increasing depth; neutral.

The depth to the strongly silica-cemented duripan ranges from 40 to 60 inches. Mottles occur at a depth of 21 to 30 inches. The soil is saturated within 30 inches of the surface except in summer. The O horizon is intermittent and less than 3 inches thick.

The A horizon has a base saturation of less than 50 percent. It is brown, dark brown, dark grayish brown, or very dark grayish brown in hues of 10YR and 7.5YR when dry and very dark grayish brown, dark brown, or dark reddish brown in hues of 10YR, 7.5YR, and 5YR when moist. It ranges from gravelly loamy coarse sand to loamy coarse sand and in places is as much as 40 percent gravel and cobblestones. It ranges from 14 to 19 inches in thickness and is slightly acid to medium acid.

The upper part of the C horizon ranges from 10R through 7.5YR when dry and from 10R through 5YR when moist from very gravelly or very cobbly coarse sands to loamy coarse sands, and from medium acid to neutral. The silica-cemented lamina of the IIC3m horizon ranges from indurated to strongly cemented and from continuous to discontinuous.

The substratum, below the pan, is white and light-gray, stratified gravelly or very gravelly coarse sand. The outwash parent material is of granitic origin, but in places there are few basic igneous or metasedimentary fragments. The outwash is from the Tioga and Tahoe glacial periods.

Celio soils are similar to Jabu soils and Elmira soils, wet variant. They are similar to Jabu soils in having a dense compact layer below a depth of 40 inches, but in contrast, they formed in younger glacial moraines and are coarser textured. They differ from Elmira soils, wet variant, in having a dense compact layer and older parent material.

Celio gravelly loamy coarse sand (Co).--This nearly level and gently sloping soil is on glacial outwash and in areas where scarps of outwash border creekbeds. It has the profile described as representative of the series.

About 6 percent of the total acreage of this soil is Meeks gravelly loamy coarse sand, in areas adjacent to the Upper Truckee River; 4 percent is Marsh, in depressional areas in the Lake Valley area where drainage is very poor and the soil material is organic; and 4 percent is Elmira loamy coarse sand, wet variant, in old eroded areas near Meeks Creek that have been filled with recent, coarse-textured alluvium.

Runoff on this Celio soil is slow, and the erosion hazard is slight. The hazard of deposition of soil and other debris from surrounding areas is moderate.

The principal uses of this soil are recreation and housing. Capability subclass IVw.

Elmira Series

The Elmira series consists of nearly level to moderately steep, somewhat excessively drained soils that are underlain by sandy granitic alluvium or highly weathered till. These soils are on glacial outwash fans and moraines. The parent material is mixed, but is predominantly granitic alluvium. Slopes are 0 to 30 percent. Elevations are 6,200 to 6,500 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is about 40° F., and the frost-free season is 50 to 80 days. The vegetation is an open stand of sagebrush and coniferous forest and some perennial grasses.

In a representative profile the surface layer is grayish-brown and brown, medium acid gravelly loamy coarse sand about 7 inches thick (pl. II, left). The next layers are pale-brown, medium acid and strongly acid gravelly loamy coarse sand and gravelly coarse sand that extend to a depth of 59 inches. The substratum is light-gray, medium acid very gravelly coarse sand.

Elmira soils are used for homesites, range, and timber.

Representative profile: Wooded area about 3 miles south of Tahoe Valley, north of Pioneer Trail Road, 2,800 feet east and 1,700 feet south of the northwest corner of sec. 21, T. 12 N., R. 18 E.

O1--1/2 inch to 0, pine litter.

A11--0 to 2 inches, grayish-brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; seams of dark gray (10YR 4/1) dry; moderate, fine and medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine and fine interstitial pores; 15 percent gravel; medium acid; abrupt, wavy boundary. 1 to 6 inches thick.

A12--2 to 7 inches, brown (10YR 5/3) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; seams of grayish brown and dark grayish brown (10YR 5/2, 4/2) dry; weak, fine and medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots and few fine roots; many very fine and fine interstitial pores; 15 percent gravel; medium acid; clear, wavy boundary. 4 to 9 inches thick.

C1--7 to 19 inches, pale-brown (10YR 6/3) loamy coarse sand, brown (10YR 4/3) moist; weak, fine and medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; 5 percent gravel; medium acid; clear, wavy boundary. 10 to 15 inches thick.

C2--19 to 27 inches, pale-brown (10YR 6/3) gravelly loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many very fine and fine interstitial pores; 15 percent gravel; medium acid; clear, wavy boundary. 7 to 15 inches thick.

C3--27 to 44 inches, pale-brown (10YR 6/3) gravelly loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many fine roots and common very fine, medium, and coarse roots; many very fine and fine interstitial pores; few very thin clay films as bridges and coatings on sand grains; 30 percent gravel; medium acid; clear, wavy boundary. 15 to 25 inches thick.

C4--44 to 59 inches, pale-brown (10YR 6/3) gravelly coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many fine roots and common very fine and medium roots; many very fine and medium roots; many very fine and fine interstitial pores; 20 percent gravel; strongly acid; abrupt, smooth boundary. 15 to 20 inches thick.

IIC5--59 to 72 inches, light-gray (10YR 7/2) very gravelly coarse sand, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots and fine roots; many fine and few very fine interstitial pores; 50 percent gravel; some silica and clay coatings on bottom side of gravel; gravel strongly weathered; medium acid.

The depth to weathered glacial till is more than 60 inches. In wooded areas this soil has an O horizon.

The A horizon ranges from dark grayish brown to brown. It ranges from loamy sand to loamy coarse sand and in places is 5 to 30 percent gravel. It has granular structure or is massive, is slightly acid or medium acid, and is 5 to 10 inches thick.

The C horizon ranges from pale brown or light yellowish brown to very pale brown or light gray. It ranges from loamy coarse sand to coarse sand and in places is 5 to 40 percent gravel. Clay films range from very few to common. Very thin clay films occur as bridges and coatings on sand grains and in thin discontinuous clay bands and in clay pockets. In places there are a few, thin bands weakly cemented with silica in the lower part of the C horizon.

The IIC horizon is highly weathered, granitic glacial till.

Elmira soils are similar to Gefo soils, but have a thinner surface layer.

Elmira gravelly loamy coarse sand, 0 to 9 percent slopes (EbC).--This soil is on morainal crests. It has the profile described as representative of the series.

About 5 percent of the acreage of this soil is Jabu coarse sandy loam, shallow variant, in swales too small to delineate; another 5 percent is Jabu coarse sandy loam; and 10 percent is a soil similar to the Elmira soil, but does not have thin clay bands in the C horizon and overlies weakly silica cemented till.

In the Elmira soil, roots can penetrate to a depth of more than 60 inches. The available water capacity is 3 to 4.5 inches. Permeability is rapid. Even if the soil is bare of vegetation, surface runoff is very slow to slow, and the erosion hazard is slight to moderate.

The principal use of this soil is urban development. Some areas are used for grazing and timber. Capability subclass IVs.

Elmira gravelly loamy coarse sand, 9 to 30 percent slopes (EbE).--This soil is on the sides of lateral moraines. The underlying till was modified by Lake Tahoe when the lake level was higher than it is at present, and it has the appearance of lake-laid sediments. These sediments are very slowly permeable to water and impermeable to roots. They are at a depth of 50 to 70 inches.

About 5 percent of the total acreage of this soil is Jabu coarse sandy loam; about 5 percent along the foot slopes is Jabu sandy loam, moderately fine subsoil variant; and 10 percent is a soil similar to this Elmira soil, but does not have clay bands in the substratum.

Water moves laterally along the underlying sediments and causes some seepage in the concave positions of this Elmira soil. Runoff is medium to rapid, and the erosion hazard is moderate to high. Roots can penetrate to a depth of 50 to 70 inches. Available water capacity is 2.5 to 4.5 inches. Permeability is rapid.

This soil is used mainly for urban development. Some areas are used for grazing and timber. Erosion caused by concentrated runoff from urban development is a major concern. Capability subclass IVs.

Elmira stony loamy coarse sand, 9 to 30 percent slopes (EcE).--This soil is on the sides of lateral moraines. Erratic stones and boulders cover 1 to 2 percent of the surface area. The underlying till was modified by Lake Tahoe when the lake level was higher than it is at present, and it has the appearance of lake-laid sediments. These sediments are very slowly permeable to water and impermeable to roots. They are at a depth of 50 to 70 inches.

About 5 percent of the total acreage of this soil is Jabu coarse sandy loam, 9 to 20 percent slopes; about 5 percent along the foot slopes is Jabu sandy loam, moderately fine subsoil variant; and 15 percent is a soil similar to this Elmira soil, but does not have clay bands in the substratum and has

weakly silica cemented bands in the underlying till. There are also inclusions in the Rubicon Bay area where slopes are as much as 45 percent.

In this Elmira soil, water moves laterally along the underlying sediments and causes some seepage in the concave positions. Runoff is medium to rapid, and the erosion hazard is moderate to high. Roots can penetrate to a depth of 50 to 70 inches. Available water capacity is 2.5 to 4.5 inches. Permeability is rapid.

This soil is chiefly used for urban development. Some areas are used for grazing and timber. Erosion caused by concentrated runoff from urban development is a major concern. Capability subclass IVs.

Elmira-Gefo loamy coarse sands, 0 to 5 percent slopes (EfB).--This complex is on alluvial outwash fans along U.S. Highway 50 from Tahoe Valley to Stateline. The Elmira soil on glacial outwash fans makes up 65 percent of the unit. The Gefo soil on alluvial fans makes up 30 percent. About 5 percent is Elmira loamy coarse sand, wet variant, in long narrow swales.

Elmira and Gefo soils are 5 to 15 percent gravel, but otherwise have a profile similar to the one described as representative of the respective series

The Gefo soil is somewhat excessively drained and has very rapid permeability. Even if it is bare of vegetation, runoff is very slow and the erosion hazard is slight. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 2.5 to 4 inches.

The Elmira soil is somewhat excessively drained and has rapid permeability. It also has very slow runoff and is subject to only a slight hazard of erosion if it is bare of vegetation. Roots can penetrate to a depth of more than 60 inches. The available water capacity is 3 to 4.5 inches.

Most areas are used for homesites. Capability subclass IVs.

Elmira Series, Wet Variant

The Elmira series, wet variant, consists of nearly level to gently sloping, poorly drained soils that are underlain by stratified alluvium. These soils are in drainageways of glacial outwash fans. The parent material is mixed, but is predominantly granitic alluvium. Slopes are 0 to 5 percent. Elevations are 6,200 to 6,500 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is about 43° F., and the frost-free season is 50 to 80 days. The vegetation is lodgepole pine, meadow grasses, and forbs.

In a representative profile the surface layer is brown, medium acid and strongly acid loamy coarse sand 11 inches thick. The next layers are pale-brown, mottled with dark brown or reddish yellow, medium acid, loamy coarse sand about 33 inches thick. The substratum, at a depth of 44 inches, is mottled dark grayish-brown and greenish-gray, stratified alluvium.

This soil is subject to flooding. Permeability is moderately rapid above the substratum and slow in the substratum. Roots penetrate to a depth of 30 to 40 inches. Available water capacity is 2.5 to 3.5 inches. The seasonal high water table fluctuates at depths of 12 to 24 inches.

Elmira soils, wet variant, are used for homesites and watershed.

Representative profile: Homesite development about 1 mile south of Tahoe Keys, 70 feet east of California Street, between lot 9 and lot 10, sec. 4, T. 12 N., R. 18 E.

O1--3 1/2 inches to 0, mat of partly decomposed lodgepole pine needles.

A11--0 to 4 inches, brown (10YR 5/3) loamy coarse sand, dark brown (10YR 3/3) moist; weak, thick, platy structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots and common coarse roots; common very fine tubular and interstitial pores; strongly acid; clear, smooth boundary. 3 to 5 inches thick.

A12--4 to 11 inches, brown (10YR 5/3) loamy coarse sand, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine, medium, and coarse roots and common fine roots; common very fine tubular and interstitial pores; medium acid; gradual, smooth boundary. 7 to 10 inches thick.

C1--11 to 28 inches, pale-brown (10YR 6/3) loamy coarse sand, brown (10YR 4/3) moist; many, medium, prominent mottles of dark brown (7.5YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, medium, and coarse roots; common very fine tubular and interstitial pores; medium acid; gradual, smooth boundary. 6 to 10 inches thick.

C2--28 to 44 inches, pale-brown (10YR 6/3) loamy coarse sand; common, medium, prominent mottles of reddish yellow (5YR 6/8) and brown (10YR 4/3), and many, coarse, distinct mottles of dark brown (7.5YR 4/4) moist; massive; slightly hard and brittle, friable, nonsticky and nonplastic; very few fine and medium roots; many very fine tubular and interstitial pores; medium acid; clear, smooth boundary. 14 to 20 inches thick.

IIC3g--44 to 56 inches, light-gray (10YR 7/1) clay loam; many, medium, prominent mottles of reddish yellow (7.5YR 6/8), dark grayish brown (2.5Y 4/2), and strong brown (7.5YR 5/6) moist; weak, thick, platy structure; very hard, firm, sticky and slightly plastic; very few fine and medium roots; common very fine tubular pores; medium acid; clear, smooth boundary. 2 to 12 inches thick.

IIIC4g--56 to 66 inches, variegated light-gray, white, and reddish-yellow (5Y 7/2, 2.5Y 8/2, 5YR 6/8) stratified fine sandy loam and sandy loam, greenish gray (5G 5/1) and strong brown (7.5YR 5/6) moist; massive; hard, friable, slightly sticky and slightly plastic; no roots; common very fine tubular pores; slightly acid.

The water table fluctuates between depths of 12 and 24 inches in spring and between 36 and 68 inches in fall.

The A horizon ranges from brown to very dark grayish brown and from loamy coarse sand to loamy sand. It has platy to granular structure or is massive, is medium acid or strongly acid, and is 10 to 15 inches thick.

The C1 and C2 horizons range from pale brown to reddish yellow in hues of 10YR and 7.5YR, and from loamy sand to coarse sand. They are medium acid or strongly acid. The IIC horizon is stratified and gleyed and ranges from clay loam to loamy sand.

Elmira soils, wet variant, are similar to Jabu soils, seeped, and Celio soils. In contrast with Jabu soils, they do not have a fragipan. In contrast with Celio soils, they have no gravel in the profile.

Elmira loamy coarse sand, wet variant (Ev).--This nearly level to gently sloping soil is in the drainageways of glacial outwash. It has the profile described as representative of the series.

About 5 percent of the acreage of this soil is Elmira-Gefo loamy coarse sands, which occupy higher lying positions on the landscape, in areas too small to delineate; and 10 percent is Loamy alluvial land, Marsh, and a highly stratified, sandy alluvial soil.

Even if this Elmira soil is bare of vegetation, it has very slow runoff and is subject to only a slight hazard of erosion.

This soil is used mainly for urban development. Capability subclass IVw.

Fill Land

Fill land (Fd) is sandy material dredged from the Truckee Marsh to form a pad for urban development, mainly in the Truckee Marsh area. It consists of stratified sand and some fine gravel and is more than 60 inches deep.

Drainage is excessive, and permeability is very rapid. Runoff is slow, and the erosion hazard is slight. The hazard of wind erosion is moderate. Available water capacity is 2 to 3 inches. The water table is at a depth of 6 to 8 feet.

Fill land is used for homesites. Capability subclass VIs.

Fugawee Series

The Fugawee series consists of gently sloping to moderately steep, well-drained soils that are 23 to 40 inches deep over weathered latite and andesite. These soils are on uplands. Slopes are 2 to 30 percent. Elevations are 6,400 to 8,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 40° F., and the frost-free season is 30 to 50 days. The vegetation is a semidense stand of conifers, mostly red fir, white fir, Jeffrey pine, and western white pine, and an understory of mountain shrubs.

In a representative profile the surface layer is dark grayish-brown and brown, slightly acid and medium acid very stony sandy loam and gravelly sandy loam about 9 inches thick. The subsoil is light-brown and light yellowish-brown, medium acid and strongly acid gravelly loam and gravelly clay loam. It is underlain at a depth of about 37 inches by weathered volcanic bedrock.

Permeability is moderate. Roots can penetrate to a depth of 23 to 40 inches. Available water capacity is 3 to 5 inches.

Fugawee soils are used for timber and homesites.

Representative profile: Wooded area 2 miles west of Carnelian Bay, 50 feet south of a logging road, one-fourth mile east and 1,750 feet north of southwest corner of sec. 17, T. 16 N., R. 17 E.

O1--2 inches to 0, litter from conifers and broadleaf shrubs.

A11--0 to 2 inches, dark grayish-brown (10YR 4/2) very stony sandy loam, very dark brown (10YR 2/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; slightly acid; 5 percent stones; abrupt, smooth boundary. 2 to 4 inches thick.

A12--2 to 9 inches, brown (7.5YR 5/4) gravelly sandy loam, dark reddish brown (5YR 3/4) moist; moderate, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; 20 percent gravel; medium acid; clear, smooth boundary. 6 to 8 inches thick.

B1t--9 to 17 inches, light-brown (7.5YR 6/4) gravelly loam, dark reddish brown (5YR 3/4) moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; common very fine, fine, and medium tubular pores; few thin clay films in pores; 20 percent gravel; medium acid; gradual, wavy boundary. 2 to 8 inches thick.

B21t--17 to 26 inches, light-brown (7.5YR 6/4) gravelly clay loam, dark reddish brown (5YR 3/4) moist; moderate, fine and medium, subangular blocky structure; hard, friable, slightly sticky and plastic; common very fine, fine, medium, and coarse roots; common very fine and fine tubular pores; common thin clay films in pores and on ped faces; 15 percent gravel; strongly acid; gradual, wavy boundary. 6 to 9 inches thick.

B22t--26 to 37 inches, light yellowish-brown (10YR 6/4) gravelly clay loam, dark brown (7.5YR 4/4) moist; moderate, fine and medium, angular blocky structure; hard, friable, slightly sticky and plastic; common very fine and fine roots and few medium and coarse roots; common very fine and fine tubular pores; many thin clay films in pores and on ped faces; 15 percent gravel; strongly acid; clear, wavy boundary. 7 to 11 inches thick.

C--37 inches, weathered andesitic conglomerate and pockets of soil material; few clay films tongue into fracture planes.

The depth to weathered volcanic rock ranges from 23 to 40 inches. The O horizon is less than 2 inches thick. Stones and cobblestones cover about 3 to 15 percent of the surface area. They occur in the upper 12 to 18 inches, but become fewer in number with increasing depth.

The A horizon ranges from dark grayish brown to brown or grayish brown in hues of 10YR and 7.5YR. In moist soil the darkest chromas and values are in the top few inches of the surface layer. This horizon ranges from sandy loam to loam and is 10 to 30 percent gravel. It is 8 to 12 inches thick.

The Bt horizon ranges from light brown to brownish yellow or light yellowish brown to brown in hues of 10YR and 7.5YR. The B2t horizon ranges from clay loam to gravelly clay loam. It has weak to moderate structure and is medium acid to very strongly acid.

The C horizon is weathered andesitic conglomerate or vesicular latite that contains pockets of soil material. The angular coarse fragments on the surface and in the profile are derived from latite; and the rounded fragments are derived from andesite.

Fugawee soils are similar to Tahoma and Umpa soils. They are shallower over rock than Tahoma soils. They are not so gravelly as Umpa soils.

Fugawee very stony sandy loam, 2 to 15 percent slopes (FuD).--This soil is on latitic and andesitic flows. It has the profile described as representative of the series.

About 15 percent of the acreage is a soil similar to this Fugawee soil, but its subsoil is more than 35 percent coarse fragments; 5 percent is Tahoma very stony sandy loam; 5 percent is Jorge very stony sandy loam; and about 2 percent is a very shallow soil, in open areas of sagebrush and stunted conifers. Small scattered areas of Rock land are also included.

Even if this Fugawee soil is bare of vegetation, surface runoff is slow to medium and the erosion hazard is only slight.

This soil is used mainly for timber. Some areas are used for urban development. Capability subclass VIs.

Fugawee very stony sandy loam, 15 to 30 percent slopes (FuE).--This soil is on volcanic uplands.

About 15 percent of the total acreage of this soil is a soil similar to this Fugawee soil, but its subsoil is more than 35 percent coarse fragments; about 10 percent is Jorge very stony sandy loam; about 3 percent is Tahoma very stony sandy loam; and 5 percent is Stony colluvial land, Rock land, and Rock outcrop and Rubble land.

Runoff is medium to rapid on this Fugawee soil, and the erosion hazard is moderate.

This soil is used for timber. Capability subclass VIs.

Gefo Series

The Gefo series consists of nearly level to moderately steep, somewhat excessively drained soils that are underlain by sandy granitic alluvium. These soils are on glacial outwash and alluvial fans. Slopes are 2 to 20 percent. Elevations are 6,200 to 6,500 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is about 43° F., and the frost-free season is 50 to 80 days. The vegetation is sagebrush, bitterbrush, Jeffrey pine, and perennial grasses.

In a representative profile the surface layer is brown, medium acid gravelly loamy coarse sand about 15 inches thick. The next layers are light yellowish-brown and very pale brown, medium acid gravelly coarse sand. The substratum, at a depth of 65 inches, is light-gray, medium acid gravelly coarse sand.

Permeability is very rapid. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 2.5 to 4 inches.

Gefo soils are used for homesites, range, and timber.

Representative profile: Subdivision about 1 mile south of Lake Tahoe, 700 feet west and 500 feet south of Rubicon and Brockway intersection, lot 13, sec. 4, T. 12 N., R. 18 E.

A11--0 to 7 inches, brown (10YR 4/3) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, fine and medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and few fine roots; many very fine and fine interstitial pores; 15 percent gravel; medium acid; clear, wavy boundary. 4 to 9 inches thick.

A12--7 to 15 inches, brown (10YR 5/3) gravelly loamy coarse sand, dark brown (10YR 3/3) moist; weak, fine and medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and few fine roots; many very fine and fine interstitial pores; 30 percent gravel; medium acid; clear, wavy boundary. 6 to 11 inches thick.

C1--15 to 36 inches, light yellowish-brown (10YR 6/4) gravelly coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine interstitial pores; 25 percent gravel; medium acid; gradual, smooth boundary. 10 to 24 inches thick.

C2--36 to 65 inches, very pale brown (10YR 7/4) gravelly coarse sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine and fine interstitial pores; 20 percent gravel; medium acid; gradual, smooth boundary. 10 to 30 inches thick.

C3--65 to 76 inches, light-gray (10YR 7/2) gravelly coarse sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and

504-718 O - 74 - 2

nonplastic; no roots; many very fine and fine interstitial pores; 15 percent gravel; medium acid.

The soil is more than 60 inches deep. In wooded areas it has an O horizon.

The A horizon ranges from dark grayish brown to brown. It ranges from loamy sand to loamy coarse sand and in most profiles is 5 to 30 percent fine gravel. It has weak to moderate granular structure. At the surface it is single grain. It is slightly acid or medium acid and 10 to 20 inches thick.

The C horizon ranges from loamy sand to coarse sand and is 5 to 35 percent fine gravel. It is slightly acid or medium acid.

Gefo soils are similar to Elmira soils, but have a thicker surface layer.

Gefo gravelly loamy coarse sand, 2 to 9 percent slopes (GeC).--This soil is in outwash material on alluvial fans. It has the profile described as representative of the series.

About 8 percent of the acreage of this soil is Elmira gravelly loamy coarse sand; about 10 percent is Elmira loamy coarse sand, wet variant; and about 5 percent is Jabu coarse sandy loam.

Even if this Gefo soil is bare of vegetation, runoff is slow to very slow and the erosion hazard is only slight to moderate.

This soil is used chiefly for urban development. Some small areas are used for grazing and timber. Capability subclass IVs.

Gefo gravelly loamy coarse sand, 9 to 20 percent slopes (GeD).--This soil is on alluvial fans. It has a profile similar to the one described as representative of the series, but its surface layer is 10 to 15 inches thick.

About 5 percent of the acreage of this soil is Jabu coarse sandy loam.

If this Gefo soil is bare of vegetation, surface runoff is medium and the erosion hazard is high.

This soil is used for range, timber, and urban development. Erosion caused by concentrated runoff from urban development is a major concern. Capability subclass IVs.

Gravelly Alluvial Land

Gravelly alluvial land (Gr) consists of small areas of recent gravelly alluvium adjacent to stream channels and in meadows. Slopes are 0 to 5 percent. The vegetation consists of meadow grasses and sedges and scattered stands of lodgepole pine.

This land is more than 60 inches deep. It varies in color. It is stratified gravelly sandy loam, gravelly loam, and gravelly silt loam that generally becomes very gravelly with increasing depth. In places the surface is covered with 1 inch to 6 inches of peat.

Gravelly alluvial land is somewhat poorly drained to poorly drained. Permeability is moderate. Runoff is very slow, and the erosion hazard is slight. Some areas are flooded in spring during periods of runoff. A seasonal high water table is at a depth of 12 to 24 inches. The available water capacity is 4 to 6 inches.

Included in mapping are scattered areas of Loamy alluvial land and Marsh; and in the Paige Meadows are areas of this land where the surface layer is light brownish-gray stony loam and the substratum is mottled light-gray gravelly clay loam.

Gravelly alluvial land is used for grazing and urban development. Capability subclass IVw.

Graylock Series

The Graylock series consists of steep, excessively drained, extremely stony soils that are 36 to more than 60 inches deep over rock. These soils formed in residual or colluvial parent material derived from granitic rock. They are on uplands. Slopes are 30 to 50 percent. Elevations are 7,000 to 9,000 feet. The climate is cool and subhumid. The average annual precipitation is 25 to 35 inches, most of which comes as snow. The average annual air temperature is about 40° F., and the frost-free growing season is 30 to 50 days. The vegetation is coniferous timber and an understory of brush.

In a representative profile the surface layer is grayish-brown, medium acid extremely stony loamy coarse sand 8 inches thick. The next layer is light brownish-gray, medium acid gravelly loamy coarse sand 40 inches thick. Below this, at a depth of about 48 inches, is decomposed granitic rock, or grus.

Permeability is rapid. Roots can penetrate to a depth of 36 to 60 inches or more through the soil and cracks in the grus. Available water capacity is 2 to 3.5 inches, depending on the depth to grus.

Graylock soils are used chiefly for timber and wildlife.

Representative profile: Wooded area approximately 1 1/2 miles southwest of Genoa Peak, approximately 1,000 feet east and 500 feet north of the southwest corner of sec. 31, T. 14 N., R. 19 E.

O1--1 inch to 0, litter of conifer needles.

A1--0 to 8 inches, grayish-brown (10YR 5/2) extremely stony loamy coarse sand, very dark grayish brown (10YR 3/2) moist; massive; soft, friable, nonsticky and nonplastic; many very fine roots and few fine, medium, and coarse roots; many very fine interstitial pores; medium acid; abrupt, wavy boundary. 6 to 12 inches thick.

C1--8 to 48 inches, light brownish-gray (10YR 6/2) gravelly loamy coarse sand, dark grayish brown (10YR 4/2) moist; massive; soft, friable, nonsticky and nonplastic; common very fine roots and few fine, medium, and coarse roots; many very fine and few fine and medium interstitial pores; 25 to 50 percent gravel and 10 to 15 percent cobblestones, stones, and boulders; medium acid; abrupt, wavy boundary. 30 to 50 inches thick.

C2--48 inches, variegated, very dark grayish-brown (10YR 3/2), grayish brown (10YR 5/2), and white (10YR 8/2) decomposed granitic rock, or grus.

The depth to grus ranges from 36 to more than 60 inches. The O horizon of conifer needles is 0 to 2 inches thick. The volume of gravel, cobblestones, stones, and boulders ranges from 35 to 65 percent. From 15 to 50 percent of the surface area is covered with stones and boulders. Reaction ranges from medium acid to slightly acid.

The A horizon is grayish brown or brown. The A and C horizons are predominantly gravelly loamy coarse sand, but in some profiles range to gravelly loamy sand. The C horizon is light brownish gray or pale brown.

Graylock soils are similar to Cagwin and Toem soils, but are deeper over grus and have a larger volume of coarse fragments in the underlying layers.

Graylock extremely stony loamy coarse sand, 30 to 50 percent slopes (GsF).--This soil is on uplands. It has the profile described as representative of the series.

About 10 to 15 percent of the total acreage of this soil is inclusions of Cagwin loamy coarse sand, Toem loamy coarse sand, and Rock land.

If this Graylock soil is bare of vegetation, surface runoff is rapid and the erosion hazard is high.

This soil is used mainly for timber and wildlife. Capability subclass VIIs.

Inville Series

The Inville series consists of gently sloping to moderately steep, well-drained soils on alluvial fans, terraces, and flood plains. These soils formed in alluvium and outwash derived from mixed volcanic and granitic parent rocks, of which the dominant rock type is andesite. Slopes are 0 to 30 percent. Elevations are 6,200 to 7,000 feet. The average annual precipitation is 20 to 30 inches, most of which is snow. The average annual air temperature is about 41° F., and the frost-free growing season is 50 to 80 days. The vegetation is coniferous forest and an understory of brush.

In a representative profile the surface layer is brown, medium acid stony coarse sandy loam and gravelly coarse sandy loam 4 inches thick. The subsoil is reddish-brown and brown, medium acid gravelly and cobbly sandy loam 31 inches thick. The substratum is brown, medium acid very gravelly and cobbly loamy coarse sand.

Roots can penetrate to a depth of more than 60 inches. Available water capacity is 3 to 5 inches.

Inville soils are used chiefly for urban development.

Representative profile: Area of urban development in Incline Village approximately 2,200 feet east and 2,200 feet south of the northwest corner of sec. 15, T. 16 N., R. 18 E.

O1--2 inches to 0, litter of conifer needles.

A11--0 to 1 inch, brown (10YR 4/3) stony coarse sandy loam, very dark brown (10YR 2/2) moist; moderate, fine and medium, granular structure; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; 20 percent gravel; medium acid; abrupt, smooth boundary. 1 to 4 inches thick.

A12--1 to 4 inches, brown (10YR 5/3) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky and moderate, fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine interstitial pores and few very fine tubular pores; 20 percent gravel; medium acid; clear, smooth boundary. 3 to 5 inches thick.

B1--4 to 10 inches, brown (10YR 5/3) gravelly coarse sandy loam, variegated with about equal amounts of dark brown (10YR 3/3) and dark yellowish brown (10YR 3/4) moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many fine interstitial pores and common very fine tubular pores; few thin clay films in pores; 20 percent gravel; medium acid; clear, wavy boundary. 4 to 8 inches thick.

B21t--10 to 26 inches, reddish-brown (5YR 5/3) cobbly and gravelly sandy loam, reddish brown (5YR 4/3) moist; weak, medium, subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine interstitial pores and common very fine tubular pores; common thin clay films in pores and few thin clay films on ped faces; 25 percent cobblestones and 35 percent gravel; medium acid; clear, wavy boundary. 10 to 20 inches thick.

B22t--26 to 35 inches, brown (10YR 5/3) cobbly and gravelly sandy loam, brown (10YR 4/3) moist; dark yellowish brown (10YR 4/4) moist clay films; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine and common medium roots; many very fine interstitial pores and few very fine tubular pores; few thin clay films coating and bridging sand grains; 35 percent gravel and 35 percent cobblestones; medium acid; clear, wavy boundary. 9 to 18 inches thick.

C--35 to 60 inches, brown (10YR 5/3) dry and moist, cobbly and very gravelly loamy coarse sand; massive; soft, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many fine and medium interstitial pores; 50 percent gravel and 35 percent cobblestones; medium acid; 15 to 30 inches thick.

The thickness of the solum ranges from 27 to 45 inches. The O horizon of conifer needles is 0 to 2 inches thick. The volume of gravel, cobblestones, stones, and boulders ranges from 15 to 50 percent in

the A horizon and from 35 to 75 percent in the B and C horizons. From 1 to 5 percent of the surface is covered with cobblestones, stones, and boulders.

The A horizon ranges from medium acid to slightly acid, is brown or dark grayish brown, and is dominantly gravelly coarse sandy loam but ranges to gravelly sandy loam or gravelly loamy coarse sand.

The B horizon is predominantly reddish brown but ranges to light reddish brown or brown in hues of 5YR, 7.5YR, and 10YR. It is dominantly gravelly and cobbly sandy loam but ranges to coarse sandy loam or loam.

The C horizon is very gravelly or cobbly loamy coarse sand or coarse sandy loam and ranges widely in color. In some places there is a weakly silica cemented hardpan at a depth of 40 to 68 inches.

Inville soils are similar to Jabu, Elmira, and Meeks soils. They have a larger volume of coarse fragments in the subsoil than Jabu soils. They also have a larger volume of coarse fragments than Elmira soils and are finer textured. They are warmer and finer textured than Meeks soils.

Inville gravelly coarse sandy loam, 0 to 5 percent slopes (IgB).--This soil is on glacial outwash terraces. It has a profile similar to the one described as representative of the series, but its surface layer is 15 to 20 percent gravel and less than 1 percent of the surface area is covered with cobblestones and stones. The subsoil extends to a depth of 40 to 68 inches. It ranges from gravelly, cobbly, very gravelly, or very cobbly coarse sandy loam to light sandy clay loam, and by volume is more than 35 percent coarse fragments. It is underlain by a hardpan, weakly cemented with silica, that is very hard to extremely hard in place, but disintegrates under pressure (pl. II, right).

About 5 percent of the acreage of this soil is Jabu coarse sandy loam, and 5 percent is Jabu coarse sandy loam, shallow variant.

Even if this Inville soil is bare of vegetation, it has slow runoff and only a slight hazard of erosion. Roots form a mat on top of the hardpan. Permeability is very slow in the pan.

This soil is used chiefly for urban development. Some areas are used for timber. Capability subclass IVe.

Inville stony coarse sandy loam, 2 to 9 percent slopes (IsC).--This soil is on alluvial fans, terraces, and flood plains. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Cagwin, Jabu, and Umpa soils; and near Incline Village on the shores of Lake Tahoe, areas of Jabu coarse sandy loam, shallow variant.

Runoff is slow to medium on this Inville soil, and the erosion hazard is slight to moderate. Permeability is moderately rapid.

This soil is used chiefly for urban development. Capability subclass IVe.

Inville stony coarse sandy loam, 9 to 15 percent slopes (IsD).--This soil is on alluvial fans and terraces. About 5 percent of the acreage is Jabu coarse sandy loam and Jabu coarse sandy loam, shallow variant.

Unless this Inville soil has a protective cover of vegetation, surface runoff is rapid and the erosion hazard is moderate. Limitations are moderate in reestablishing vegetation. Permeability is moderately rapid.

This soil is used chiefly for urban development. Capability subclass IVe.

Inville stony coarse sandy loam, 15 to 30 percent slopes (IsE).--This moderately steep or hilly soil is on alluvial fans and terraces.

Included with this soil in mapping are areas of Jabu coarse sandy loam, Elmira gravelly loamy coarse sand, and Meeks very stony loamy coarse sand.

Unless this Inville soil has a protective cover of vegetation, surface runoff is rapid and the erosion hazard is high. Limitations are moderate in reestablishing vegetation. Permeability is moderately rapid.

The principal use of this soil is urban development. Capability subclass IVe.

Jabu Series

The Jabu series consists of nearly level to moderately steep, well drained to moderately well drained soils that are about 40 inches deep over a dense fragipan. These soils are on glacial outwash terraces. The parent material is mixed, but is predominantly granitic alluvium. Slopes are 0 to 20 percent. Elevations are 6,200 to 6,900 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 42° F., and the frost-free season is 50 to 80 days. The vegetation is a coniferous forest and an understory of shrubs.

In a representative profile the surface layer is brown, medium acid coarse sandy loam about 6 inches thick. To a depth of about 45 inches, the subsoil is brown and strong-brown, medium acid and strongly acid coarse sandy loam and gravelly coarse sandy loam. Below this is a brittle, dense fragipan over highly weathered, compacted till.

Permeability is moderate in the subsoil and slow in the pan. In spring and early in summer, water moves laterally along the contact between the fragipan and the compacted till.

Jabu soils are used for homesites, range, and timber.

Representative profile: Wooded area about 5.5 miles south of Bijou, 15 feet north of Fountain Place road, 0.2 mile east of the southwest corner of sec. 23, T. 12 N., R. 18 E.

O1--1 inch to 0, fir needles.
A1--0 to 2 inches, brown (7.5YR 5/4) coarse sandy loam, dark brown (7.5YR 3/2) moist; weak, thick, platy structure; soft, very friable, nonsticky and nonplastic; many very fine and few fine roots; common very fine interstitial

pores; 10 percent gravel; medium acid; clear, smooth boundary. 2 to 6 percent slopes.

A3--2 to 6 inches, brown (7.5YR 5/4) coarse sandy loam, reddish brown (5YR 4/4) moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and common fine, medium, and coarse roots; common very fine interstitial pores and few fine tubular pores; 10 percent gravel; medium acid; clear, smooth boundary. 4 to 12 inches thick.

B1t--6 to 10 inches, brown (7.5YR 5/4) coarse sandy loam, reddish brown (5YR 4/4) moist; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; common very fine interstitial pores and few fine tubular pores; common thin clay films as bridges and coatings on sand grains; 11 percent gravel; medium acid; clear, smooth boundary. 4 to 15 inches thick.

B21t--10 to 20 inches, strong-brown (7.5YR 5/6) coarse sandy loam, dark reddish brown (5YR 3/4) moist; massive; hard, friable, nonsticky and nonplastic; many very fine and coarse roots; common very fine tubular and interstitial pores; many thin clay films in bridges and coatings on sand grains, clay films moderately thick in places; 11 percent gravel; strongly acid; abrupt, wavy boundary. 8 to 12 inches thick.

IIB22tb--20 to 29 inches, strong-brown (7.5YR 5/6) gravelly coarse sandy loam, yellowish red (5YR 4/6) moist; brown (7.5YR 5/4) coatings; massive; hard, firm, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine tubular and interstitial pores and few fine tubular pores; many thin and few moderately thick clay films in bridges and coatings on sand grains; few cobblestones on upper boundary of horizon; 17 percent gravel; strongly acid; gradual, smooth boundary. 8 to 12 inches thick.

IIB23tb--29 to 37 inches, strong-brown (7.5YR 5/6, 5/8) gravelly coarse sandy loam, yellowish red (5YR 5/6) moist; brown (7.5YR 5/4) coatings; massive; hard, firm, slightly sticky and slightly plastic; very few fine, medium, and coarse roots; common very fine interstitial and tubular pores and few fine tubular pores; continuous thin and few moderately thick clay films in bridges and coatings on sand grains; 16 percent gravel; strongly acid; gradual, wavy boundary. 8 to 12 inches thick.

IIB24tb--37 to 45 inches, strong-brown (7.5YR 5/6, 5/8) gravelly coarse sandy loam, yellowish red (5YR 4/8) moist; massive; hard, firm, slightly sticky and slightly plastic; very few fine, medium, and coarse roots; common very fine interstitial pores; continuous, moderately thick, yellowish-red (5YR 4/6) clay films in bridges and coatings on sand grains; 29 percent gravel; strongly acid; abrupt, wavy boundary. 7 to 10 inches thick.

IIIBx1--45 to 52 inches, variegated reddish-yellow and strong-brown (7.5YR 6/6, 5/6) loamy coarse sand, strong brown (7.5YR 5/6, 5/8) moist; light-gray (10YR 7/2) bleached areas, reddish yellow (7.5YR 6/6) moist; massive; hard, firm, brittle, nonsticky and nonplastic; no roots; common very fine interstitial pores; common thin clay films line pores; 7 percent gravel; strongly acid; clear, wavy boundary. 5 to 7 inches thick.

IIIBx2--52 to 66 inches, light-gray (2.5Y 7/2) loamy coarse sand, olive gray (5Y 5/2) moist; dark grayish-brown (2.5Y 4/2) bands; massive; extremely hard, extremely firm, brittle, nonsticky and nonplastic; no roots; few very fine interstitial pores; 10 percent gravel; strongly acid; clear, wavy boundary. 5 to 14 inches thick.

IVC1--66 to 72 inches, white (N 8/0), finely stratified sandy loam and silty clay, light gray (N 7/0) moist; strong, medium, platy structure; slightly hard, firm, nonsticky and plastic; horizon has very thin horizontal bands of clay and silt and black coatings on plate surfaces; 6 percent gravel; strongly acid. 0 to 6 inches thick.

VC2--72 inches, light-gray (2.5Y 7/2) compacted till, grayish brown (2.5Y 5/2) moist; auger sample.

Thickness of the solum over the fragipan ranges from 40 to 80 inches. In places the profile is as much as 20 percent stones and cobblestones.

The A horizon ranges from brown to yellowish brown in hues of 10YR and 7.5YR, and to 5YR if it is moist. It ranges from loamy coarse sand to coarse sandy loam and from weak platy structure to weak subangular blocky or strong granular structure. It is slightly acid or medium acid and 6 to 17 inches thick.

The Bt horizon ranges from brown or strong brown to yellowish red in hues of 7.5YR and 5YR. It ranges from coarse sandy loam to loamy coarse sand and in places is as much as 45 percent gravel. It is 3 to 6 percent higher in clay content than the A horizon. It has weak blocky structure or is massive and is medium acid or strongly acid. The fragipan is in the lower part of the Bt horizon and, in some profiles, is in the C horizon. The pan is massive, has bleached seams, and is brittle and hard to extremely hard when dry and firm to extremely firm when moist. Below the pan in most profiles is compacted till.

Jabu soils are similar to Inville soils and Jabu soils, shallow variant. They are not so gravelly in the subsoil as Inville soils. They are deeper over the fragipan than Jabu soils, shallow variant.

Jabu coarse sandy loam, 0 to 9 percent slopes (JaC).--This soil is on glacial outwash terraces. It has a profile similar to the one described as

representative of the series, but the surface layer is 8 to 20 inches thick and in some areas the fragipan is underlain by lake-laid sediments.

About 5 percent of the acreage of this soil is Jabu coarse sandy loam, shallow variant; about 5 percent is Elmira gravelly loamy coarse sand; about 2 percent is Elmira-Gefo loamy coarse sands; and 10 percent is a soil that is similar to this Jabu soil, but does not have a fragipan.

This Jabu soil is well drained. Even in areas bare of vegetation, surface runoff is slow and the erosion hazard is only slight to moderate. Roots can penetrate to a depth of 40 to 60 inches or more. Available water capacity is 4 to 5.5 inches.

This soil is used mainly for urban development. Small areas are used for limited grazing and timber. Capability subclass IVe.

Jabu coarse sandy loam, 9 to 20 percent slopes (JaD).--This soil is on glacial outwash terraces. It has the profile described as representative of the series.

About 10 percent of the acreage of this soil is a soil that is similar to this Jabu soil, but does not have a fragipan; 5 percent is Jabu coarse sandy loam, shallow variant; 5 percent is Elmira gravelly loamy coarse sand; and 2 percent is Gefo loamy coarse sand.

This Jabu soil is well drained. In areas bare of vegetation, however, surface runoff is medium and the erosion hazard is high. The available water capacity is 4 to 5.5 inches. Roots can penetrate to a depth of 40 to 60 inches or more.

This soil is used chiefly for urban development. Some areas are used for limited grazing and timber. Erosion caused by concentrated runoff from urban development is a major concern. Capability subclass IVe.

Jabu coarse sandy loam, seeped, 2 to 15 percent slopes (JbD).--This soil occupies concave positions in moraines above the Upper Truckee River, west of Meyers. Water moving laterally from higher lying, adjacent soils accumulates to develop seeps and raises the water table to within a depth of 2 or 3 feet during spring and summer. The downward movement of water is impeded by the fragipan and the underlying compacted till. The vegetation is a thicket of lodgepole pine and white fir. This soil has a profile similar to the one described as representative for the series, but it is seeped and is shallower over the fragipan, and the upper part of the pan is mottled.

This soil is only 30 to 40 inches deep over the fragipan and is therefore outside the range defined for the series, but this does not significantly alter its usefulness or behavior.

About 5 percent of the acreage of this soil is Meeks stony loamy coarse sand, and 5 percent is Meeks gravelly loamy coarse sand.

This Jabu soil is moderately well drained. Water moves laterally along the upper part of the fragipan in spring and early in summer. The underlying compacted till is saturated throughout the year. Even if this soil is bare of vegetation, it has slow to medium runoff and only a slight to moderate hazard of erosion. Roots can penetrate to a depth of 30 to 40 inches. Available water capacity is 2.5 to 3.5 inches.

This soil is used mainly for urban development. Capability subclass IVw.

Jabu Series, Shallow Variant

The Jabu series, shallow variant, consists of nearly level to strongly sloping, moderately well drained soils that are 11 to 25 inches deep over a fragipan. These soils are on glacial outwash terraces. The parent material is mixed, but is predominantly granitic alluvium. Slopes are 0 to 15 percent. Elevations are 6,200 to 6,400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 43° F., and the frost-free season is 50 to 80 days. The vegetation consists of Jeffrey pine, lodgepole pine, and white fir, and an understory of mountain shrubs.

In a representative profile the surface layer is brown, medium acid coarse sandy loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. The upper 3 inches is reddish-yellow, medium acid coarse sandy loam. The rest is a reddish-yellow to pale-brown, slightly acid to medium acid, dense, compact fragipan (pl. III, left).

The water table stands at a depth of about 3 to 4 feet during spring snowmelt; it is very low late in summer and in fall. Permeability is very slow. Many roots penetrate as far down as the fragipan, but few penetrate the pan. Bulk density of the pan ranges from 1.7 to 2.2 grams per cubic centimeter. Excavation is difficult when the soil is dry.

Jabu soils, shallow variant, are used for homesites and timber.

Representative profile: Wooded area about 1.3 miles northeast of Meyers, 100 feet south of dirt road extension of Oneidas Street, 2,700 feet east and 200 feet south of the northwest corner of sec. 28, T. 12 N., R. 18 E.

O1--1 inch to 0, pine needle litter.

A11--0 to 3 inches, brown (7.5YR 5/4) coarse sandy loam, dark brown (7.5YR 3/2) moist; weak, thin and medium, platy structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; very few very fine interstitial pores and very few fine tubular pores; medium acid; abrupt, wavy boundary. 3 to 6 inches thick.

A12--3 to 8 inches, brown (7.5YR 5/4) coarse sandy loam, dark brown (7.5YR 3/2) moist; weak, medium and coarse, subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine and medium roots; very few very fine interstitial pores and very few fine tubular pores; medium acid; clear, wavy boundary. 3 to 5 inches thick.

B11t--8 to 11 inches, reddish-yellow (7.5YR 6/6) coarse sandy loam, reddish brown (5YR 4/4) moist; weak, medium and coarse, subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; very few medium interstitial pores and very few fine tubular pores; few thin clay films in bridges and pores; medium acid; abrupt, wavy boundary. 5 to 14 inches thick.

B12tx--11 to 14 inches, reddish-yellow (7.5YR 6/6) coarse sandy loam, reddish brown (5YR 4/4) moist; one-eighth inch, random horizontally and diagonally oriented, disconnected, white (10YR 8/2) seams; massive; hard and brittle, very friable, nonsticky and nonplastic; few fine, medium and coarse roots; very few very fine interstitial pores and fine tubular pores; many strong-brown (7.5YR 5/6) thin clay films in bridges and pores; soft, very friable and nonbrittle seams that contain many bleached sand grains; medium acid; abrupt, wavy boundary. 3 to 5 inches thick.

B13tx--14 to 19 inches, light-brown (7.5YR 6/3) coarse sandy loam, brown (7.5YR 4/4) moist; strong-brown (7.5YR 5/6) spots; few very pale brown (10YR 9/3) seams; massive; hard and brittle, friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many very fine and few fine interstitial pores; common very thin clay films in bridges; soft, very friable and nonbrittle seams that contain many bleached sand grains; medium acid; clear, wavy boundary. 0 to 6 inches thick.

B14tx--19 to 29 inches, light yellowish-brown (10YR 6/4) sandy loam, strong brown (7.5YR 4/6) moist; very pale brown (10YR 8/3) seams; massive; hard and brittle, friable, sticky and plastic; few very fine and fine roots; common very fine and few fine interstitial pores; many strong-brown and reddish-yellow (7.5YR 5/6, 6/6), thin clay films and very few moderately thick clay films in bridges; soft, very friable and nonbrittle seams that contain many bleached sand grains; medium acid; abrupt, wavy boundary. 0 to 10 inches thick.

B21tx--29 to 44 inches, pale-brown (10YR 6/3) coarse sandy loam, brown (10YR 4/3) moist; very pale brown (10YR 7/3) seams; few, fine and medium, reddish-yellow (7.5YR 6/8) iron stains; massive; very hard and brittle, friable, sticky and plastic; few very fine and fine roots; common very fine and few fine interstitial pores; many thin and common moderately thick brown (7.5YR 4/4) clay films as bridges; soft, very friable and nonbrittle seams that contain many bleached sand grains; medium acid; clear, wavy boundary. 10 to 15 inches thick.

B22tx--44 to 64 inches, strong-brown (7.5YR 5/6, when crushed) gravelly coarse sandy loam, dark yellowish brown (10YR 4/4) moist; many white (10YR 8/2), unoriented seams one-eighth to one-fourth inch wide; few, coarse, prominent, yellowish-red and reddish-brown (5YR 5/8, 4/4) iron stains; massive; very hard and brittle, friable, slightly sticky and plastic; few fine and medium roots; common very fine and fine interstitial pores; many, thin, and few, moderately thick, dark reddish-brown (5YR 3/3) clay films as bridges; soft, very friable and nonbrittle seams that contain many bleached sand grains; diffuse, smooth boundary. 10 to 20 inches thick.

B31tx--64 to 75 inches, reddish-yellow (7.5YR 6/6) gravelly coarse sandy loam, brown (7.5YR 4/4) moist; many white (10YR 8/2), unoriented seams one-eighth to one-fourth inch wide; common, medium, prominent reddish-yellow (5YR 6/6) mottles; few coarse and common fine iron stains, strong brown (7.5YR 5/8) moist; massive; very hard, friable, slightly sticky and plastic; few fine and medium roots; common very fine and fine interstitial pores; common, moderately thick, dark reddish-brown (5YR 3/4), moist clay bands; common moderately thick and few thin clay films in bridges and on sand grains; soft, very friable and nonbrittle seams that contain many bleached sand grains; medium acid; gradual, irregular boundary. 5 to 12 inches thick.

B32tx--75 to 80 inches, brown (7.5YR 4/4, when crushed) gravelly coarse sandy loam, yellowish brown (10YR 5/6) moist; common white (10YR 8/2) seams one-eighth inch wide and common moderately thick seams; dark reddish brown (5YR 3/3) moist; many, medium, distinct mottles in hue of 7.5YR; massive; very hard, very friable, nonsticky and slightly plastic; few fine and medium roots; many very fine and few fine interstitial pores; many clay bands in hue of 7.5YR; soft, very friable and nonbrittle seams that contain many bleached sand grains; slightly acid; gradual, wavy boundary. 5 to 15 inches thick.

Depth to the fragipan ranges from 11 to 25 inches. Reaction of the Btx horizon is medium acid to strongly acid.

The A horizon is 6 to 11 inches thick. The A1 horizon is dark grayish brown, brown, strong brown, or reddish brown in hues of 10YR, 7.5YR, and 5YR when dry and dark brown, dark reddish brown, or reddish brown in hues of 5YR, 7.5YR, and 10YR when moist. It ranges from platy or subangular blocky structure to granular. It is typically coarse sandy loam, but in places is as much as 20 percent fine gravel.

The fragipan begins in the lower part of the B1 horizon and extends through the B2t and B3 horizons. It is hard to extremely hard when dry.

Jabu soils, shallow variant, are similar to Inville and Jabu soils and to Jabu soils, moderately fine subsoil variant. They have a less gravelly subsoil than Inville soils and have a fragipan, whereas those soils do not. They are shallower over the pan than Jabu soils. They differ from Jabu soils, moderately fine subsoil variant, in that those soils do not have a fragipan and are moderately deep over lake sediments.

Jabu coarse sandy loam, shallow variant, 0 to 5 percent slopes (JeB).--This soil is on glacial outwash terraces. It has the profile described as representative of the series.

About 5 percent of the acreage of this soil is Jabu coarse sandy loam; 2 percent is Elmira gravelly loamy coarse sand; 1 percent is Inville gravelly coarse sandy loam; and 2 percent is Elmira and Gefo loamy coarse sands. Another inclusion in some swale areas is a soil that is similar to this Jabu soil, but is somewhat poorly drained to poorly drained.

Even if this Jabu soil is bare of vegetation, it has slow runoff and is subject to only a slight hazard of erosion. It holds 4 to 6 inches of water available to plants in the 60-inch root zone.

This soil is used chiefly for urban development. Capability subclass IVe.

Jabu coarse sandy loam, shallow variant, 5 to 15 percent slopes (JeD).--This soil is on outwash terraces in the Stateline area at the south end of the Lake. The depth to unrelated decomposed granitic rock, or grus, ranges from 40 to 60 inches. Coarse fragments consisting of rounded quartz pebbles and cobblestones make up to 15 percent of the soil volume. The surface layer of this soil is 8 to 16 inches thick. Otherwise, this soil has a profile similar to the one described as representative for the series.

About 15 percent of the acreage of this soil is Cagwin loamy coarse sand and Toem coarse sand, and 5 percent is Jabu coarse sandy loam, shallow variant, 0 to 5 percent slopes.

If this Jabu soil is bare of vegetation, it has medium runoff and is subject to a moderate hazard of erosion. It holds 3 to 6 inches of water available to plants in its 40- to 60-inch root zone.

This soil is used mainly for urban development. Capability subclass IVe.

Jabu Series, Moderately Fine Subsoil Variant

The Jabu series, moderately fine subsoil variant, consists of level to moderately sloping, well drained and moderately well drained soils that overlie lake sediments. These soils formed in alluvium from mixed sources that was deposited over older lake sediments. Slopes range from 0 to 9 percent. Elevations are 6,200 to 6,800 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is about 43° F., and the frost-free season is 50 to 80 days. The vegetation is an open stand of Jeffrey pine and white fir and an understory of bitterbrush, greenleaf manzanita, sagebrush, and other shrubs.

In a representative profile the surface layer is dark yellowish-brown, slightly acid stony sandy loam about 5 inches thick. The subsoil is brown and strong-brown, slightly acid and medium acid loam and sandy clay loam that extends to a depth of 29 inches. Below this is older lake sediment of clay loam texture.

Permeability is moderately slow in the subsoil and very slow in the substratum.

The Jabu moderately fine subsoil variant is used for homesites and timber.

Representative profile: Wooded area 1 mile west of Kings Beach, 1,000 feet east and 300 feet north of the southwest corner of sec. 12, T. 16 N., R. 17 E.

O1&O2--1 inch to 0, litter and duff.

A1--0 to 5 inches, dark yellowish-brown (10YR 4/4) stony sandy loam, dark brown (7.5YR 3/2) moist; moderate, fine and medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine and few coarse roots; common very fine interstitial pores; slightly acid; clear, smooth boundary. 4 to 12 inches thick.

B2t--5 to 19 inches, brown (10YR 5/3) heavy loam, dark reddish brown (5YR 3/4) moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine roots and common medium and coarse roots; common very fine interstitial pores; few thin clay films as bridges; medium acid; abrupt, wavy boundary. 9 to 21 inches thick.

IIB2tb--19 to 29 inches, strong-brown (7.5YR 5/6) sandy clay loam, brown (7.5YR 4/4) moist; massive; hard, firm, sticky and plastic; few very fine and fine roots; common very fine tubular and interstitial pores; common thin clay films in pores and as bridges; common, fine, black manganese stains; slightly acid; abrupt, wavy boundary. 10 to 20 inches thick.

IIIC--29 to 60 inches, light-gray, old lake sediments of clay loam texture; massive; upper 3 inches is banded with many, medium, faint, light olive-brown mottles; slightly acid.

The depth of the soil over lake sediments ranges from 23 to 53 inches. Stones and large cobblestones make up as much as 5 percent of the surface area. In wooded areas, there is a thin O horizon.

The A horizon is grayish brown, brown, dark brown, or dark yellowish brown in hues of 10YR and 7.5YR when dry and dark brown or dark reddish brown in hues of 7.5YR and 5YR when moist. This horizon ranges from coarse sandy loam to loam and in places is as much as 20 percent gravel. It is 4 to 8 inches thick.

The Bt horizon ranges from strong brown to reddish yellow or pale brown and white in hues of 7.5YR, 5YR, or 10YR. It ranges from heavy loam or sandy clay loam to clay loam. It has blocky structure or is massive. The B2t horizon is stratified and in places contains layers of buried soils. It is slightly acid to medium acid.

The C horizon consists of unrelated, older lake sediments of clay loam to clay texture. In places it contains volcanic ash and diatomaceous earth. It is slightly acid to moderately alkaline.

Jabu soils, moderately fine subsoil variant, are similar to Fugawee, Jabu, Jabu shallow variant,

Inville, and Tahoma soils. In contrast with Fugawee and Tahoma soils, they formed in alluvium, whereas those soils formed in residuum. In contrast with Jabu soils and Jabu shallow variant, they overlie lake sediments. In contrast with Inville soils they have a less gravelly subsoil and overlie lake sediments, whereas those soils overlie alluvium and outwash sediments.

Jabu sandy loam, moderately fine subsoil variant, 0 to 9 percent slopes (JgC).--This soil is near Meyers on toe slopes of the lateral moraine between Pioneer Trail Road and the Truckee meadow by the Tahoe Airport. It has a profile similar to the one described as representative of the variant, but it is not stony and the alluvium is predominantly from granitic sources.

The thickness of the soil over the lake sediment ranges from 30 to 53 inches. The surface layer ranges from brown to grayish brown and from coarse sandy loam to fine sandy loam. It is 6 to 10 inches thick. The subsoil ranges from pale brown to white. Mottles and iron bands are common in the lower part of the subsoil. The substratum, or the lake sediment, is of clay loam to clay texture.

About 2 percent of the acreage of this soil is Elmira gravelly loamy coarse sand; 5 percent is Jabu sandy loam, shallow variant; and 3 percent is Jabu coarse sandy loam. About 10 percent of the acreage is a light-gray soil that formed in lake sediment and has a silt loam surface layer and a silty clay loam subsoil; 5 percent is a claypan soil that is shallow over lake sediment and has a cover of low sagebrush; and 5 percent is a poorly drained, darker colored soil in swales and meadow areas.

This Jabu soil is moderately well drained. In spring during periods of runoff, water moves laterally along the contact between the subsoil and the lake sediment. Seeps appear in concave positions where cuts are made into the lake sediment. Even if this soil is bare of vegetation, surface runoff is slow and the erosion hazard is slight to moderate. Roots penetrate to a depth of 30 to 53 inches. Available water capacity is 4 to 6 inches.

This soil is used mainly for urban development. Capability subclass IVe.

Jabu stony sandy loam, moderately fine subsoil variant, 2 to 9 percent slopes (JhC).--This soil is on alluvial fans that extend from Tahoe City to Kings Beach. The alluvium is from andesitic sources. The profile of this soil is the one described as representative of the variant.

About 5 percent of the acreage is a soil along drainageways that is similar to this Jabu soil, but is very deep and its subsoil is more than 50 percent coarse fragments; about 5 percent is a stone-free soil; about 2 percent along the contact with the upland soils is either Tahoma stony sandy loam or Jorge very stony sandy loam; and about 5 percent near the Lake shore is a soil that is similar to this Jabu soil, but is moderately deep over a silica-cemented pan and is underlain by gravelly alluvium.

This Jabu soil is well drained. In spring during the period of runoff, there is some lateral movement of water along the contact between the subsoil and the lake sediment. Even if this soil is bare of vegetation, surface runoff is slow and the erosion hazard is only slight. Roots can penetrate to a depth of 23 to 44 inches. Available water capacity is 3 to 5 inches.

This soil is used chiefly for homesites and timber. Capability subclass IVe.

Jorge Series

The Jorge series consists of gently sloping to steep, well-drained, stony soils that are underlain by basic volcanic rock--andesite, basalt, and latite. These soils formed on uplands. Slopes range from 2 to 50 percent. Elevations are 6,200 to 9,000 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 40° F., and the frost-free season is 30 to 50 days. The vegetation is a semidense to dense stand of conifers, mostly red fir, white fir, Jeffrey pine, and Western white pine, and an understory of mountain shrubs.

In a representative profile the surface layer is brown, medium acid very stony sandy loam and very gravelly sandy loam about 22 inches thick. The subsoil is brown, medium acid very gravelly loam about 26 inches thick. The substratum is dark yellowish-brown, medium acid gravelly sandy loam that grades to weathered volcanic rock at a depth of about 84 inches.

Permeability is moderate. The effective rooting depth is more than 60 inches, and the available water capacity is 3 to 5 inches.

Jorge soils are used for timber, watershed, and homesites.

Representative profile: Wooded area about 4 miles north of Tahoe City; 1,200 feet west of the northeast corner of sec. 19, T. 16 N., R. 17 E.

O1&O2--1 1/2 inches to 0, litter and duff, mainly from manzanita.

A11--0 to 9 inches, brown (7.5YR 5/4) very stony heavy sandy loam, dark brown (7.5YR 4/4) moist; weak, very fine, subangular blocky structure; soft, very friable, nonsticky and slightly plastic; many very fine and fine roots and common medium and coarse roots; many very fine and fine interstitial pores; slightly hydrophobic (resistant to wetting); 5 percent stones and 1 percent cobblestones; medium acid; clear, smooth boundary. 6 to 12 inches thick.

A12--9 to 22 inches, brown (7.5YR 5/4) very gravelly heavy sandy loam, dark brown (7.5YR 4/4) moist; weak, very fine and fine, subangular blocky structure; soft, friable, nonsticky and slightly plastic; many very fine and fine roots and common medium and coarse roots; many very fine and fine interstitial pores; 40 percent gravel and 4 percent cobblestones; medium acid; clear, wavy boundary. 9 to 13 inches thick.

B1--22 to 32 inches, brown (7.5YR 5/4) very gravelly light loam, dark brown (7.5YR 4/4) moist; weak, fine, subangular blocky structure; soft, friable, nonsticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores and common very fine vesicular pores; 35 percent gravel and 3 percent cobblestones; medium acid; clear, wavy boundary. 10 to 12 inches thick.

B2t--32 to 48 inches, brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 4/4) moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots and common medium and coarse roots; many very fine and fine interstitial pores and few very fine vesicular pores; few thin clay films as bridges; 40 percent gravel and 2 percent cobblestones; medium acid; gradual, wavy boundary. 15 to 31 inches thick.

C1--48 to 84 inches, dark yellowish-brown (10YR 4/4) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine and fine interstitial pores; 45 percent gravel and 2 percent cobblestones; medium acid; gradual, wavy boundary. 10 to 40 inches thick.

C2--84 inches, weathered vesicular andesitic conglomerate.

The depth to bedrock is more than 60 inches. The O horizon is less than 3 inches thick. Base saturation is less than 60 percent in parts of the B2t horizon. Reaction is slightly acid and medium acid in the A horizon and strongly acid and medium acid in the B horizon.

The A horizon is brown, dark yellowish brown, or pale yellowish brown in hues of 7.5YR and 10YR when dry and dark brown, dark-yellowish brown, or reddish brown in 10YR, 7.5YR, and 5YR when moist. In moist soil the dark-colored chromas are in the top few inches of the surface layer. The A horizon ranges from weak granular structure through weak subangular blocky and from gravelly or very gravelly sandy loam to loam.

The B2t horizon is yellowish brown, light yellowish brown, brown, or reddish brown in hues of 10YR, 7.5YR, and 5YR when dry and dark brown, brown, dark yellowish brown, or dark reddish brown in hues of 10YR, 7.5YR, and 5YR when moist. This horizon is gravelly to very gravelly and ranges from sandy clay loam through clay loam. It is 35 to 65 percent, by volume, coarse fragments that range in size from gravel through stones.

In places the upper part of the bedrock has weathered into soil material. In most places 5 to 15 percent of the surface area is covered with stones and large cobblestones, but in some, 15 to 30 percent is covered with cobblestones.

Jorge soils are similar to Fugawee, Tahoma, and Umpa soils. They have a larger volume of coarse fragments in the subsoil than Tahoma soils. They are deeper over rock than Fugawee and Umpa soils.

The Jorge soils in the Tahoe Basin Area are mapped only with Tahoma soils.

Jorge-Tahoma cobbly sandy loams, 2 to 15 percent slopes (JtD).--These soils are on volcanic flows in the northern part of the survey area. The Jorge soil makes up about 55 percent of the mapping unit, the Tahoma soil about 40 percent, and Jorge and Tahoma very stony sandy loams and scattered small areas of Rock land make up the other 5 percent.

Jorge and Tahoma soils have a profile similar to the one described as representative of their respective series, but angular cobblestones cover 15 to 30 percent of the surface area of both. The Tahoma soil is described under the heading "Tahoma Series."

The Jorge soil is well drained and has moderate permeability in the subsoil. Runoff is slow to medium, even if the soil is bare of vegetation, and the erosion hazard is only slight. Roots can penetrate to a depth of more than 60 inches, and the available water capacity is 3 to 5 inches.

The Tahoma soil is well drained and has moderate subsoil permeability. Runoff is slight to medium, and the erosion hazard is slight. Roots can penetrate to a depth of 43 to 84 inches, and the available water capacity is 4.5 to 6.5 inches.

These soils are used for timber and homesites. Capability subclass VIe.

Jorge-Tahoma very stony sandy loams, 2 to 15 percent slopes (JwD).--These soils are on volcanic flows in the northern part of the survey area. The Jorge soil makes up about 45 percent of the mapping unit, and the Tahoma soil about 40 percent. Fugawee very stony sandy loam, Umpa very stony sandy loam, and a soil in the Kings Beach area, similar to the Jorge soil, but alluvial in origin, makes up the other 15 percent.

The Tahoma soil is described under the heading "Tahoma Series." It has a profile similar to the one described as representative of the series, but 5 to 15 percent of the surface area is covered with cobblestones and boulders.

The Jorge soil is well drained and has moderate subsoil permeability. If it is bare of vegetation, runoff is slow to medium and the erosion hazard is only slight. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 3 to 5 inches.

The Tahoma soil is well drained and has moderate subsoil permeability. Runoff is slow to medium, and the erosion hazard is slight. Roots can penetrate to a depth of more than 60 inches, and the available water capacity is 4.5 to 6.5 inches.

These soils are used for timber and homesites. Capability subclass VIs.

Jorge-Tahoma very stony sandy loams, 15 to 30 percent slopes (JwE).--These soils are on volcanic flows in the northern part of the survey area. The Jorge soil makes up about 50 percent of the unit. It occupies the steeper, convex parts of the landscape. The Tahoma soil makes up about 35 percent of

the unit. It occupies the slightly concave bench positions. About 15 percent of the unit is Umpa very stony sandy loam, Fugawee very stony sandy loam, Stony colluvial land, Rock land, and Rock outcrop and Rubble land.

The Jorge soil has the profile described as representative of the Jorge series. The Tahoma soil has a profile similar to the one described as representative of the Tahoma series, but cobblestones, stones, and rock outcrops cover 5 to 15 percent of the surface area.

The Jorge soil is well drained and has moderate subsoil permeability. If it is bare of vegetation, runoff is medium and the erosion hazard is moderate. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 3 to 5 inches.

The Tahoma soil is well drained and has moderate subsoil permeability. Runoff is medium, and the erosion hazard is moderate. Roots can penetrate to a depth of 43 to more than 60 inches, and the available water capacity is 4.5 to 6.5 inches.

These soils are used for timber and homesites. Capability subclass VIs.

Jorge-Tahoma very stony sandy loams, 30 to 50 percent slopes (JwF).--These soils are on volcanic mountains in the northern part of the survey area. The Jorge soil makes up about 60 percent of the unit, and the Tahoma soil about 30 percent. The remaining 10 percent is Umpa very stony sandy loam, Stony colluvial land, Rock land, and Rock outcrop and Rubble land.

The Tahoma soil has a profile similar to the one described as representative of the series, but rocks, stones, and boulders cover 5 to 15 percent of the surface area.

The Jorge soil is well drained and has moderate subsoil permeability. If it is bare of vegetation, runoff is rapid and the erosion hazard is high. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 3 to 5 inches. Inherent fertility is moderate.

The Tahoma soil is well drained and has moderate subsoil permeability. Runoff is rapid, and the erosion hazard is high. Roots can penetrate to a depth of 43 to more than 60 inches, and the available water capacity is 4.5 to 6.5 inches.

These soils are used for timber and watershed. Capability subclass VIs.

Loamy Alluvial Land

Loamy alluvial land (Lo) consists of small areas of recent alluvium adjacent to stream channels and in meadows. It is nearly level to gently sloping. The vegetation is sedges, meadow grasses, and scattered lodgepole pine.

The surface layer is dark grayish-brown to dark-brown, slightly acid to medium acid sandy loam to silt loam. In places it is covered with 1 inch to 6 inches of peat. Below this is stratified, mottled sandy loam to silty clay loam. The substratum, at a depth of more than 48 inches, is gravel, lake sediment, or loamy alluvium.

Loamy alluvial land is somewhat poorly drained to poorly drained. Permeability and the available water capacity vary. Runoff is very slow, and the erosion hazard is slight. Flooding is a hazard in spring during periods of runoff. The seasonal high water table is at a depth of 12 to 24 inches.

Included in mapping are scattered areas of Gravelly alluvial land and Marsh.

Loamy alluvial land is used for grazing and urban development. Capability subclass IVw.

Marsh

Marsh (Mh) is in the Upper Truckee Marsh and in very poorly drained and ponded meadows. It is mostly nearly level. The vegetation is reeds, sedges, and tules in the ponded areas and sedges, meadow grasses, and scattered thickets of willow and lodgepole pine in the very poorly drained areas.

Most of the acreage is under water for at least 10 months of the year. In the very poorly drained areas, the surface is covered with about 6 to 8 inches of reddish-brown peat. Below this is about 6 to 10 inches of black peat, which is underlain by black muck. The substratum, at a depth of 30 to 60 inches, is gleyed sand and gravel.

Permeability varies. Runoff is ponded, and the erosion hazard is slight.

Included in mapping are scattered areas of Elmira soils, wet variant, and Loamy alluvial land.

Marsh is used for recreation, wildlife, and limited grazing. Some areas are being filled and used for homesites (pl. IV, top). Capability subclass VIIw.

Meeks Series

The Meeks series consists of level to very steep, somewhat excessively drained, stony soils that are 41 to 70 inches deep over a hardpan weakly cemented with silica. These soils are on glacial outwash of Tioga and Tahoe age and on mountainous glacial moraines. The parent material is mixed, but is dominantly of granitic origin. Slopes range from 0 to 60 percent. Elevations are 6,200 to 7,700 feet. The average annual precipitation is 35 to 45 inches, the average annual air temperature is about 41° F., and the frost-free season is 30 to 50 days. The vegetation is sparse coniferous woodland and an understory of brush and some perennial grass.

In a representative profile the surface layer is grayish-brown and brown, slightly acid very stony loamy coarse sand and gravelly loamy coarse sand about 11 inches thick. The next layers are pale-brown, slightly acid and medium acid gravelly loamy coarse sand and very gravelly loamy coarse sand about 50 inches thick. Below a depth of 61 inches is light-gray, strongly acid gravelly loamy coarse sand that is weakly cemented with silica and has a nearly continuous, very thin silica-cemented lamina on the surface.

Permeability is rapid as far down as the weakly cemented substratum. It is slow in the substratum.

Meeks soils are used for timber, watershed, and homesites.

Representative profile: In Glenridge subdivision, one-half mile north of Meeks Bay and one-fourth mile east of the center of sec. 20, T. 14 N., R. 17 E.

01&02--2 inches to 0, litter and duff, mainly from shrubs.

A11--0 to 3 inches, grayish-brown (10YR 5/2) very stony loamy coarse sand, dark brown (10YR 3/3) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine and fine interstitial pores; 5 percent stones and 5 percent gravel; slightly acid; clear, smooth boundary. 3 to 7 inches thick.

A12--3 to 11 inches, brown (10YR 5/3) gravelly loamy coarse sand, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; 15 percent gravel and 5 percent cobblestones; slightly acid; gradual, smooth boundary. 7 to 10 inches thick.

C1--11 to 24 inches, pale-brown (10YR 6/3) very gravelly loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many very fine and fine interstitial pores; 30 percent gravel and 40 percent cobblestones and stones; slightly acid; gradual, smooth boundary. 8 to 13 inches thick.

C2--24 to 61 inches, pale-brown (10YR 6/3) very gravelly loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; 40 percent gravel and 40 percent cobblestones and stones; medium acid; clear, smooth boundary. 26 to 48 inches thick.

C3si--61 to 71 inches, light-gray (5Y 7/1) gravelly loamy coarse sand, olive (5Y 5/3) moist; weakly cemented with silica; very thin (1 millimeter), almost continuous, silica lamina on surface; massive; matrix is hard, firm, brittle, nonsticky and nonplastic; very few pores; common very pale brown (10YR 7/4) silica bridges between sand grains and silica coatings on sand grains; strongly acid.

Depth to the Csi horizon ranges from 41 to 70 inches. The 0 horizon is one-half inch to 2 inches thick. Up to 50 percent of the surface area is covered with boulders and stones.

The A horizon ranges from grayish brown to brown in 10YR hue; in moist soil values become higher with increasing depth. This horizon is loamy sand and loamy coarse sand and is dominantly 5 to 30 percent gravel by volume. It is single grain or massive or has granular structure. It is slightly acid to medium acid and is 10 to 17 inches thick.

The C horizon ranges from yellowish brown or pale brown to light brownish gray in hues of 10YR and 2.5Y. It is loamy coarse sand or sand and by volume is 40 to 80 percent gravel, cobblestones, stones, and boulders. It is slightly acid or medium acid.

The Csi horizon ranges from weakly cemented to strongly cemented and is hard to very hard when dry and firm to very firm when moist. The surface of this horizon is a thin, less than 2 millimeters, discontinuous to continuous, horizontal lamina that impedes plant roots and water movement. The Csi horizon commonly contains coarse fragments that range in size from cobblestones to boulders. It is medium acid to strongly acid. The parent material is of granitic origin, but the profile contains a few fragments of basic igneous or metamorphic rock.

Meeks soils are similar to Celio, Tallac, and Elmira. They differ from Elmira soils in having a weakly cemented layer below a depth of 40 inches. They are sandier in the subsoil than Tallac soils. They have better drainage than the poorly drained Celio soils.

Meeks gravelly loamy coarse sand, 0 to 5 percent slopes (MkB).--This soil is on glacial outwash. The surface layer is 14 to 19 inches thick; less than 1 percent of the surface area is covered with cobblestones, stones, and boulders; and the coarse fragments in the underlying horizons consist dominantly of gravel and cobblestones and a few stones and boulders. Otherwise, this soil has a profile similar to the one described as representative of the series.

About 6 percent of the acreage of this soil is Gefo gravelly loamy coarse sand, most of which is southeast of the intersection of U.S. Highway 50 and California Highway 89; about 6 percent is Celio gravelly loamy coarse sand, adjacent to the Upper Truckee River; and about 3 percent is Gravelly alluvial land, near Meyers. Also, scattered throughout are small areas where 1 to 5 percent of the surface area of the Meeks soil is covered with stones.

Runoff is slow on this Meeks soil. The erosion hazard is slight. The available water capacity is 1.5 to 2.5 inches, depending on depth to the weakly silica cemented hardpan. Water is perched on the pan for a short period in spring during the period of snowmelt. The effective depth is 41 to 70 inches.

The principal use of this soil is for housing. Capability subclass VIs.

Meeks gravelly loamy coarse sand, 5 to 15 percent slopes (MkD).--This soil is on scarps of dissected glacial outwash. The surface layer is about 15 inches thick, and less than 1 percent of the surface area is covered with cobblestones, stones, and boulders. Otherwise, this soil has a profile similar to the one described as representative of the series.

About 7 percent of the total acreage of this soil is Jabu sandy loam, seeped, at the upper limit of the scarps west of the Upper Truckee road; 7 percent is Celio gravelly loamy coarse sand, at the bottom of scarps on the east side of the Lake Valley; and about 5 percent is Meeks very stony loamy coarse sand.

Runoff is medium in the strongly sloping areas of this Meeks soil. Seeps occur where road cuts and other disturbance expose the downslope movement of water on the weakly silica cemented hardpan. The

erosion hazard is ordinarily slight, but is moderate in disturbed, strongly sloping areas under construction. Available water capacity is 1.5 to 2.5 inches. The depth to the weakly silica cemented substratum is 41 to 68 inches.

The principal uses of this soil are timber and housing. Capability subclass VIs.

Meeks stony loamy coarse sand, 0 to 5 percent slopes (MmB).--This soil is on glacial outwash and ground moraines. It has a profile similar to the one described as representative of the series, but only 1 to 5 percent of the surface area is covered with stones and boulders.

The surface layer is 10 to 17 inches thick. The underlying layer in places is stratified sand and glacial flour. In areas of glacial outwash there are lenses of weakly cemented sand and of strongly cemented rock flour.

About 5 percent of the acreage of this soil is Meeks gravelly loamy coarse sand, in areas where more sorting by glacial outwash has taken place; 5 percent is Celio gravelly loamy coarse sand, in depressions adjacent to creeks; and 5 percent is a soil that is similar to the Meeks soil, but is coarse sandy loam and its subsoil is less than 35 percent coarse fragments. Water that at times is perched on the weakly cemented substratum seeps into the depressions and produces the wet variant inclusions.

Runoff is slow on this Meeks soil, and the erosion hazard is slight. The available water capacity is 1.5 to 2.5 inches, but water is trapped in surface undulations in nearly level areas and is available to plants for a longer period than in sloping areas. The effective rooting depth is 41 to 68 inches. Most roots mat on the top of the weakly cemented substratum.

The principal uses of this soil are housing and timber. Capability subclass VIs.

Meeks very stony loamy coarse sand, 5 to 15 percent slopes (MsD).--This soil is on lateral moraines and ground moraines. It has a profile similar to the one described as representative of the series, but the substratum is strongly cemented with silica and is continuous.

About 10 percent of the acreage of this soil is a Meeks soil, mostly west of the Upper Truckee River and west of Meyers, but only 1 to 5 percent of its surface area is covered with stones; about 2 percent is Gefo gravelly loamy coarse sand, adjacent to creek banks and washes; 3 percent is Jabu coarse sandy loam, seeped, in scarp areas of old moraines on the west side of Lake Valley; 5 percent is Tallac stony coarse sandy loam, adjacent to the transition zone where metabasic lateral moraine debris is bermed over ridgetops, as in the area one-half mile northeast of Angora Lookout; and about 5 percent is a moderately steep Meeks very stony loamy coarse sand, adjacent to the strongly sloping areas.

Runoff is slow on this Meeks soil. The erosion hazard is ordinarily slight. In highway cuts and under housing pads in strongly sloping areas, however, the erosion hazard is moderate. During spring thaw in the strongly sloping areas, seeps form in road cuts and disturbed areas because the melt water penetrates the soil to the strongly silica cemented substratum and then moves laterally to the exposed areas, resulting in small slips and slides.

Available water capacity is 1.5 to 2.5 inches. Because this soil occupies the foot slopes of steeper Meeks soils, the downslope movement of water on the hardpan keeps the profile recharged during dry periods. Depth to the silica hardpan is 41 to 68 inches.

The principal uses of this soil are timber, watershed, and homesites. Capability subclass VIIs.

Meeks very stony loamy coarse sand, 15 to 30 percent slopes (MsE).--This soil is on lateral moraines. It has the profile described as representative of the series.

About 2 percent of the acreage of this soil is Rock outcrop and Rubble land, generally in the upper limits of the lateral moraine; 3 percent is Tallac very stony coarse sandy loam, in the vicinity of Tahoe Mountain to the Cascade Lake area; 2 percent is Tallac gravelly coarse sandy loam, seeped, in the vicinity of Sugarpine Point; and 4 percent is Toem coarse sand, in random areas near the upper part of the lateral moraines.

If this Meeks soil is bare of vegetation, surface runoff is medium to rapid and the erosion hazard is high. The available water capacity is 1.5 to 2.5 inches, depending on depth to the silica-cemented substratum. The effective rooting depth is 41 to 68 inches, and all but a few tap roots and very coarse roots spread out laterally at this depth.

The principal uses of this soil are timber, watershed, and housing. The erosion hazard is an important consideration if this soil is to be used for housing development. Capability subclass VIIs.

Meeks very stony loamy coarse sand, 30 to 60 percent slopes (MsG).--This soil is on lateral moraines. It has a profile similar to the one described as representative of the series, but depth to the weakly silica cemented substratum is only 41 to 50 inches.

About 5 percent of the acreage of this soil is Toem coarse sand, in areas at the upper limit of the lateral moraines; 5 percent is Meeks extremely stony loamy coarse sand, in small random spots; 2 percent is Rock outcrop and Rubble land, where bedrock is exposed or boulders, stones, or cobblestones are interlaced so tightly that little soil is present; and about 6 percent is a soil that is similar to Meeks but differs in not having the silica hardpan.

Runoff is rapid on this Meeks soil. The erosion hazard is moderate in undisturbed areas and high in disturbed areas. A few seeps have formed in areas where bedrock is exposed and the silica-cemented substratum is interrupted. Available water capacity is 1.5 to 2 inches in the 41- to 50-inch root zone.

The principal uses of this soil are watershed, timber, and housing. The tree cover is thinner than on other Meeks soils. Capability subclass VIIs.

Meeks extremely stony loamy coarse sand, 15 to 30 percent slopes (MtE).--This soil is on lateral moraines. It has a profile similar to the one described as representative of the series, but stones and boulders cover 15 to 50 percent of the surface area.

About 10 percent of the acreage of this soil is Meeks extremely stony loamy coarse sand that has slopes of 5 to 15 percent; 5 percent is Rock outcrop and Rubble land, where bedrock is exposed or boulders, stones, or cobblestones are interlaced so tightly that little soil is present; 6 percent is Cagwin loamy coarse sand, at the upper end of the lateral moraines; and 2 percent is Toem coarse sand, near areas of exposed bedrock.

Runoff is medium on this Meeks soil. The erosion hazard is moderate in undisturbed areas, but high in areas under construction. The available water capacity is 1.5 to 2.5 inches. The depth to the silica-cemented substratum is 41 to 68 inches.

The principal uses for this soil are urban development, timber, and watershed. The tree cover is less dense than on some other Meeks soils. Capability subclass VIIs.

Meeks extremely stony loamy coarse sand, 30 to 60 percent slopes (MtG).--This soil is on lateral moraines. It has a profile similar to the one described as representative of the series, but stones and boulders cover 15 to 50 percent of the surface area, and the average depth to the weakly silica cemented substratum is only 41 to 50 inches.

About 5 percent of the acreage of this soil is Rock outcrop and Rubble land, where bedrock is exposed or boulders, stones, or cobblestones are interlaced so tightly that little soil is present; 3 percent is Cagwin loamy coarse sand, at the upper limits of the lateral moraines in the Meeks Creek area; 3 percent is Toem coarse sand, near areas of bedrock exposures at the upper limits of the lateral moraines; 4 percent is Meeks very stony loamy coarse sand, at the toe slopes of lateral moraines near lakes and marshes in the Osgood Swamp area; and about 5 percent is a soil that is similar to Meeks but does not have a silica-cemented hardpan.

Runoff is rapid on this Meeks soil. The erosion hazard is ordinarily moderate, but is high in disturbed areas under construction. A few seeps occur in areas where bedrock is exposed and the hardpan is interrupted, because the perched water that normally moves laterally downhill on the surface of the silica-cemented substratum rises to the surface. Available water capacity is 1.5 to 2.0 inches in the 41- to 50-inch root zone.

The principal uses of this soil are watershed, timber, and housing. The timber stand is thin. Capability subclass VIIs.

Meiss Series

The Meiss series consists of strongly sloping to steep, excessively drained soils that are 10 to 20 inches deep over hard andesitic rock. These are soils of the mountainous uplands. Slopes are 9 to 50 percent. Elevations are 7,000 to 10,000 feet. The average annual air temperature is about 40° F., the average annual precipitation is 35 to 50 inches, and the frost-free season is 30 to 50 days. The vegetation is scattered basin sagebrush, wyethia, and grass, and a few western juniper and whitebark pine.

In a representative profile the surface layer is brown and yellowish-brown, slightly acid and medium acid cobbly and gravelly loam that rests abruptly on hard andesitic rock at a depth of about 13 inches.

Permeability is moderately rapid. The effective rooting depth is 10 to 20 inches. Available water capacity is 1 to 2 inches.

Meiss soils are used for watershed and wildlife.

Representative profile: 1 mile southeast of Meiss Lake; NW1/4NW1/4 sec. 10, T. 10 N., R. 18 E.

A11--0 to 6 inches, brown (10YR 5/3) cobbly loam, dark brown (10YR 3/3) moist; moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores; 10 percent cobblestones, 20 percent gravel; slightly acid; clear, smooth boundary. 4 to 7 inches thick.

A12--6 to 13 inches, yellowish-brown (10YR 5/4) gravelly loam, dark yellowish brown (10YR 3/4) moist; moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium and coarse roots; many very fine interstitial pores; 5 percent cobblestones, 20 percent gravel; medium acid; abrupt, wavy boundary. 6 to 13 inches thick.

R--13 inches, hard andesitic rock.

The depth to bedrock ranges from 10 to 20 inches. The profile is as much as 30 percent gravel, cobblestones, and stones. There is little or no litter.

The A horizon is brown or yellowish brown when dry and dark brown or dark yellowish brown when moist. It is gravelly loam or gravelly sandy loam.

Meiss soils are similar to Waca and Toem soils. They are shallower over bedrock than Waca soils. They formed in material derived from andesitic rock, whereas Toem soils formed in material derived from granite.

Meiss cobbly loam, 9 to 30 percent slopes (MxE).--This soil is on broad ridgetops and benches in valley bottoms adjacent to steeper soils.

About 5 percent of the acreage of this soil is a steeper Meiss cobbly loam; 10 to 15 percent is Waca cobbly loam; and about 2 percent is Rock land.

Runoff is medium on this Meiss soil, and the erosion hazard is moderate.

This soil is used for watershed and wildlife. Capability subclass VIIe.

Meiss cobbly loam, 30 to 50 percent slopes (MxF).--This soil is in mountainous areas. It has the profile described as representative of the series.

About 5 percent of the acreage of this soil is a more gently sloping Meiss cobbly loam and a steeper Meiss cobbly loam; 5 to 10 percent is Waca cobbly loam; and about 5 percent is Rock land.

Surface runoff is rapid on this Meiss soil, and the erosion hazard is high.

This soil is used chiefly for watershed and wildlife. Capability subclass VIIe.

Pits and Dumps

Pits and dumps (Px) consists of sand and gravel pits, refuse dumps, and rock quarries. These areas are typically barren and vary in natural drainage, permeability, erosion hazard, runoff, and available water capacity. Capability subclass VIIIs.

Rock Land

Rock land (Ra) is in areas of granitic, metamorphic, and volcanic rocks. Large areas at the higher elevations in the southwestern part of the survey area are the result of glaciation. This land is undulating to very steep. Slopes are 5 to 75 percent. The vegetation consists of open stands of mountain shrubs and scattered conifers. In granitic areas, Rock land is associated with Cagwin, Graylock, and Toem soils and in metamorphic and volcanic areas, with Fugawee, Jorge, Tahoma, Umpa, and Waca soils.

Rock outcrop and stones cover 50 to 90 percent of the surface area. In the crevices is a thin mantle of soil material generally less than 10 inches deep. Drainage is excessive, runoff is rapid, and the erosion hazard is slight. The available water capacity is less than 1 inch.

Included in mapping are scattered areas of Cagwin, Fugawee, Graylock, Jorge, Tahoma, Umpa, and Waca soils, and Rock outcrop and Rubble land.

Rock land is used for watershed and wildlife. Capability subclass VIIIs.

Rock Outcrop

Rock outcrop consists of slightly weathered to hard granitic, metamorphic, and volcanic rock. The outcrops range from scattered rock 1 to 5 feet in diameter to large expanses of rock that cover 1 to 2 acres or more.

Rock outcrop is essentially barren except for an open stand of mountain shrubs and scattered conifers. Runoff is rapid or very rapid. The erosion hazard is slight because there is scarcely any soil material.

Rock outcrop is used for watershed and wildlife.

Rock outcrop in the Tahoe Basin Area is mapped only with Cagwin, Toem, and Waca soils and Rubble land.

Rock outcrop-Cagwin complex, 30 to 50 percent slopes (RcF).--This complex is on granitic uplands, mainly in the southern and eastern part of the survey area. It is about 25 to 50 percent granitic Rock outcrop and 50 to 75 percent soils. About 65 percent of the acreage of soils is a Cagwin soil; about 15 percent is a soil similar to the Cagwin soil, but deeper than 40 inches over weathered rock; 15 percent is Toem coarse sand; and 5 percent is Graylock extremely stony loamy coarse sand.

The Cagwin soil is somewhat excessively drained. If it is bare of vegetation, surface runoff is rapid and the erosion hazard is high. Available water capacity is 1.5 to 2.5 inches. Permeability is rapid, but the surface layer does not absorb water readily.

This complex is used for watershed and timber and for recreation, such as skiing. Capability subclass VIIs.

Rock outcrop-Cagwin complex, 50 to 70 percent slopes (RcG).--This complex is on granitic uplands. It is about 25 to 50 percent granitic Rock outcrop and about 50 to 75 percent soils. About 65 percent of the acreage of soils is a Cagwin soil; about 10 percent is a soil similar to the Cagwin soil, but deeper than 40 inches over weathered rock; 15 percent is Toem coarse sand; and 10 percent is Graylock extremely stony loamy coarse sand.

The Cagwin soil is somewhat excessively drained. If it is bare of vegetation, surface runoff is very rapid and the erosion hazard is very high. Available water capacity is 1.5 to 2.5 inches. Permeability is rapid, but the surface layer does not absorb water readily.

This complex is used for watershed and recreation and to a limited extent for timber. Capability subclass VIIs.

Rock outcrop-Toem complex, 30 to 50 percent slopes (RtF).--This complex is on granitic uplands, mainly in the southern and eastern parts of the survey area. It is about 25 to 50 percent granitic rock outcrop and 50 to 75 percent soils. About 85 percent of the acreage of soils is a Toem soil, and 15 percent is Cagwin loamy coarse sand.

The Toem soil is excessively drained. Runoff is rapid, and the erosion hazard is high. The available water capacity is 0.5 to 1 inch.

This complex is used for watershed, wildlife, and recreation. Capability subclass VIIs.

Rock outcrop-Toem complex, 50 to 70 percent slopes (RtG).--This complex is on granitic uplands. It is about 25 to 50 percent granitic Rock outcrop and about 50 to 75 percent soils. About 85 percent of the acreage of soils is a Toem soil; 10 percent is Cagwin loamy coarse sand; and 5 percent is Graylock extremely stony loamy coarse sand.

The Toem soil is excessively drained. Runoff is very rapid, and the erosion hazard is very high. The available water capacity is 0.5 to 1 inch.

This complex is used for watershed, wildlife, and recreation. Capability subclass VIIs.

Rock outcrop and Rubble land (Rx).--This mapping unit is in areas of granitic, metamorphic, and volcanic rock. At the higher elevations in the southwestern part of the survey, it is the result of

glaciation. In other areas, it is mostly volcanic plugs and vents and the associated talus slopes. It ranges from moderately sloping to very steep. There is little or no vegetation.

In granitic areas Rock outcrop and Rubble land is associated with Graylock, Toem, and Meeks soils, and in metamorphic and volcanic areas, with Jorge, Tallac, Umpa, and Waca soils.

Rock outcrop consists of areas of rock left bare by the scouring of glaciers or of large bare faces of hard metamorphic or volcanic rock. There is little or no soil material in the crevices. Runoff is very rapid.

Rubble land consists of stony colluvium on the toe slopes of glaciated areas, stony colluvium from glacial deposits, or moraines, and stony colluvium below volcanic plugs or vents. It is more than 90 percent stones and boulders. Below a depth of 40 inches in some moraine areas is a cemented pan or compact till. Rubble land is excessively drained. Runoff is slow, and the erosion hazard is slight.

Included in mapping are scattered areas of Meeks, Toem, and Waca soils; areas of Tallac soils, shallow variant; and areas of Rock land and Stony colluvial land.

Rock outcrop and Rubble land is used for watershed. Capability subclass VIIIs.

Shakespeare Series

The Shakespeare series consists of strongly sloping to steep, moderately well drained soils that are 48 to more than 60 inches deep over rock. These soils formed in colluvium and alluvium derived from mixed, undifferentiated metamorphic rock. They are on uplands. Slopes range from 9 to 50 percent. Elevations are 7,000 to 9,000 feet. The mean annual precipitation is 25 to 30 inches, most of which is snow. The mean annual air temperature is about 41° F., and the frost-free growing season is 30 to 50 days. The vegetation is coniferous woodland and an understory of brush.

In a representative profile the surface layer is brown, medium acid silt loam and gravelly loam about 4 inches thick. The subsurface layer is leached, pale-brown, medium acid gravelly heavy loam about 5 inches thick. The subsoil is mottled pale-brown and grayish-brown, medium acid gravelly heavy loam and gravelly clay loam about 24 inches thick. The substratum is mottled yellowish-red, strongly acid silty clay loam.

Permeability is slow. Roots can penetrate to a depth of 48 inches or more. Available water capacity is 6 to 8 inches. Reestablishing vegetation is only slightly difficult.

Shakespeare soils are used predominantly for timber and wildlife.

Representative profile: In Douglas County, Nevada, about one-half mile east of Genoa Peak, approximately 500 feet east and 1,000 feet north of the S1/4 corner of sec. 30, T. 14 N., R. 19 E.

O1--1 inch to 0, litter of conifer needles.

A11--0 to 1 inch, brown (10YR 4/3) silt loam, very dark brown (10YR 2/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores; medium acid; abrupt, wavy boundary. 0 to 3 inches thick.

A12--1 to 4 inches, brown (10YR 5/3) gravelly heavy loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots and common fine and medium roots; many very fine interstitial pores and common very fine tubular pores; 35 percent gravel; medium acid; clear, wavy boundary. 1 to 5 inches thick.

A2--4 to 9 inches, pale-brown (10YR 6/3) gravelly heavy loam, brown (10YR 4/3) moist; weak, very fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine interstitial pores and common very fine and few fine tubular pores; 40 percent gravel; medium acid; clear, wavy boundary. 4 to 12 inches thick.

B1t--9 to 20 inches, pale-brown (10YR 6/3) gravelly heavy loam, brown (10YR 4/3) moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; few very fine interstitial pores and common very fine and few fine tubular pores; few thin clay films in pores and on ped faces; 35 percent gravel and 5 percent cobblestones; medium acid; clear, wavy boundary. 9 to 15 inches thick.

B2t--20 to 33 inches, grayish-brown (10YR 5/2) gravelly clay loam, brown (7.5YR 4/2) moist; few, fine, distinct, brown (7.5YR 4/4) mottles; moderate, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine and few fine tubular pores; common thin and few moderately thick clay films on ped faces and in pores; 25 percent gravel and 10 percent cobblestones; medium acid; clear, wavy boundary. 10 to 20 inches thick.

IIC--33 to 60 inches, yellowish-red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; common, faint, red (2.5YR 4/6) mottles; massive; very hard, friable, sticky and plastic; few very fine, fine, medium, and coarse roots; strongly acid.

The depth to bedrock ranges from 48 to more than 60 inches. The O horizon is a litter of conifer needles 0 to 3 inches thick. The average volume of gravel, cobblestones, stones, and boulders in the soil ranges from 35 to 50 percent. Cobblestones, stones, and boulders cover less than 1 percent to 5 percent of the surface area. The A1 horizon is brown or grayish brown in hues of 10YR or 2.5Y. It ranges from slightly acid to medium acid and from sandy loam to silt loam. The A2 horizon is pale brown or light gray in hues of 10YR or 2.5Y and is mottled in places with reddish yellow, brownish

yellow, or yellowish brown. This horizon is similar to the A1 horizon in texture. It is strongly acid to medium acid. The B horizon is pale brown, light brown, grayish brown, or brown in hues of 10YR or 7.5YR and is mottled with yellowish red, reddish yellow, brown, very dark brown, brownish yellow, or dark yellowish brown. It is gravelly heavy clay loam or clay.

Shakespeare soils are similar to Fugawee, Tahoma, and Jorge soils, but they have an A2 horizon and are not so well drained.

Shakespeare gravelly loam, 9 to 30 percent slopes (ShE).--This soil is on uplands near Genoa Peak. It has the profile described as representative of the series.

About 10 to 25 percent of the acreage of this soil is Umpa very stony sandy loam, Waca cobbly coarse sandy loam, Toem coarse sand, and Rock outcrop and Rubble land.

If this Shakespeare soil is bare of vegetation, surface runoff is medium to rapid and the erosion hazard is slight to moderate.

This soil is used chiefly for timber and wildlife. Capability subclass VIe.

Shakespeare stony loam, 30 to 50 percent slopes (SkF).--This soil is on uplands. Its profile is similar to the one described as representative of the series, but 1 to 5 percent of the surface area is covered with cobblestones, stones, and boulders.

About 10 to 15 percent of the acreage of this soil is Umpa very stony sandy loam, Waca cobbly coarse sandy loam, Toem coarse sand, and Rock outcrop and Rubble land.

Surface runoff is rapid on this Shakespeare soil, and the erosion hazard is high.

This soil is used chiefly for timber and wildlife. Capability subclass VIIe.

Stony Colluvial Land

Stony colluvial land (Sm) occurs in areas of colluvium from granitic, metamorphic, and volcanic rock and from highly fractured volcanic flow. It is steep to very steep in the areas of granitic, metamorphic, and volcanic rock and is gently sloping to steep in the areas of fractured volcanic flow. Slopes range from 2 to 75 percent. The vegetation is an open stand of conifers and mountain shrubs in areas of metamorphic and volcanic rock and mountain shrubs and scattered conifers in areas of granitic rock. In granitic areas this land is associated with Cagwin, Graylock, and Toem soils, and in metamorphic and volcanic areas with Fugawee, Jorge, Umpa, and Waca soils.

Large cobblestones, stones, and boulders cover 50 to 90 percent of the surface area. Coarse fragments make up more than 50 percent of the volume. The texture generally ranges from sand to gravelly sandy loam. The depth to bedrock is 30 to more than 60 inches. Stony colluvial land is excessively drained. Permeability and the available water capacity vary. Runoff is slow to medium, and the erosion hazard is slight.

Included in mapping are areas of Rock land, Rock outcrop and Rubble land, and Graylock, Jorge, Toem, Waca, and Umpa soils.

Stony colluvial land is used for watershed and wildlife, and in some areas, for urban development. Capability subclass VIIIs.

Tahoma Series

The Tahoma series consists of gently sloping to strongly sloping, well-drained soils that are 43 to 60 inches or more deep over volcanic rock. These soils formed in material derived from vesicular latite flows of Quaternary age and andesitic conglomerate. Slopes are 2 to 15 percent. Elevations are 6,200 to 8,000 feet. The annual precipitation is 35 to 45 inches, the average annual air temperature is about 40° F., and the frost-free season is 30 to 50 days. The vegetation is mainly red fir and white fir and an understory of mountain shrubs.

In a representative profile the surface layer is brown, medium acid and strongly acid stony sandy loam and gravelly sandy loam about 19 inches thick. The subsoil is brown, very strongly acid gravelly loam, gravelly clay loam, and clay loam. Vesicular, olivine latite bedrock is at a depth of 68 inches.

Permeability is moderate. Roots can penetrate to a depth of 43 to more than 60 inches. Available water capacity is 5 to 6.5 inches.

Tahoma soils are used for homesites and timber.

Representative profile: Wooded area about 1.5 miles north of Tahoe City, 20 feet south of an old logging road, 300 feet south and 700 feet east of the W1/4 corner, sec. 36, T. 16 N., R. 16 E.

O1--3 inches to 0, red fir litter.

A11--0 to 11 inches, brown (7.5YR 5/4) stony sandy loam, dark brown (7.5YR 4/4) moist; strong, fine, granular structure; soft, friable, nonsticky and nonplastic; many very fine, fine, and medium roots; common very fine tubular and interstitial pores; 5 percent stones, 15 percent cobblestones, 30 percent gravel; medium acid; clear, wavy boundary. 7 to 11 inches thick.

A12--11 to 19 inches, brown (7.5YR 5/4) gravelly sandy loam, dark brown (7.5YR 4/4) moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine interstitial pores and common very fine tubular pores; 15 percent cobblestones and 30 percent gravel; strongly acid; clear, wavy boundary. 6 to 10 inches thick.

B1t--19 to 35 inches, brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; many very fine and fine tubular pores; common thin clay films in pores and as

504-718 O - 74 - 3

coatings on sand grains; 20 percent gravel and 10 percent cobblestones; very strongly acid; clear, wavy boundary. 5 to 16 inches thick.

B21t--35 to 56 inches, brown (7.5YR 5/4) gravelly light clay loam, dark brown (7.5YR 4/4) moist; weak, fine, subangular blocky structure; hard, firm, sticky and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine tubular pores; many thin clay films in pores and on ped faces; 10 percent cobblestones and 20 percent gravel; very strongly acid; gradual, wavy boundary. 13 to 21 inches thick.

B22t--56 to 68 inches, brown (7.5YR 5/4) light clay loam, dark brown (7.5YR 3/4) moist; moderate, medium, subangular blocky structure; hard, firm, sticky and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine and fine tubular pores; many thin clay films in pores and on ped faces; 5 percent gravel; very strongly acid; gradual, wavy boundary. 12 to 15 inches thick.

R--68 inches, coarse, vesicular, olivine latite.

Stones cover 1 to 15 percent of the surface area. The O horizon is generally no more than 3 inches thick. Most of the stones and cobblestones in the profile are within a depth of 12 to 18 inches and become fewer with increasing depth.

The A horizon ranges from brown to dark grayish brown in hues of 7.5YR and 10YR. It ranges from loam to sandy loam and in places is as much as 50 percent gravel and cobblestones. It has weak to strong granular structure. It is slightly acid to strongly acid and 10 to 21 inches thick.

The Bt horizon ranges from brown to reddish brown in hues of 10YR, 7.5YR, and 5YR. It ranges from gravelly heavy loam or light clay loam to gravelly light clay loam and is very strongly acid to medium acid. Depth to the R horizon ranges from 43 to more than 60 inches. The upper 1 to 3 inches of the parent rock is weathered to varying degrees.

Tahoma soils are similar to Fugawee, Umpa, Jorge, and Waca soils. They are brighter in color, have less gravel in the subsoil, and are deeper over bedrock than Umpa soils. They differ from Waca soils in having a slightly lighter colored surface layer and a textural subsoil. They have less gravel in the subsoil than Jorge soils. They are deeper than Fugawee soils.

Tahoma stony sandy loam, 2 to 15 percent slopes (TaD).--This soil is on latite flows and andesitic conglomerate at the north end of Lake Tahoe. It has the profile described as representative of the series.

About 1 percent of the acreage of this soil is a deep, red soil that has a clay subsoil; 5 percent is Umpa very stony sandy loam; 5 percent is Jorge and Tahoma very stony sandy loams; 4 percent is Fugawee very stony sandy loam, and about 5 percent is a soil that is similar to the Tahoma soil, but has a dark-colored surface layer more than 6 inches thick.

If this Tahoma soil is bare of vegetation, surface runoff is slow to medium and the erosion hazard is slight to moderate.

This soil is used chiefly for timber. Some areas are used for urban development. Capability subclass IVe.

Tahoma very stony sandy loam, 2 to 15 percent slopes (TbD).--This soil is on latite flows and andesitic conglomerate. Its profile is similar to the one described as representative of the series, but 5 to 15 percent of the surface area is covered with stones and large cobblestones.

About 10 percent of the acreage of this soil is Jorge and Tahoma very stony sandy loams; 5 percent is Fugawee very stony sandy loam; and about 5 percent is a soil that is similar to this Tahoma soil, but has a dark-colored surface layer more than 6 inches thick. Along the contact with Umpa soils are included areas of Umpa very stony sandy loam. Also included are scattered areas of Stony colluvial land and Rock land.

If this Tahoma soil is bare of vegetation, surface runoff is slow to medium and the erosion hazard is slight to moderate.

This soil is used chiefly for timber. Some areas are used for urban development. Capability subclass VIs.

Tallac Series

The Tallac series consists of gently sloping to steep, well drained and moderately well drained soils that are 40 to 70 inches deep over a weakly silica cemented hardpan. These soils are on glacial deposits from basic and metamorphic rock. Slopes are 0 to 60 percent. Elevations are 6,300 to 8,600 feet. The average annual precipitation is 30 to 40 inches, the average annual air temperature is about 41° F., and the frost-free season is 30 to 50 days. The vegetation is a semidense to dense stand of conifers, mostly Jeffrey pine, white fir, red fir, and lodgepole pine, and of shrubs, dominantly greenleaf manzanita and mountain whitethorn.

In a representative profile the surface layer is dark grayish-brown and dark-brown, medium acid gravelly coarse sandy loam about 21 inches thick. The next layers are yellowish-brown, medium acid very cobbly coarse sandy loam and gravelly sandy loam. They are underlain at a depth of 42 inches by yellowish-brown and brown gravelly coarse sandy loam that is weakly cemented with silica.

Permeability is moderately rapid as far down as the weakly silica cemented pan and is slow in the pan. Roots also penetrate as far down as the pan. Available water capacity is 2.5 to 3.5 inches.

Tallac soils are used for timber, watershed, wildlife, and recreation.

Representative profile: 2 miles west of Camp Richardson, lot 18, Spring Creek Tract, SE1/4 sec. 34, T. 13 N., R. 17 E.

01&02--1 inch to 0, fresh and decomposed conifer needles. 1 to 3 inches thick.

A11--0 to 15 inches, dark grayish-brown (10YR 4/2) gravelly coarse sandy loam, very dark brown (10YR 2/2) moist; weak, fine, crumb structure; soft, very friable, nonsticky and nonplastic; many very fine, medium, and coarse roots; many very fine interstitial pores; 20 percent gravel; medium acid; diffuse, wavy boundary. 13 to 17 inches thick.

A12--15 to 21 inches, dark-brown (10YR 4/3) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine interstitial pores; 20 percent gravel and 2 percent cobblestones; medium acid; diffuse, wavy boundary. 6 to 8 inches thick.

C1--21 to 31 inches, yellowish-brown (10YR 5/4) very cobbly coarse sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine, medium, and coarse roots; many very fine interstitial pores; 50 percent cobblestones and 10 percent gravel; medium acid; diffuse, wavy boundary. 10 to 17 inches thick.

C2--31 to 42 inches, yellowish-brown (10YR 5/6) gravelly coarse sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots and few coarse roots; many very fine interstitial pores; 35 percent gravel and 1 percent cobblestones; medium acid; abrupt, smooth boundary. 11 to 28 inches thick.

C3si--42 to 65 inches, yellowish-brown and brown (10YR 5/4, 7.5YR 5/4) gravelly coarse sandy loam, weakly cemented with silica, that has a very thin (1 millimeter thick), discontinuous lamina on the horizon surface, dark brown (10YR 4/3, 7.5YR 4/4) moist; massive; hard, firm, nonsticky and nonplastic; few fine, medium, and coarse roots mostly matted on the surface of the horizon; common grading to few silica bridges between sand grains and as coatings on sand grains and pebbles; 30 percent gravel; strongly acid.

The depth to the Csi horizon is 40 to 70 inches. Less than 1 to 15 percent of the surface area is covered with stones.

The A horizon ranges from brown to dark grayish brown and from gravelly coarse sandy loam to light loam. It is 13 to 25 inches thick.

The upper part of the C horizon ranges from olive yellow to yellowish brown in hues of 2.5Y and 10YR, and in a few places, the colors are interspersed. It is gravelly to very cobbly coarse sandy loam to loamy coarse sand.

The Csi horizon ranges from light gray to pale brown or yellowish brown to brown in hues of 5Y, 2.5Y, 10YR, and 7.5YR. It ranges from very gravelly sandy loam to very gravelly loamy sand. The silica lamina is less than 2 millimeters thick and discontinuous to almost continuous.

Tallac soils are similar to Meeks and Waca soils. In contrast with Meeks soils, they are loamy, whereas Meeks soils are sandy. They differ from Waca soils in having a silica-cemented pan, and they formed in glacial deposits, whereas Waca soils formed in material derived from andesitic rock.

Tallac gravelly coarse sandy loam, seeped, 0 to 5 percent slopes (TcB).--This soil is on glacial outwash deposits.

About 10 percent of the acreage of this soil is a moderately sloping Tallac gravelly coarse sandy loam, seeped; 5 percent is Meeks stony loamy coarse sand; and 5 percent is Gravelly alluvial land.

This Tallac soil is moderately well drained. The surface layer does not absorb water readily. Runoff is slow, and the erosion hazard is slight. Water accumulates above the weakly silica cemented pan in spring during the period of snowmelt.

This soil is used for timber, watershed, recreation, and urban development. Capability subclass IVe.

Tallac gravelly coarse sandy loam, seeped, 5 to 9 percent slopes (TcC).--This soil is on glacial outwash deposits. It has the profile described as representative of the series.

About 10 percent of the acreage of this soil is a gently sloping Tallac gravelly sandy loam, seeped, and 5 percent is Meeks stony loamy coarse sand.

This Tallac soil is moderately well drained. The surface layer does not absorb water readily. Runoff is slow to medium, and the erosion hazard is slight. Water accumulates above the weakly silica cemented pan in spring during the period of snowmelt.

This soil is used for timber, watershed, recreation, and urban development. Capability subclass IVe.

Tallac stony coarse sandy loam, 5 to 15 percent slopes (TdD).--This soil is on moraines (pl. III, right). Stones cover 1 to 5 percent of the surface area, and the surface layer is 13 to 17 inches thick. Otherwise, the profile of this soil is similar to the one described as representative of the series.

About 10 percent of the acreage of this soil is Tallac gravelly coarse sandy loam, seeped; 10 percent is areas where 5 to 15 percent of the surface area is covered with stones; and 5 percent is Meeks very stony loamy coarse sand. In the High Meadows and Fountain Place area, the parent material of this soil is mainly granitic. In the area north of Ward Creek, this soil has been water modified at elevations of less than 6,800 feet.

This Tallac soil is well drained. The surface layer does not absorb water readily. Runoff is slow to medium, and the erosion hazard is slight to moderate. Water accumulates on top of the weakly silica cemented pan for a short period in spring during snowmelt.

This soil is used for timber, watershed, recreation, and urban development. Capability subclass VIe.

Tallac very stony coarse sandy loam, 15 to 30 percent slopes (TeE).--This moderately steep soil is

on glacial moraines. Stones cover 5 to 15 percent of the surface area, and the surface layer is 10 to 15 inches thick. Otherwise, the profile of this soil is similar to the one described as representative of the series.

About 15 percent of the acreage of this soil is a Tallac soil that has only 1 to 5 percent of its surface area covered with stones, and 5 percent is Meeks very stony loamy coarse sand. In the High Meadows area the parent material of this soil is mainly granitic.

This Tallac soil is well drained. The surface layer does not absorb water readily. Runoff is medium, and the erosion hazard is moderate.

This soil is used for timber, watershed, recreation, and urban development. Capability subclass VIs.

Tallac very stony coarse sandy loam, 30 to 60 percent slopes (TeG).--This soil is on lateral moraines. Stones cover 5 to 15 percent of the surface area, and the surface layer is 10 to 15 inches thick. Otherwise, the profile of this soil is similar to the one described as representative of the series.

About 10 percent of the acreage is a soil that is similar to this soil, but does not have a silica-cemented pan in the substratum; 10 percent consists of areas where 1 to 5 percent of the surface area is covered with stones; and about 5 percent is Meeks very stony loamy coarse sand. Also included in mapping are areas of less steep soils on narrow ridgetops or benches on the sides of the moraines.

This Tallac soil is well drained. The surface layer does not absorb water readily. Runoff is rapid, and the erosion hazard is high.

This soil is used for timber, watershed, and recreation. Capability subclass VIIs.

Tallac very stony coarse sandy loam, seeped, 2 to 9 percent slopes (TkC).--This soil is on glacial outwash deposits, mostly in the Blackwood Canyon and Ward Creek areas. Stones cover 5 to 15 percent of the surface area. Otherwise, this soil has a profile similar to the one described as representative of the series.

About 10 percent of the acreage is Tallac gravelly coarse sandy loam, and 5 percent is Tallac stony coarse sandy loam.

This Tallac soil is moderately well drained. The surface layer does not absorb water readily. Runoff is slow to medium, and the erosion hazard is slight. Water accumulates above the weakly silica cemented pan in spring during the period of snowmelt.

This soil is used for timber and homesites. Capability subclass VIs.

Tallac Series, Shallow Variant

The Tallac series, shallow variant, consists of gently sloping to steep, well-drained soils that are 22 to 38 inches deep over a weakly silica cemented pan. These soils are on glacial deposits. Slopes range from 9 to 50 percent. Elevations are 6,500 to 8,600 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is 39° to 45° F., and the frost-free season is 30 to 50 days. The vegetation is a semidense stand of conifers, mostly red fir, western white pine, and lodgepole pine. Scattered basin sagebrush and huckleberry oak are the dominant shrubs.

In a representative profile the surface layer is dark-brown and dark grayish-brown, very strongly acid gravelly coarse sandy loam about 9 inches thick. The next layers are brown and pale-brown, medium acid gravelly coarse sandy loam. They are underlain at a depth of about 24 inches by a weakly silica cemented pan.

Permeability is moderately rapid as far down as the cemented pan, and slow in the pan. Depth to the pan ranges from 22 to 38 inches. Available water capacity is 1.5 to 2 inches.

Tallac soils, shallow variant, are used for watershed and wildlife.

Representative profile: NW1/4 sec. 16, T. 12 N., R. 17 E.

O1--1/2 inch to 0, leaf litter.

A11--0 to 3 inches, dark-brown (10YR 3/3) gravelly coarse sandy loam, very dark brown (10YR 2/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many roots; many pores; 25 percent gravel and 5 percent cobblestones and stones; very strongly acid; clear, smooth boundary. 3 to 6 inches thick.

A12--3 to 9 inches, dark grayish-brown (10YR 4/2) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many roots; many pores; 30 percent gravel and 10 percent cobblestones and stones; very strongly acid; clear, smooth boundary. 5 to 8 inches thick.

AC--9 to 14 inches, brown (10YR 4/3) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; many roots; many pores; 30 percent gravel and 20 percent cobblestones and stones; medium acid; clear, wavy boundary. 5 to 9 inches thick.

C1--14 to 24 inches, pale-brown (10YR 6/3) gravelly coarse sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, friable, nonsticky and nonplastic; many roots; many pores; 30 percent gravel and 20 percent cobblestones and stones; medium acid; abrupt, smooth boundary. 9 to 15 inches thick.

C2si--24 to 40 inches, pale-olive (5Y 6/3), weakly cemented very gravelly coarse sandy loam, olive (5Y 4/3) moist; massive; very hard, very firm, nonsticky and nonplastic; few roots; many pores; 35 percent gravel and 25 percent cobblestones and stones; medium acid.

The A horizon ranges from 8 to 14 inches in thickness and is strongly acid to very strongly acid. The

C horizon is medium acid to strongly acid. The C1 horizon ranges from pale brown to light yellowish brown. The weakly silica cemented C2si horizon is at a depth of 22 to 38 inches. It is pale olive to light gray in hues of 2.5Y and 5Y. Cobblestones and stones are common throughout the profile. The control section is more than 35 percent coarse fragments by volume.

Tallac, shallow variant, soils are similar to Tallac and Meeks soils. They are not so deep over the silica-cemented pan as Tallac and Meeks soils. They are less sandy than Meeks soils.

Tallac gravelly coarse sandy loam, shallow variant, 9 to 30 percent slopes (TmE).--This soil is on glacial deposits. It has the profile described as representative of the variant.

About 5 percent of the acreage is a Tallac gravelly loam, shallow variant, that is steeper than 30 percent, and 5 to 10 percent is Tallac stony coarse sandy loam.

Runoff is medium on this Tallac soil, and the erosion hazard is moderate.

This soil is used for watershed and wildlife. Capability subclass VIIe.

Tallac gravelly coarse sandy loam, shallow variant, 30 to 50 percent slopes (TmF).--This soil is on glacial moraines.

About 5 percent of the acreage is Tallac gravelly sandy loam, shallow variant, 9 to 30 percent slopes; and 5 to 10 percent is a Tallac very stony coarse sandy loam.

Runoff is rapid on this Tallac soil, and the erosion hazard is high.

This soil is used for watershed and wildlife. Capability subclass VIIe.

Toem Series

The Toem series consists of strongly sloping to very steep, excessively drained soils that are 8 to 20 inches deep over decomposed granitic material. These soils are on mountainous uplands. Slopes range from 9 to 70 percent. Elevations are 6,500 to 9,500 feet. The average annual precipitation is 35 to 50 inches, the average annual air temperature is about 40° F., and the frost-free season is 30 to 50 days. The vegetation is an open to semidense stand of mixed conifers, such as Jeffrey pine, red fir, and western white pine. Pinemat manzanita and huckleberry oak are common as a shrub understory.

In a representative profile the surface layer is grayish-brown, slightly acid and medium acid gravelly coarse sand about 9 inches thick. The next layer is pale-brown, medium acid gravelly coarse sand. It grades to decomposed granitic material at a depth of about 17 inches.

Permeability is rapid. The effective rooting depth is 8 to 20 inches, and the available water capacity is 0.5 to 1 inch.

Toem soils are used chiefly for watershed and wildlife, and to a limited extent for timber.

Representative profile: 100 feet north of High Meadow Road, SW1/4 sec. 12, T. 12 N., R. 18 E.

O1--1 inch to 0, pine litter.
A11--0 to 2 inches, grayish-brown (10YR 5/2) gravelly coarse sand, very dark brown (10YR 2/2) moist; very dark grayish-brown pockets; weak, very fine and fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine and fine interstitial pores; 25 percent gravel; medium acid; clear, wavy boundary. 2 to 3 inches thick.
A12--2 to 9 inches, grayish-brown (10YR 5/2) gravelly coarse sand, very dark grayish brown (10YR 3/2) moist; dark-gray and very dark grayish-brown pockets and seams adjacent to coarse roots or old root channels; weak, fine and medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots and few coarse roots; many very fine and fine interstitial pores; 20 percent gravel; slightly acid; abrupt, wavy boundary. 3 to 7 inches thick.
C1--9 to 17 inches, pale-brown (10YR 6/3) gravelly coarse sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine roots and few fine, medium, and coarse roots; many very fine and fine interstitial pores; 30 percent gravel; medium acid; clear, wavy boundary. 3 to 10 inches thick.
C2--17 inches, weathered granodiorite grus.

The depth to grus ranges from 8 to 20 inches. The A horizon is grayish brown, brown, or dark grayish brown when dry and is very dark brown or very dark grayish brown when moist. It is typically loamy coarse sand or coarse sand 5 to 10 inches thick and is 15 to 35 percent gravel.

The C1 horizon is pale brown, light yellowish brown, or light gray in hues of 10YR, 2.5Y, and 5Y. It is coarse loamy sand or coarser and is 20 to 40 percent gravel.

Toem soils are similar to Cagwin and Meiss soils. They are not so deep as Cagwin soils. They are sandier than Meiss soils and formed in material derived from grus, whereas, those soils formed in material derived from andesitic rock.

The Toem soils in the Tahoe Basin Area are mapped only with Rock outcrop.

Toem-Rock outcrop complex, 9 to 30 percent slopes (TrE).--This complex is on broad ridgetops and benches and in valley bottoms adjacent to steep soils. It is about 85 to 95 percent soil material and 5 to 15 percent granitic Rock outcrop. The soil material is about 75 percent Toem soil and 25 percent Cagwin loamy coarse sand.

The Toem soil is excessively drained. Runoff is medium, and the erosion hazard is high.

Rock outcrop consists of slightly weathered to hard granitic rock. It ranges from scattered rock 1 to 5 feet in diameter to large expanses covering 100 to 500 square feet. Runoff is very rapid, but the erosion hazard is slight.

This complex is used chiefly for watershed, wildlife, and recreation, and to a limited extent for timber. Capability subclass VIIs.

Toem-Rock outcrop complex, 30 to 50 percent slopes (TrF).--This complex is on granitic uplands, mainly in the southern and eastern parts of the survey area. It is about 75 to 90 percent soil material and 10 to 25 percent granitic Rock outcrop. The soil material is about 80 percent Toem soil and about 20 percent Cagwin loamy coarse sand.

The Toem soil is excessively drained. The surface layer does not absorb water readily, and runoff is medium to rapid, depending on the amount of cover. The erosion hazard is high in disturbed areas.

Rock outcrop consists of slightly weathered to hard granitic rock. The outcrops include scattered rock from 1 to 5 feet in diameter and large expanses covering about 100 to 500 square feet. Runoff is very rapid, but the erosion hazard is slight.

This complex is used principally for watershed, wildlife, and recreation, and to a limited extent for timber. Capability subclass VIIs.

Umpa Series

The Umpa series consists of gently rolling to steep, well-drained soils that are 20 to 40 inches deep over andesite. These soils are on mountainous uplands. Slopes are 5 to 50 percent. Elevations are 6,400 to 9,000 feet. The annual precipitation is 35 to 45 inches, the average annual air temperature is about 40° F., and the frost-free season is 30 to 50 days. The vegetation is mainly red fir, white fir, Jeffrey pine, and western white pine, and an understory of mountain shrubs.

In a representative profile the surface layer is dark grayish-brown and pale-brown, medium acid very stony sandy loam and gravelly sandy loam about 11 inches thick. The subsoil is very pale brown and light-gray, medium acid and strongly acid very gravelly heavy sandy loam about 29 inches thick. At a depth of about 40 inches is fractured andesite.

Permeability is moderately rapid. Roots generally penetrate as far down as bedrock; a few extend down into the fractures in the bedrock. Available water capacity is 2 to 3.5 inches.

Umpa soils are used for timber.

Representative profile: Wooded area about 3 miles north of Tahoe City, north side of logging road, 400 feet west and 100 feet north of S1/4 corner of sec. 19, T. 16 N., R. 17 E.

01&02--2 inches to 0, fir litter and duff.

A1--0 to 3 inches, dark grayish-brown (10YR 4/2) very stony sandy loam, very dark brown (10YR 2/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores; 10 percent stones and boulders, 25 percent gravel; medium acid; abrupt, smooth boundary. 2 to 4 inches thick.

A3--3 to 11 inches, pale-brown (10YR 6/3) gravelly sandy loam, brown (10YR 4/3) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots and common coarse roots; many very fine and fine interstitial pores; 30 percent gravel; medium acid; clear, smooth boundary. 4 to 7 inches thick.

B1--11 to 30 inches, very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; 50 percent gravel and 10 percent stones; medium acid; clear, wavy boundary. 9 to 19 inches thick.

B2--30 to 40 inches, light-gray (10YR 7/1) very gravelly heavy sandy loam, gray and reddish gray (5YR 5/1, 5/2) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; common very fine and fine tubular and interstitial pores; few thin clay films in pores and as coatings on sand grains and gravel; 50 percent gravel and 10 percent stones; strongly acid; clear, wavy boundary. 5 to 10 inches thick.

R--40 inches, hard, fractured andesite.

Thickness of the soil over bedrock ranges from 20 to 40 inches. Stones and boulders cover 5 to 20 percent of the surface area. The 0 horizon is less than 3 inches thick.

The A1 horizon ranges from grayish brown to pinkish gray in hues of 10YR and 7.5YR. It ranges from weak platy structure to moderate granular and from medium acid to strongly acid.

The B horizon has weak subangular blocky structure or is massive. It is strongly acid to very strongly acid. The weighted average of coarse fragments ranges from 40 to 75 percent of the volume.

The B2 horizon ranges from light gray to pinkish gray in hues of 10YR to 5YR and a value of 6 or 7. It ranges from very gravelly sandy loam to very gravelly heavy sandy loam. The increase in clay from the A to the B horizon ranges from 1 to 3 percent.

The upper 1 to 3 inches of bedrock is weathered to varying degrees.

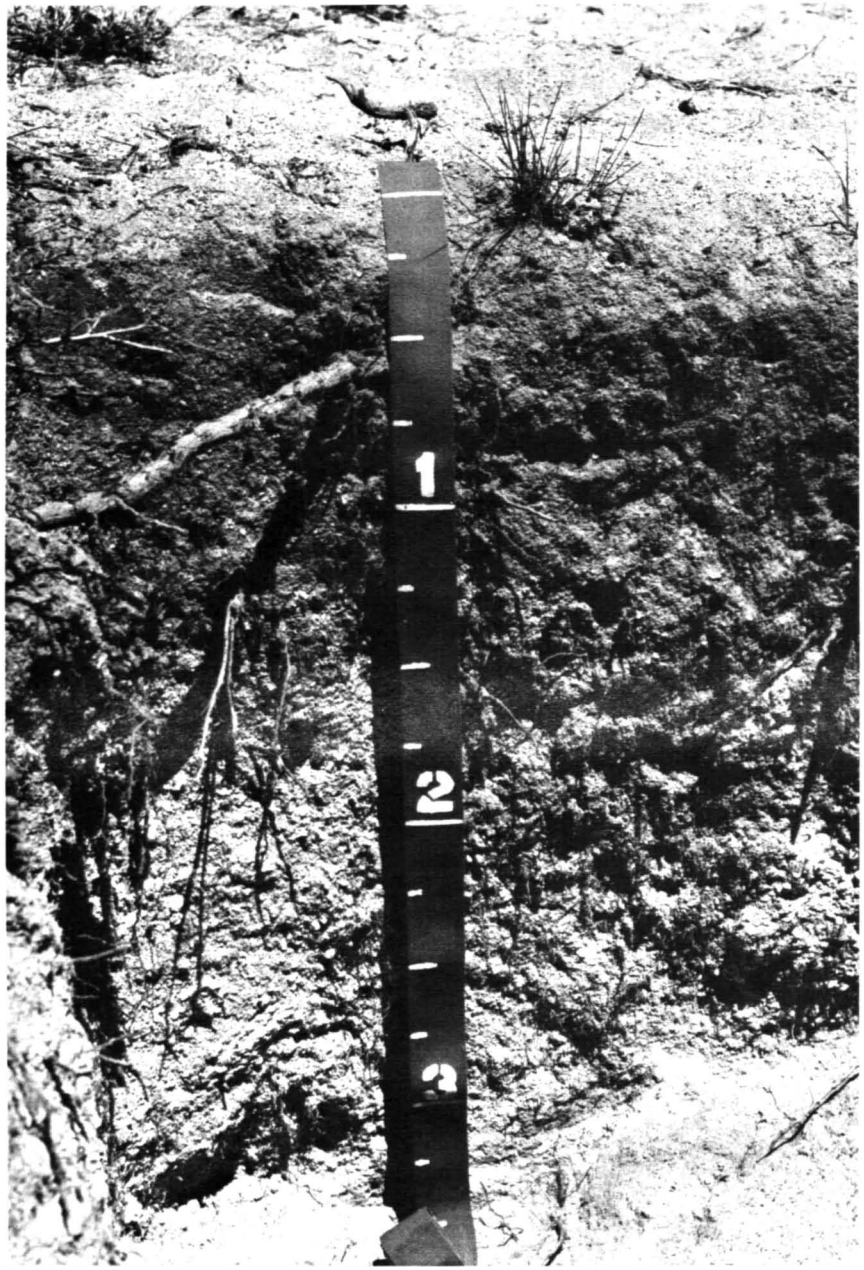
Umpa soils are similar to Tahoma, Fugawee, Jorge, and Waca soils. They have a larger number of coarse fragments in the subsoil than Fugawee and Tahoma soils. They are not so deep as Tahoma and Jorge soils. They have a thinner surface layer than Waca soils.

Umpa very stony sandy loam, 5 to 15 percent slopes (UmD).--This soil is on the foot slopes of Mount Watson and Mount Pluto.

About 5 percent of the acreage is Tahoma stony sandy loam; 10 percent is a soil similar to this Umpa soil, but does not have the slight clay increase in the subsoil or the large number of coarse fragments; and 10 percent is Jorge-Tahoma very stony sandy loams.

If this Umpa soil is bare of vegetation, surface runoff is medium and the erosion hazard is slight.

This soil is mainly used for timber. Urbanization is encroaching on this soil. Capability subclass VIs.



Profile of a Cagwin loamy coarse sand. Grus is at a depth of 40 inches.

Profile of Celio gravelly loamy coarse sand. Strongly silica-cemented hardpan is at a depth of 48 inches.

Profile of Elmira gravelly loamy coarse sand, 0 to 9 percent slopes.

Profile of Inville gravelly coarse sandy loam, 0 to 5 percent slopes. Weakly cemented pan is at a depth of 50 inches.

Profile of Jabu coarse sandy loam, shallow variant, 0 to 5 percent slopes. A dense, compact layer, or fragipan, begins at the depth of 11 inches. Roots penetrate soft areas in the pan.

Profile of a Tallac stony coarse sandy loam. Weakly silica-cemented pan is at a depth of 40 inches.

View from Tahoe Mountain showing urban encroachment on Truckee Marsh. Lake Tahoe and the Carson Range are in the background.

Boulders and stones on a Meeks very stony loamy coarse sand.

Umpa very stony sandy loam, 15 to 30 percent slopes (UmE).--This moderately steep or hilly soil is on uplands in the Mount Watson-Mount Pluto area.

About 5 percent of the acreage is Tahoma stony sandy loam; 10 percent is a soil similar to this Umpa soil, but has only a slight clay increase in the subsoil and does not contain a large number of coarse fragments; and 10 percent is Jorge-Tahoma very stony sandy loams. Also included in mapping, along the contact with granitic rock on the Nevada side of the Lake, are scattered areas of a soil similar to this Umpa soil that is underlain by granitic rock.

If this Umpa soil is bare of vegetation, surface runoff is medium and the erosion hazard is moderate.

This soil is used for timber. Capability subclass VIs.

Umpa very stony sandy loam, 30 to 50 percent slopes (UmF).--This soil is at the north end of the survey area, from Mount Watson and Mount Pluto east to the State line. It has the profile described as representative for the Umpa series.

About 10 percent of the acreage is a soil similar to this Umpa soil, but has only a slight clay increase in the subsoil and does not contain a large number of coarse fragments; 5 percent is Jorge-Tahoma very stony sandy loams; and 5 percent is Rock land. Also included in mapping, along the contact with granitic rock on the Nevada side of the Lake, are scattered areas of a soil that is similar to this Umpa soil, but is underlain by granitic rock.

If this Umpa soil is bare of vegetation, surface runoff is rapid and erosion hazard is high.

The principal use of this soil is timber. Capability subclass VIIs.

Waca Series

The Waca series consists of hilly to steep, well-drained soils that are 20 to 40 inches deep over andesitic tuff. These soils are on mountainous uplands at elevations of 6,500 to 9,500 feet. Slopes range from 9 to 50 percent. The annual precipitation is 35 to 70 inches, the average annual air temperature is about 42° F., and the frost-free season is 30 to 50 days. The vegetation is a semidense to dense stand of conifers, mostly red fir, white fir, and western white pine.

In a representative profile the surface layer is brown, slightly acid and medium acid cobbly coarse sandy loam and gravelly coarse sandy loam about 21 inches thick. The next layer is pale-brown, medium acid very gravelly coarse sandy loam. At a depth of about 36 inches is fractured andesitic rock.

Permeability is moderately rapid, but the surface layer does not absorb water readily. Available water capacity is 2.5 to 3.5 inches. The effective rooting depth is 20 to 40 inches.

Waca soils are used for watershed, timber, wildlife, and recreation.

Representative profile: Wooded area 100 feet south of Blackwood Canyon Road in S1/2 sec. 34, T. 15 N., R. 16 E.

01&02--2 inches to 0, fir litter and duff.

A11--0 to 9 inches, brown (10YR 5/3) cobbly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine roots; 30 percent gravel and 14 percent cobblestones; slightly acid; abrupt, smooth boundary. 3 to 9 inches thick.

A12--9 to 14 inches, brown (10YR 5/3) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots and many medium roots; many very fine and fine interstitial pores; 35 percent gravel and 3 percent cobblestones; medium acid; diffuse, wavy boundary. 4 to 6 inches thick.

A13--14 to 21 inches, brown (10YR 5/3) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; weak, medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; 35 percent gravel and 2 percent cobblestones; medium acid; diffuse, wavy boundary. 3 to 7 inches thick.

C--21 to 36 inches, pale-brown (10YR 6/3) very gravelly coarse sandy loam, brown (10YR 4/3) moist; weak, medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine interstitial pores; 45 percent gravel and 3 percent cobblestones; medium acid; clear, irregular boundary. 11 to 18 inches thick.

R--36 inches, slightly weathered, fractured andesitic tuff.

The depth to andesitic rock ranges from 20 to 40 inches.

The A horizon ranges from 10 to 22 inches in thickness. It is brown, dark brown, or dark grayish brown when dry and very dark brown, very dark grayish brown, or dark brown when moist.

The C horizon is brown, yellowish brown, pale brown, or light yellowish brown in hues of 10YR and 7.5YR when dry. It is medium acid to strongly acid. The control section ranges from coarse sandy loam to light loam and is 35 to 70 percent, by volume, gravel or cobblestones.

Waca soils are similar to Meiss, Cagwin, and Tallac soils. They are deeper than Meiss soils. They are not so sandy as Cagwin soils. They differ from Cagwin and Tallac soils in the kind of parent material; they formed in andesitic material, whereas Cagwin soils formed in granitic material, and Tallac soils in glacial-deposited material.

Waca cobbly coarse sandy loam, 9 to 30 percent slopes (WaE).--About 5 percent of the acreage of this soil is a Waca cobbly coarse sandy loam that

has slopes of more than 30 percent, and 2 to 5 percent is Meiss cobbly loam.

Runoff is medium on this Waca soil, and the erosion hazard is moderate.

This soil is used for watershed, recreation, and timber. Capability subclass VIe.

Waca cobbly coarse sandy loam, 30 to 50 percent slopes (WaF).--This soil has the profile described as representative for the series.

About 5 to 10 percent of the acreage is Waca cobbly coarse sandy loam, 9 to 30 percent slopes; 5 to 10 percent is Meiss cobbly loam; and about 5 percent is Rock land. Also included are some areas of a Waca cobbly coarse sandy loam that has slopes of as much as 70 percent; and on the Nevada side of the Lake is a soil that is similar to this Waca soil but has a reddish loam subsoil.

If this Waca soil is bare of vegetation, surface runoff is rapid and the erosion hazard is high.

The principal uses of this soil are watershed, recreation, and timber. Capability subclass VIIe.

Waca-Rock outcrop complex, 9 to 30 percent slopes (WcE).--This complex is on volcanic uplands, mainly in the western part of the survey area. It is about 80 to 95 percent soil material and 5 to 20 percent volcanic rock outcrop. The soil material is about 80 percent Waca cobbly coarse sandy loam, of which about 5 percent has slopes of more than 30 percent; 15 percent is Meiss cobbly loam; and 5 percent is Tallac stony coarse sandy loam.

This Waca soil is well drained. Runoff is medium, and the erosion hazard is moderate. Available water capacity is 2.5 to 3.5 inches. Depth to rock is 20 to 40 inches.

Rock outcrop consists of hard andesitic breccia. It ranges from scattered rock 1 to 2 feet in diameter to expanses covering 50 to 200 square feet. Runoff is rapid, and the erosion hazard is slight.

This complex is used for watershed, recreation, and timber. Capability subclass VIs.

Waca-Rock outcrop complex, 30 to 50 percent slopes (WcF).--This complex is on volcanic uplands. It is about 75 to 90 percent soil material and 10 to 25 percent volcanic rock outcrop. The soil material is about 75 percent Waca cobbly coarse sandy loam that in some areas has slopes of 50 to 70 percent and in other areas, slopes of 9 to 30 percent; about 20 percent is Meiss cobbly loam; and 5 percent is Tallac very stony coarse sandy loam.

The Waca soil is well drained. If it is bare of vegetation, surface runoff is rapid and the erosion hazard is high. Available water capacity is 2.5 to 3.5 inches. Depth to rock is 20 to 40 inches.

Rock outcrop consists of hard andesitic breccia. The outcrops range from scattered rock 1 to 2 feet in diameter to large expanses covering 50 to 500 square feet. Runoff is very rapid, and the erosion hazard is slight.

This complex is used for watershed, recreation, and timber. Capability subclass VIIs.

SOILS AND ENGINEERING[2/]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal systems. Among the properties most important are shear strength, permeability, compaction characteristics, shrink-swell behavior, available water capacity, grain size, plasticity, soil reaction, piping potential, and infiltration rate. Topography, depth to bedrock, depth to seasonal water table, and stratification within the profile are also important.

Information concerning these and related soil properties is given in tables 2 and 3. The actual test data, estimates, and interpretations in these tables can be used to--

1. Make 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.
2. Make studies that will aid in selecting and developing industrial, commercial, residential, and recreational sites.
3. Locate probable sources of borrow material for road fill and for construction of dams, dikes, levees, and other embankments.
4. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
5. Develop other preliminary estimates for construction purposes pertinent to the particular area.
6. Supplement other publications, such as maps, reports, and aerial photographs, that are used in preparing engineering reports for a specific area.
7. Correlate performance of soil mapping units to develop information that will be useful in designing and maintaining engineering structures.
8. Aid in estimating sediment sources and potential dust producing areas during construction operations.

The engineering interpretations reported here do not eliminate the need for sampling and testing at the site of specific engineering works. They are

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2/ O. T. GERBAZ, area engineer, Soil Conservation Service, helped prepare this section.

useful, however, in planning more detailed field investigations and in indicating the kinds of problems that may be expected.

Some of the terms used by soil scientists have a special meaning in soil science that may not be familiar to engineers. These terms are defined in the Glossary.

Engineering Classification

The two systems most commonly used in classifying soils for engineering are the systems approved by the American Association of State Highway Officials (AASHO) and the Unified system.

The AASHO system (2) is used to classify soils according to those properties that affect use in highway construction. In this system soil materials are classified in seven principal groups. The groups range from A-1, which consists of soils that have the highest shear strength and are the best soils for subgrade, to A-7, which consists of soils that have the lowest shear strength when wet and are the poorest soils for subgrade.

In the Unified system (20) soils are classified according to their texture and plasticity and their performance as engineering construction material. Soils are grouped in 15 classes. Those identified as GP, GW, SP, and SW are clean gravels and sands. Those identified as GM, GC, SM, and SC are gravels and sands that include an appreciable amount of nonplastic and plastic fines. ML and CL are nonplastic and plastic fine materials that have low liquid limit, and MH and CH are nonplastic and plastic fine-textured soils that have a high liquid limit. Organic soils and peat are designated by the symbols OL, OH, and Pt. Soils on the borderline between two classes are designated by symbols for both classes, for example, ML-CL.

Soil scientists use the USDA textural classification (14). In this system the texture of the soil is determined according to the proportion of soil particles smaller than 2 millimeters in diameter, that is, the proportion of sand, silt, and clay. Textural modifiers, such as gravelly, cobbly, and very stony are used as needed for material larger than 2 millimeters in diameter.

Table 2 shows the AASHO and Unified classifications of specific soils in the survey area, as determined by laboratory tests. Table 3 shows the estimated classification of all the soils in the survey area according to all three systems of classification.

Engineering Test Data

Samples from selected horizons of 10 representative soils in the Tahoe Basin Area were tested in order to evaluate the soil properties significant in engineering. Results of these tests are shown in table 2, along with the soil name, the location where the soil was sampled, and the depth at which the sample was taken.

Mechanical analysis of the selected samples was determined by the sieve and hydrometer method. The size and proportions of soil particles in each size class affect the behavior of soil material when it is used for engineering purposes.

The moisture-density relations, that is, the maximum dry density and the optimum moisture content were determined by the California Division of Highways Test Number 216. The density of the compacted soil increases as the moisture content increases until the optimum moisture content is reached; after that, the density decreases with an increase in moisture content. The moisture content at which the maximum dry density is obtained is the optimum moisture content.

Tests for liquid limit, plastic limit, and plasticity index measure the effect of water on consistence of the soil material. As the moisture content of a clayey soil increases from a dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the soil material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range in moisture content within which a soil material is in a plastic condition.

Estimates of Engineering Properties

Estimates of soil properties significant in engineering are shown in table 3. They are based on data shown in table 2, on field examination, and on experience with soils within the survey area and with similar soils in other areas. Because the estimates given in table 3 are for typical soils, some variation from the estimated values should be expected.

Shrink-swell potential is that quality of the soil that determines its volume change with change in moisture content. The volume-change behavior of soil is influenced by the amount of moisture change and the amount and kind of clay in the soil.

Damage to building foundations, roads, and other structures may result from soil shrinking when dry and swelling when wet. Shrink-swell potential ratings are an indication of the hazard to structures resulting from this volume change.

The shrink-swell potential of each soil in the survey area is rated low, moderate, or high in table 3. Low potential means that shrinking and swelling is not a significant problem and the soil is suitable for construction sites if other features are favorable. Moderate and high ratings indicate progressively greater limitations. A high rating does not necessarily mean that structures cannot be built, but rather that appropriate, compensating design measures can be incooperated during construction. Most soils in the Tahoe Basin Area have a low or moderate shrink-swell potential.

TABLE 2.--ENGINEERING

[Tests performed by the District III, California Division of Highways and the Nevada State Department of

Soil name and location	Depth	Classification		Moisture-density 2/	
		AASHO 1/	Unified	Maximum dry density	Optimum moisture
	In.			Lb./cu. ft.	Pct.
Celio:					
El Dorado County, 0.1 mi. N. of SE. corner, sec. 30, T. 12 N., R. 18 E.; 0.25 mi. W. of Meyers Checking Station, west side of State Highway 89 extension. (Modal)	0-16	A-1-b(0)	SW-SM	122	11
	23-45	A-1-a(0)	GP	134	11
	67-77	A-1-b(0)	SP	115	12
Elmira:					
El Dorado County, 0.1 mi. W. of SW. corner, sec. 21, T. 12 N., R. 18 E.; 1 mi. NE. of Meyers off Pioneer Trail Rd. (Modal)	0-13	A-2-4(0)	SM	119	12
	13-36	A-1-b(0)	SM	125	12
	36-51	A-1-b(0)	SM	127	11
	51-73	A-1-b(0)	SW-SM	116	12
*Graylock:					
Douglas County, 1,000 ft. E. and 500 ft. N. of SW. corner of sec. 31, T. 14 N., R. 19 E.; about 1 mi. S. of Genoa Peak. (Modal)	0-8	A-1-b(0)	SM	---	--
	8-48	A-1-a(0)	SM	---	--
*Inville:					
Washoe County, 2,200 ft. E. and 2,200 ft. S. of NW. corner of sec. 15, T. 16 N., R. 18 E.	0-4	A-1-b(0)	SM	---	--
	10-26	A-1-b(0)	GM	---	--
	26-35	A-1-a(0)	GM	---	--
	35-54	A-1-a(0)	GP-GM	---	--
*Jabu:					
Washoe County, 1,000 ft. E. and 700 ft. N. of SW. corner of sec. 15, T. 16 N., R. 18 E. (Yellowish-brown, cobbly B horizon)	0-3	A-1-b(0)	SM	---	--
	3-13	A-1-b(0)	SM	---	--
	19-34	A-1-b(0)	SM	---	--
	34-49	A-2-4(0)	SM-SC	---	--
Jabu shallow variant:					
El Dorado County, 0.1 mi. SE. of $N\frac{1}{4}$ corner sec. 28, T. 12 N., R. 18 E., $1\frac{1}{2}$ mi. NE. of Meyers off Pioneer Trail Rd., 200 ft. beyond end of pavement of Oneidas St., 50 ft. S. of dirt road, South Lake Tahoe.	14-24	A-2-4(0)	SM	129	9.3
	24-58	A-2-4(0)	SC	125	12.1
	58-72	A-2-4(0)	SM	130	9.5
*Shakespeare:					
Douglas County, 500 ft. E. and 1,000 ft. N. of $S\frac{1}{4}$ corner of sec. 30, T. 14 N., R. 19 E., at the base of Genoa Peak. (Modal)	0-4	A-5	SM	---	--
	4-9	A-2-4(0)	SM	---	--
	20-33	A-4(2)	SM	---	--
	33-60	A-4(8)	ML	---	--

See footnotes at end of table.

TEST DATA

Highways. An asterisk identifies the soils tested by the Nevada State Department of Highways]

Mechanical analysis 3/														Liquid limit	Plasticity index
Percentage passing sieve--												Percentage smaller than--			
3 in.	1 1/2 in.	3/4 in.	1/2 in.	No. 4	No. 8	No. 10	No. 16	No. 30	No. 40	No. 50	No. 200	0.005 mm.	0.001 mm.		
100	99	86	79	67	60	--	50	35	--	22	11	3	1	---	4/ NP
100	90	66	58	43	40	--	34	22	--	9	2	1	0	---	NP
---	100	99	98	98	93	--	85	61	--	24	3	2	0	---	NP
---	100	99	99	98	93	--	81	63	--	40	17	7	2	---	NP
100	99	97	95	90	85	--	75	57	--	37	17	7	2	---	NP
100	97	96	92	82	77	--	70	56	--	35	14	7	3	---	NP
---	---	100	99	99	96	--	90	66	--	33	10	4	1	---	NP
---	---	100	--	79	--	57	--	--	37	--	19	--	--	25.0	NP
100	96	91	--	66	--	46	--	--	26	--	13	--	--	25.5	NP
---	100	95	--	87	--	80	--	--	49	--	22	--	--	27.9	NP
100	75	67	--	55	--	47	--	--	31	--	14	--	--	22.7	NP
100	86	73	--	54	--	42	--	--	25	--	13	--	--	24.6	NP
100	85	53	--	36	--	29	--	--	17	--	9	--	--	26.9	2.7
100	94	94	--	88	--	78	--	--	41	--	17	--	--	30.6	NP
---	100	92	--	82	--	74	--	--	46	--	21	--	--	23.3	NP
100	82	82	--	73	--	66	--	--	44	--	21	--	--	21.6	NP
---	100	93	--	86	--	78	--	--	55	--	30	--	--	26.5	5.9
---	---	100	99	98	95	--	89	76	--	60	30	14	7	----	NP
---	---	---	100	98	95	--	89	78	--	60	29	14	8	26	8
---	---	100	99	95	89	--	82	69	--	52	25	9	5	----	NP
100	96	90	--	70	--	61	--	--	46	--	37	--	--	43.6	NP
100	79	60	--	54	--	51	--	--	44	--	35	--	--	26.3	NP
---	---	100	--	84	--	74	--	--	58	--	47	--	--	29.9	3.3
---	---	100	--	99	--	98	--	--	91	--	80	--	--	36.2	5.5

TABLE 2.--ENGINEERING

Soil name and location	Depth	Classification		Moisture-density 2/	
		AASHO 1/	Unified	Maximum dry density	Optimum moisture
	In.			Lb./cu. ft.	Pct.
Tallac:					
El Dorado County, 0.2 mi. N. and 0.1 mi. W. of SE. corner of sec. 34, T. 13 N., R. 17 E.; 2 mi. W. of Camp Richardson, lot 18 of the Forest Service Spring Creek Tract. (Modal)	0-21	A-1-b(0)	SM	121	11
	21-42	A-1-b(0)	SM	136	10.4
	42-65	A-1-b(0)	SM	132	11.3
*Umpa:					
Washoe County, 2,000 ft. E. and 500 ft. N. of SW. corner of sec. 9, T. 16 N., R. 18 E., Incline Village, Nev.	0-3	A-1-b(0)	SM	---	----
	3-13	A-1-b(0)	SM	---	----
	13-24	A-1-b(0)	SM	---	----
Waca:					
Placer County, SE¼ sec. 8, T. 14 N., R. 16 E.; 0.4 mi. E. of Barker Pass, 70 ft. S. of Blackwood Canyon Rd.	13-29	A-1-b(0)	GM	109	21

1/ Based on American Association of State Highway Officials Designation: M145-66.

2/ District III California State Division of Highways, Method No. 216.

TEST DATA--Continued

Mechanical analysis 3/														Liquid limit	Plasticity index
Percentage passing sieve--												Percentage smaller than--			
3 in.	1 1/2 in.	3/4 in.	1/2 in.	No. 4	No. 8	No. 10	No. 16	No. 30	No. 40	No. 50	No. 200	0.005 mm.	0.001 mm.		
100	99	87	80	72	66	--	59	50	--	39	21	3	1	---	NP
100	98	87	79	62	56	--	51	42	--	32	17	2	1	---	NP
100	97	86	79	64	54	--	44	35	--	29	14	2	1	---	NP
100	96	95	--	63	--	51	--	--	35	--	22	---	---	30	NP
94	91	88	--	67	--	56	--	--	42	--	18	---	---	24	NP
100	80	78	--	67	--	56	--	--	41	--	18	---	---	22	NP
96	83	70	65	56	51	--	46	40	--	33	21	---	---	--	--

3/ District III California State Division of Highways, Method No. 202, and Nevada State Department of Highways.

4/ Nonplastic.

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[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or this reason it is necessary to follow carefully the instructions for referring to other series

Soil series and map symbols	Depth to--		Depth from surface	Classification			Coarse fragments greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Ft.	Ft.	In.				Pct.
Beaches: Be. No valid estimates can be made. On-site investigation required.							
Cagwin: CaD, CaE, CaF--- Mapped only with Rock outcrop.	1½-3½	(1/)	0-26	Loamy coarse sand and coarse sand.	SP-SM or SM	A-1	0-2
			26	Grus.			
Celio: Co----------	>5	1-5	0-23	Gravelly loamy coarse sand.	SP-SM or SM	A-1	5-15
			23-45	Very gravelly coarse sand.	GP or SP	A-1	5-20
			45-56	Strongly silica cemented hardpan.	----------	---------	-----
*Elmira: 2/ 2/ EbC, EbE, EcE----------	>5	(1/)	0-44	Gravelly loamy coarse sand.	SP-SM or SM	A-1 or A-2	0-2 (EcE)
			44-59	Gravelly coarse sand.	SP-SM or SM	A-1	-----
			59-72	Very gravelly coarse sand.	GP or GP-GM	A-1	0-2 (EcE)
EfB---------- For Gefo part of EfB, see Gefo series.	>5	(1/)	0-39	Loamy coarse sand---	SP-SM or SM	A-1	-----
			39-61	Coarse sand---------	SP-SM	A-1	-----
Elmira wet variant: Ev--	>5	1-2	0-44	Loamy coarse sand---	SP-SM or SM	A-1 or A-2	-----
			44-56	Clay loam----------	ML	A-7	-----
			56-66	Fine sandy loam and sandy loam.	SM	A-4	-----
Fill land: Fd----------	>5	6-8	0-60	Coarse sand---------	SP-SM or SM	A-1	-----
Fugawee: FuD, FuE-------	2-3½	(1/)	0-17	Gravelly sandy loam.	SM	A-2	5-20
			17-37	Gravelly clay loam--	SC or CL	A-6	0-10
			37	Andesite.			
Gefo: GeC, GeD----------	>5	(1/)	0-76	Gravelly loamy coarse sand and gravelly coarse sand.	SP-SM or SM	A-1	-----
Gravelly alluvial land: Gr. No valid estimates can be made. Onsite investigation required.	>5	1-2					

See footnotes at end of table.

more kinds of soil. The soils in such mapping units may have different properties and limitations, and for that appear in the first column of this table. The symbol < means less than; > means more than]

Percentage less than 3 inches passing sieve--				Atterberg values		Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosion potential of uncoated steel
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plastic index					
						In./hr.	In./in. of soil	pH value		
65-90	55-85	30-50	10-20	3/ NP	3/ NP	6.3-20	0.05-0.07	5.1-6.5	Low----------	Low.
60-70	50-60	25-40	5-15	NP	NP	6.3-20	0.04-0.06	5.6-6.5	Low----------	High.
40-70	30-50	10-25	0-5	NP	NP	6.3-20	0.03-0.05	5.6-7.3	Low----------	High.
-----	-----	-----	-----	------	------	0.06-0.2	---------	5.6-7.3	----------	----------
80-100	70-95	30-55	10-20	NP	NP	6.3-20	0.06-0.08	5.6-6.5	Low----------	Low.
60-85	50-80	20-50	5-15	NP	NP	>20	0.04-0.06	5.1-6.0	Low----------	Low.
40-70	30-50	15-25	0-10	NP	NP	>20	0.03-0.05	5.1-6.0	Low----------	Low.
90-100	80-100	35-50	5-15	NP	NP	6.3-20	0.06-0.08	5.6-6.0	Low----------	Low.
90-100	80-100	35-45	5-12	NP	NP	>20	0.04-0.06	5.6-6.0	Low---------	Low.
90-100	80-100	35-55	5-15	NP	NP	2.0-6.3	0.06-0.08	5.1-6.0	Low---------	High.
100	100	90-100	70-80	40-50	10-20	0.06-0.2	0.15-0.17	5.6-6.0	Moderate----	High.
100	100	75-85	35-50	NP	NP	2.0-6.3	0.12-0.14	6.1-6.5	Low---------	High.
90-100	80-100	35-45	5-15	NP	NP	>20	0.04-0.06	5.6-6.0	Low---------	Low.
80-90	60-75	50-60	20-30	NP	NP	2.0-6.3	0.07-0.09	5.6-6.5	Low---------	Low.
70-80	60-70	55-65	35-55	30-40	10-15	0.63-2.0	0.12-0.17	4.5-6.0	Moderate----	Moderate.
60-100	55-95	30-50	5-20	NP	NP	>20	0.05-0.07	5.6-6.5	Low---------	Low.

TABLE 3.--ESTIMATES OF SOIL PROPERTIES

Soil series and map symbols	Depth to--		Depth from surface	Classification			Coarse fragments greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Ft.	Ft.	In.				Pct.
Graylock: GsF----------	3->5	(1/)	0-48	Gravelly loamy coarse sand, extremely stony on surface.	SP-SM or SM	A-1	45-55
			48	Grus.			
Inville: IgB----------	>5	(1/)	0-40	Gravelly coarse sandy loam.	GM or GP-GM	A-1	0-5
			40-68	Cemented gravelly loamy sand.	SP-SM or SM	A-1	0-5
IsC, IsD, IsE----------	>5	(1/)	0-35	Gravelly and cobbly sandy loam.	SM or SP-SM	A-1	15-50
			35-60	Cobbly and very gravelly loamy sand.	GP-GM or GM	A-1	25-50
Jabu: JaC, JaD, JbD-----	>5	(1/) (JaC, JaD)	0-45	Coarse sandy loam and gravelly coarse sandy loam.	SM	A-1 or A-2	0-20
		2-3 (JbD)	45-66	Compact loamy coarse sand.	SM	A-2	0-20
Jabu, moderately fine subsoil variant:	>5	4-6	0-17	Sandy loam----------	SM	A-2	-----
			17-42	Clay loam----------	CL	A-6	-----
JgC----------			42-60	Clay and clay loam--	ML or MH	A-7	-----
JhC----------	>5	4-6	0-19	Stony sandy loam and heavy loam.	SM or SC	A-4 or A-2	1-5
			19-29	Sandy clay loam-----	SC	A-6	1-5
			29-56	Clay and clay loam--	MH or ML	A-7	-----
Jabu, shallow variant: JeB, JeD.	>5 (JeB)	3-4	0-11	Coarse sandy loam---	SM	A-2	-----
	3½-5 (JeD)		11-44	Compact coarse sandy loam.	SM or SC	A-2	-----
			44-91	Compact gravelly coarse sandy loam.	SM	A-1 or A-2	-----
Jorge: JtD, JwD, JwE, JwF. Mapped only with Tahoma soils. For Tahoma part, see Tahoma series.	>5	(1/)	0-84	Very gravelly sandy loam and very gravelly loam.	GP-GM or GM	A-1	5-50
			84	Volcanic rock.			
Loamy alluvial land: Lo- No valid estimates can be made. On-site investigation required.	>5	1-2					

See footnotes at end of table.

SIGNIFICANT IN ENGINEERING--Continued

Percentage less than 3 inches passing sieve--				Atterberg values		Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosion potential of uncoated steel
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plastic index					
						In./hr.	In./in. of soil	pH value		
60-80	50-70	20-40	10-20	NP	NP	6.3-20	0.03-0.05	5.6-6.5	Low---------	Low.
50-60	40-50	20-30	10-20	NP	NP	0.63-2.0	0.07-0.09	5.6-6.5	Low---------	Low.
65-75	60-70	35-45	10-15	NP	NP	<0.06	---------	5.6-6.5	Low---------	Moderate.
50-90	40-80	25-50	10-25	NP	NP	0.63-2.0	0.08-0.10	5.6-6.5	Low---------	Low.
30-50	25-40	15-30	5-20	15-30	0-5	0.63-2.0	0.03-0.05	5.6-6.0	Low---------	Low.
75-85	65-75	40-50	20-30	20-35	0-5	0.63-2.0	0.07-0.09	5.1-6.5	Low---------	Low (JaC, JaD), moderate (JbD).
90-100	80-95	50-70	15-30	NP	NP	0.06-0.2	---------	5.1-5.5	Low---------	Moderate (JbD). Low (JaC, JaD).
95-100	85-95	60-70	25-35	15-25	NP	2.0-6.3	0.08-0.10	5.1-6.0	Low---------	Low.
95-100	95-100	70-85	60-70	30-40	10-15	0.2-0.63	0.16-0.18	5.1-6.0	Moderate----	Moderate.
100	100	85-95	70-85	45-55	10-20	<0.06	0.14-0.16	5.6-6.0	Moderate----	High.
90-100	80-95	60-75	25-50	15-35	NP-10	0.63-2.0	0.08-0.10	6.1-6.5	Low---------	Low.
100	80-100	60-85	35-50	30-40	10-20	0.2-0.63	0.15-0.17	5.6-6.5	Moderate----	Moderate.
100	100	85-95	70-85	45-55	10-20	<0.06	0.14-0.16	6.5-8.0	Moderate----	High.
95-100	70-95	50-60	25-35	NP	NP	2.0-6.3	0.08-0.10	5.1-6.0	Low---------	Moderate.
90-100	85-95	55-65	25-35	20-30	5-10	<0.06	---------	4.5-6.5	----------	----------
75-90	70-85	40-60	20-30	NP	NP	<0.06	---------	4.5-6.5	----------	----------
45-55	40-50	25-35	5-15	NP	NP	0.63-2.0	0.06-0.08	5.1-6.5	Low---------	Low.

Soil series and map symbols	Depth to--		Depth from surface	Classification			Coarse fragments greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Ft.	Ft.	In.				Pct.
Marsh: Mh---------- No valid estimates can be made. On-site investigation required.	>5	(4/)					
Meeks: MkB, MkD, MmB, MsD, MsE, MsG, MtE, MtG.	>5	(1/)	0-61	Gravelly loamy coarse sand and very gravelly loamy coarse sand.	GP or GP-GM	A-1	5-40
			61-71	Weakly cemented gravelly loamy coarse sand.	SP-SM or SP	A-1	25-40
Meiss: MxE, MxF--------	1-1½	(1/)	0-13	Cobbly, gravelly loam.	SM or SC	A-4 or A-2	5-20
			13	Andesite.			
Pits and dumps: Px. No valid estimates can be made. On-site investigation required.							
Rock land: Ra. No valid estimates can be made. On-site investigation required.							
Rock outcrop: RcF, RcG, RtF, RtG. No valid estimates can be made for Rock outcrop. For Cagwin part of RcF and RcG and Toem part of RtF and RtG, see their respective series.							
Rock outcrop and Rubble land: Rx. No valid estimates can be made. On-site investigation required.							
Shakespeare: ShE, SkF-	4->5	(1/)	0-33	Gravelly heavy loam and gravelly clay loam.	SM or GM	A-4	10-25
			33-60	Silty clay loam----	ML	A-4	0-10
			60	Metamorphic rock.			

See footnotes at end of table.

SIGNIFICANT IN ENGINEERING--Continued

Percentage less than 3 inches passing sieve--				Atterberg values		Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosion potential of uncoated steel
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plastic index					
						In./hr.	In./in. of soil	pH value		
40-55	30-40	20-30	0-10	NP	NP	6.3-20	0.03-0.05	5.6-6.5	Low---------	Low.
65-75	40-60	10-20	0-10	NP	NP	0.06-0.2	0.02-0.04	5.1-6.0	Low---------	Low.
65-80	60-75	55-60	30-40	10-30	0-10	2.0-6.3	0.08-0.10	5.6-6.5	Low---------	Low.
65-85	60-75	50-60	35-50	25-35	NP-5	0.2-0.63	0.10-0.16	5.1-6.5	Low---------	Moderate.
95-100	95-100	90-95	70-85	30-40	5-10	0.06-0.2	0.16-0.18	5.1-5.5	Low---------	Moderate.

TABLE 3.--ESTIMATES OF SOIL PROPERTIES

Soil series and map symbols	Depth to--		Depth from surface	Classification			Coarse fragments greater than 3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Ft.	Ft.	In.				Pct.
Stony colluvial land: Sm. No valid estimates can be made. On-site investigation required.							
Tahoma: TaD, TbD-------	3½->5	(1/)	0-35	Gravelly sandy loam and gravelly loam, stony on surface.	SM	A-2 or A-4	5-30
			35-68	Gravelly clay loam---	GC or CL	A-6	5-15
			68	Volcanic rock.			
Tallac: TcB, TcC, TdD, TeE, TeG, TkC. Depth to seasonal high water table 3½ to 6 feet in TcB, TcC, and TkC.	>5	(1/)	0-42	Gravelly coarse sandy loam and very cobbly coarse sandy loam.	SM or GM	A-1	5-65
			42-65	Weakly cemented gravelly coarse sandy loam.	SM or SP-SM	A-1	-----
Tallac, shallow variant: TmE, TmF.	>5	(1/)	0-24	Gravelly coarse sandy loam.	SM	A-1 or A-2	10-30
			24-40	Weakly cemented very gravelly coarse sandy loam.	SM or SP-SM	A-1	20-30
Toem: TrE, TrF--------- Mapped only with Rock outcrop.	1-1½	(1/)	0-17	Gravelly coarse sand-	SP-SM or SM	A-1	0-5
			17	Grus.			
*Umpa: UmD, UmE, UmF----	1½-3½	(1/)	0-40	Gravelly sandy loam and very gravelly sandy loam.	SM or SP-SM	A-1	10-35
			40	Andesite.			
Waca: WaE, WaF, WcE, WcF. No valid estimates can be made for Rock outcrop part of WcE and WcF.	1½-3½	(1/)	0-36	Gravelly coarse sandy loam and very gravelly coarse sandy loam.	GM	A-1	5-30
			36	Andesite.			

1/ No water table observed to a depth of about 5 feet, or above bedrock or a hardpan if either is within 5 feet of the surface.

2/ Very slow permeability (<0.06 inches per hour) below a depth of 50 to 70 inches.

SIGNIFICANT IN ENGINEERING--Continued

Percentage less than 3 inches passing sieve--				Atterberg values		Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosion potential of uncoated steel
No. 4	No. 10	No. 40	No. 200	Liquid limit	Plastic index					
						In./hr.	In./in. of soil	pH value		
85-90	60-80	50-60	25-40	NP	NP	2.0-6.3	0.10-0.12	4.5-6.5	Low--------	Low.
65-95	60-95	50-80	45-60	30-40	10-15	0.63-2.0	0.12-0.13	4.5-5.5	Moderate---	Moderate.
55-65	45-60	30-45	15-25	NP	NP	2.0-6.3	0.06-0.08	5.6-6.0	Low--------	Moderate.
60-75	45-65	25-40	10-25	NP	NP	0.06-0.2	0.04-0.06	5.1-5.5	Low--------	Moderate.
70-75	50-70	45-50	20-30	NP	NP	2.0-6.3	0.07-0.09	4.5-6.0	Low--------	Moderate.
60-75	50-60	30-40	10-20	NP	NP	0.06-0.2	0.03-0.05	5.1-6.0	Low--------	Low.
70-80	50-70	25-45	5-15	NP	NP	6.3-20	0.03-0.05	5.6-6.5	Low--------	Low.
60-70	30-60	15-45	5-25	NP	NP	2.0-6.3	0.06-0.08	4.5-6.0	Low--------	Low.
45-60	35-50	25-40	15-25	NP	NP	2.0-6.3	0.06-0.08	5.1-6.5	Low---------	Low.

3/ Nonplastic.
4/ Ponded.

Only the B horizon, or the control section, of the soil is considered in the ratings, unless otherwise noted. Criteria used for rating the shrink-swell potential of soils are given in table 4.

Corrosivity of untreated, or uncoated, steel, or the rate at which steel corrodes or deteriorates when buried in soil, depends largely on the physical, chemical, and biological characteristics of the soil and on the physical and chemical characteristics of the steel. The rate and extent of corrosion also depend on the depth at which the steel is buried. Corrosion probability is generally greater for installations that intersect soil boundaries or soil horizons than for installations in one kind of soil or in one soil horizon.

Ratings for corrosivity are based on soil in its natural state. The effects of other factors, such as quality of the water, are not considered. Corrosion of untreated steel pipe is likely to be increased by electrical leaks from underground cables and by electrical charge resulting from the contact of dissimilar metals.

Corrosion potential is expressed as low, moderate, and high. It is based on such soil properties as texture, drainage, total acidity, and conductivity of saturation extract. The estimates shown in table 3 are only for general planning purposes. They are not to be substituted for detailed, onsite investigation. In estimating corrosion potential, it is assumed that the pipe or steel structure is in the control section, or the B horizon, of the soil. If pipe is located in other horizons, soil properties of these horizons must be considered. Criteria used for rating corrosion potential of untreated steel are given in table 5.

SOIL RESOURCE INTERPRETATIONS

The four soil resource groupings shown in table 6 relate to agricultural management of each soil in the survey area. The table gives estimates of the limitations and suitability for selected uses, and lists specific soil features that affect certain engineering practices. The interpretations in table 6 are based on field examination and experience. They are given for representative soils; hence, some variation from the estimated values should be expected.

Features of the soil that determine the interpretations shown in table 6 are explained in the paragraphs and criteria tables that follow. It should be noted that the least favorable feature determines the rating. It should also be noted that unfavorable features do not add up to a cumulative rating; for example, several moderate limitations do not add up to a severe limitation.

The information in this section is intended only as a guide. It is not a substitute for the detailed information in the section "Descriptions of the Soils," and it does not eliminate the need for onsite investigation.

CAPABILITY SUBCLASS.--The capability subclass is a grouping of soils that have the same kind of dominant limitation for agricultural use. An explanation of the capability subclass is given under the heading "Capability Grouping," page 66.

VEGETATIVE GROUPS.--The vegetative group is a grouping of soils that have similar properties and qualities and are suited to about the same kinds of plants and the same general management. The grouping is used chiefly to determine the choice of plants by defining the major limiting soil features. Not considered in the determinations were precipitation, maximum and minimum temperatures, length of growing season, and possibility of irrigation. Five of the vegetative soil groups in a statewide system are recognized in the Tahoe Basin Area.

Group A. Choice of plants is not limited. Soils have no major limitation. They are more than 40 inches deep. Texture of the surface layer is stony sandy loam. Drainage is good, permeability is moderate in the subsoil, and the available water capacity for the entire profile is generally more than 5 inches.

Group B. Choice of plants is limited by droughtiness and low fertility. Soils are mostly more than 40 inches deep over weathered rock, but some are only 20 inches deep. Texture of the surface layer ranges from loamy coarse sand to gravelly loam and in places is stony or very stony. Drainage is moderately good to somewhat excessive, permeability is very rapid to slow in the subsoil, and the available water capacity is mostly less than 5 inches.

Group E. Choice of plants is limited by wetness. Soils are more than 30 inches deep. Texture of the surface layer ranges from sand through silt loam and in places is very gravelly. Natural drainage is poor to somewhat poor and the available water capacity for the entire profile is mostly more than 2 inches.

Group G. Choice of plants is limited by depth. Soils are as shallow as 20 inches over bedrock or a hardpan. Texture of the surface layer ranges from coarse sandy loam to very stony sandy loam. Drainage is moderately good to good. Permeability is moderate to slow, and the available water capacity for the entire profile is more than 3 inches.

Group J. Choice of plants depends on onsite investigation. The group includes all soils and land types in capability classes VII and VIII and steep and very steep soils.

Criteria used in grouping soils for vegetative purposes are given in table 7.

TABLE 4.--CRITERIA FOR RATING SHRINK-SWELL POTENTIAL OF SOILS

Factors affecting shrink-swell potential	Shrink-swell potential		
	Low	Moderate	High
Amount of clay and predominant clay mineral.	0 to 18 percent mixed or montmorillonitic clays; or 0 to 35 percent kaolinitic clay.	18 to 35 percent mixed or montmorillonitic clays; or more than 35 percent kaolinitic clay.	More than 35 percent mixed or montmorillonitic clays.
Coefficient of linear extensibility (COLE) (in./in.).	Less than 0.03----------	0.03 to 0.06----------	More than 0.06.

TABLE 5.--CRITERIA FOR RATING CORROSION POTENTIAL OF UNTREATED STEEL

Factors affecting corrosion potential	Corrosion potential		
	Low	Moderate	High
Drainage and texture.	Somewhat excessively drained to excessively drained and coarse textured; well drained and moderately coarse textured to medium textured; or somewhat poorly drained and coarse textured.	Well drained and moderately fine textured; moderately well drained and medium textured; somewhat poorly drained and moderately coarse textured; or very poorly drained peats and mucks that have a water table at the surface throughout the year.	Moderately well drained to well drained and fine textured; moderately well drained and moderately fine textured; somewhat poorly drained and medium textured to moderately fine textured; poorly drained and coarse textured to modately fine textured; somewhat poorly drained, poorly drained, and very poorly drained and fine textured; very poorly drained and a fluctuating water table within a depth of 1 foot; or peats and mucks that have a fluctuating water table.
Total acidity 1/ (meq. H+/100 g.)	Less than 8----------	8 to 12----------	More than 12.
Conductivity of saturation extract (mmhos/cm @ 25° C.)	Less than 1----------	1 to 4----------	More than 4.

1/ Roughly equal to the extractable acidity as determined by Soil Survey Laboratories, or the sodium acetate cation exchange capacity (CEC, NaOAc) minus sum of bases (Ca+Mg+Na+K).

TABLE 6.--SOIL RESOURCE INTERPRETATIONS

Map symbol	Soil name	Land capability	Vegetative group	Hydrologic group	Timber management group	Erosion hazard	Frost-heave potential	Degree of limitation for--		
								Road location	Excavation	Dwellings
Be	Beaches----------	VIIIs	J	A	(1/)	Slight---	Slight---	Severe---	Severe---	Severe.
CaD	Cagwin-Rock outcrop complex, 5 to 15 percent slopes.	VIs	B	C	3o3	Moderate-	Moderate-	Severe---	Severe---	Severe.
CaE	Cagwin-Rock outcrop complex, 15 to 30 percent slopes.	VIs	B	C	3o3	High-----	Moderate-	Severe---	Severe---	Severe.
CaF	Cagwin-Rock outcrop complex, 30 to 50 percent slopes.	VIIs	J	C	3r4	High-----	Moderate-	Severe---	Severe---	Severe.
Co	Celio gravelly loamy coarse sand.	IVw	E	D	3w7	Slight---	Moderate-	Severe---	Severe---	Severe.
EbC	Elmira gravelly loamy coarse sand, 0 to 9 percent slopes.	IVs	B	A	3o3	Slight---	Moderate-	Moderate-	Slight---	Slight.
EbE	Elmira gravelly loamy coarse sand, 9 to 30 percent slopes.	IVs	B	A	3o3	Moderate-	Moderate-	Severe---	Slight---	Severe.
EcE	Elmira stony loamy coarse sand, 9 to 30 percent slopes.	IVs	B	A	3o3	Moderate-	Moderate-	Severe---	Slight---	Severe.
EfB	Elmira-Gefo loamy coarse sands, 0 to 5 percent slopes.	IVs	B	A	3o3	Slight---	Moderate-	Moderate-	Slight---	Slight.
Ev	Elmira loamy coarse sand, wet variant.	IVw	E	D	3w7	Slight---	Moderate-	Severe---	Moderate-	Severe.
Fd	Fill land----------	VIs	B	A	(1/)	Slight---	Moderate-	Severe---	Slight---	Slight.
FuD	Fugawee very stony sandy loam, 2 to 15 percent slopes.	VIs	G	C	2o1	Slight---	Severe---	Moderate-	Moderate-	Moderate.
FuE	Fugawee very stony sandy loam, 15 to 30 percent slopes.	VIs	G	C	2o1	Moderate-	Severe---	Severe---	Moderate-	Severe.
GeC	Gefo gravelly loamy coarse sand, 2 to 9 percent slopes.	IVs	B	A	3o3	Slight---	Moderate-	Moderate-	Slight---	Slight.
GeD	Gefo gravelly loamy coarse sand, 9 to 20 percent slopes.	IVs	B	A	3o3	Moderate-	Moderate-	Moderate-	Slight---	Moderate.
Gr	Gravelly alluvial land-	IVw	E	D	3w7	Slight---	Variable-	Severe---	Severe---	Severe.
GsF	Graylock extremely stony loamy coarse sand, 30 to 50 percent slopes.	VIIs	J	A	5x10	High-----	Moderate-	Severe---	Severe---	Severe.
IgB	Inville gravelly coarse sandy loam, 0 to 5 percent slopes.	IVe	B	C	3o2	Slight---	Moderate-	Moderate-	Slight---	Slight.
IsC	Inville stony coarse sandy loam, 2 to 9 percent slopes.	IVe	B	B	3o2	Slight---	Moderate-	Moderate-	Severe---	Severe.
IsD	Inville stony coarse sandy loam, 9 to 15 percent slopes.	IVe	B	B	3o2	Moderate-	Moderate-	Moderate-	Severe---	Severe.
IsE	Inville stony coarse sandy loam, 15 to 30 percent slopes.	IVe	B	B	3o2	Moderate-	Moderate-	Severe---	Severe---	Severe.

TABLE 6.--SOIL RESOURCE INTERPRETATIONS--Continued

Map symbol	Soil name	Land capability	Vegetative group	Hydrologic group	Timber management group	Erosion hazard	Frost-heave potential	Degree of limitation for--		
								Road location	Excavation	Dwellings
JaC	Jabu coarse sandy loam, 0 to 9 percent slopes.	IVe	B	B	3o3	Slight---	Moderate-	Slight---	Slight---	Slight.
JaD	Jabu coarse sandy loam, 9 to 20 percent slopes.	IVe	B	B	3o3	Moderate-	Moderate-	Moderate-	Slight---	Moderate.
JbD	Jabu coarse sandy loam, seeped, 2 to 15 percent slopes.	IVw	E	C	3w7	Moderate-	Moderate-	Severe---	Severe---	Moderate.
JgC	Jabu sandy loam, moderately fine subsoil variant, 0 to 9 percent slopes.	IVe	B	C	3o3	Slight---	Moderate-	Moderate-	Moderate-	Slight.
JhC	Jabu stony sandy loam, moderately fine subsoil variant, 2 to 9 percent slopes.	IVe	B	C	3o3	Slight---	Moderate-	Moderate-	Moderate-	Slight.
JeB	Jabu coarse sandy loam, shallow variant, 0 to 5 percent slopes.	IVe	G	D	3o3	Slight---	Moderate-	Moderate-	Moderate-	Slight.
JeD	Jabu coarse sandy loam, shallow variant, 5 to 15 percent slopes.	IVe	G	D	3o3	Moderate-	Moderate-	Moderate-	Moderate-	Moderate.
JtD	Jorge-Tahoma cobbly sandy loams, 2 to 15 percent slopes.									
	Jorge----------	VIe	B	B	2o1	Slight---	Moderate-	Moderate-	Severe---	Moderate.
	Tahoma----------	VIe	B	B	2o1	Slight---	Severe---	Moderate-	Moderate-	Moderate.
JwD	Jorge-Tahoma very stony sandy loams, 2 to 15 percent slopes.									
	Jorge----------	VIs	B	B	2o1	Slight---	Moderate-	Moderate-	Moderate-	Severe.
	Tahoma----------	VIs	B	B	2o1	Slight---	Severe---	Moderate-	Moderate-	Severe.
JwE	Jorge-Tahoma very stony sandy loams, 15 to 30 percent slopes.									
	Jorge----------	VIs	B	B	2o1	Moderate-	Moderate-	Severe---	Moderate-	Severe.
	Tahoma----------	VIs	B	B	2o1	Moderate-	Severe---	Severe---	Moderate-	Severe.
JwF	Jorge-Tahoma very stony sandy loams, 30 to 50 percent slopes.									
	Jorge----------	VIs	B	B	3r4	High-----	Moderate-	Severe---	Moderate-	Severe.
	Tahoma----------	VIs	B	B	3r4	High-----	Severe---	Severe---	Moderate-	Severe.
Lo	Loamy alluvial land----	IVw	E	D	3w7	Slight---	Variable-	Severe---	Severe---	Severe.
Mh	Marsh----------	VIIw	E	D	(1/)	Slight---	Variable-	Severe---	Severe---	Severe.
MkB	Meeks gravelly coarse sand, 0 to 5 percent slopes.	VIs	B	B	3o3	Slight---	Moderate-	Moderate-	Severe---	Slight.
MkD	Meeks gravelly loamy coarse sand, 5 to 15 percent slopes.	VIs	B	B	3o3	Moderate-	Moderate-	Moderate-	Severe---	Moderate.
MmB	Meeks stony loamy coarse sand, 0 to 5 percent slopes.	VIs	B	B	3o3	Slight---	Moderate-	Moderate-	Severe---	Severe.
MsD	Meeks very stony loamy coarse sand, 5 to 15 percent slopes.	VIIs	J	B	3x5	Moderate-	Moderate-	Moderate-	Severe---	Severe.

TABLE 6.--SOIL RESOURCE INTERPRETATIONS--Continued

Map symbol	Soil name	Land capability	Vegetative group	Hydrologic group	Timber management group	Erosion hazard	Frost-heave potential	Degree of limitation for--		
								Road location	Excavation	Dwellings
MsE	Meeks very stony loamy coarse sand, 15 to 30 percent slopes.	VIIs	J	B	3x5	High-----	Moderate-	Severe---	Severe---	Severe.
MsG	Meeks very stony loamy coarse sand, 30 to 60 percent slopes.	VIIs	J	B	4x8	High-----	Moderate-	Severe---	Severe---	Severe.
MtE	Meeks extremely stony loamy coarse sand, 15 to 30 percent slopes.	VIIs	J	B	3x5	High-----	Moderate-	Severe---	Severe---	Severe.
MtG	Meeks extremely stony loamy coarse sand, 30 to 60 percent slopes.	VIIs	J	B	4x8	High-----	Moderate-	Severe---	Severe---	Severe.
MxE	Meiss cobbly loam, 9 to 30 percent slopes.	VIIe	J	D	(1/)	Moderate-	Moderate-	Severe---	Severe---	Severe.
MxF	Meiss cobbly loam, 30 to 50 percent slopes	VIIe	J	D	(1/)	High-----	Moderate-	Severe---	Severe---	Severe.
Px	Pits and dumps---------	VIIIs	J	D	(1/)	Variable-	Variable-	Severe---	Variable-	Severe.
Ra	Rock land---------------	VIIIs	J	D	(1/)	Moderate-	Moderate-	Severe---	Severe---	Severe.
RcF	Rock outcrop-Cagwin complex, 30 to 50 percent slopes.	VIIs	J	C	4x8	High-----	Moderate-	Severe---	Severe---	Severe.
RcG	Rock outcrop-Cagwin complex, 50 to 70 percent slopes.	VIIs	J	C	4x8	High-----	Moderate-	Severe---	Severe---	Severe.
RtF	Rock outcrop-Toem complex, 30 to 50 percent slopes.	VIIs	J	C	5x10	High-----	Slight---	Severe---	Severe---	Severe.
RtG	Rock outcrop-Toem complex, 50 to 70 percent slopes.	VIIs	J	C	5x10	High-----	Slight---	Severe---	Severe---	Severe.
Rx	Rock outcrop and Rubble land.	VIIIs	J	D	(1/)	Slight---	Not rated.	Severe---	Severe---	Severe.
ShE	Shakespeare gravelly loam, 9 to 30 percent slopes.	VIe	B	C	3o2	Moderate-	Severe---	Severe---	Moderate-	Severe.
SkF	Shakespeare stony loam, 30 to 50 percent slopes.	VIIe	J	C	3r4	High-----	Severe---	Severe---	Moderate-	Severe.
Sm	Stony colluvial land---	VIIIs	J	C	(1/)	Moderate-	Variable-	Severe---	Severe---	Severe.
TaD	Tahoma stony sandy loam, 2 to 15 percent slopes.	IVe	A	B	2o1	Slight---	Severe---	Moderate-	Slight---	Moderate.
TbD	Tahoma very stony sandy loam, 2 to 15 percent slopes.	VIs	B	B	2o1	Slight---	Severe---	Moderate-	Moderate-	Moderate.
TcB	Tallac gravelly coarse sandy loam, seeped, 0 to 5 percent slopes.	IVe	B	C	3o2	Slight---	Moderate-	Moderate-	Moderate-	Moderate.
TcC	Tallac gravelly coarse sandy loam, seeped, 5 to 9 percent slopes.	IVe	B	C	3o2	Slight---	Moderate-	Moderate-	Moderate-	Moderate.
TdD	Tallac stony coarse sandy loam, 5 to 15 percent slopes.	VIe	B	B	3x5	Slight--	Moderate-	Moderate-	Severe---	Severe.
TeE	Tallac very stony coarse sandy loam, 15 to 30 percent slopes.	VIs	B	B	3x5	Moderate-	Moderate-	Severe---	Severe---	Severe.

TABLE 6.--SOIL RESOURCE INTERPRETATIONS--Continued

Map symbol	Soil name	Land capability	Vegetative group	Hydrologic group	Timber management group	Erosion hazard	Frost-heave potential	Degree of limitation for--		
								Road location	Excavation	Dwellings
TeG	Tallac very stony coarse sandy loam, 30 to 60 percent slopes.	VIIs	J	B	3r4	High-----	Moderate-	Severe---	Severe---	Severe.
TkC	Tallac very stony coarse sandy loam, seeped, 2 to 9 percent slopes.	VIs	B	C	3x5	Slight---	Moderate-	Moderate-	Severe---	Moderate.
TmE	Tallac gravelly coarse sandy loam, shallow variant, 9 to 30 percent slopes.	VIIe	J	C	5o9	Moderate-	Moderate-	Severe---	Severe---	Severe.
TmF	Tallac gravelly coarse sandy loam, shallow variant, 30 to 50 percent slopes.	VIIe	J	C	5x10	High-----	Moderate-	Severe---	Severe---	Severe.
TrE	Toem-Rock outcrop complex, 9 to 30 percent slopes.	VIIs	J	C	5o9	High-----	Slight---	Severe---	Severe---	Severe.
TrF	Toem-Rock outcrop complex, 30 to 50 percent slopes.	VIIs	J	C	5x10	High-----	Slight---	Severe---	Severe---	Severe.
UmD	Umpa very stony sandy loam, 5 to 15 percent slopes.	VIs	J	C	3x6	Slight---	Severe---	Moderate-	Moderate-	Severe.
UmE	Umpa very stony sandy loam, 15 to 30 percent slopes.	VIs	J	C	3x6	Moderate-	Severe---	Severe---	Moderate-	Severe.
UmF	Umpa very stony sandy loam, 30 to 50 percent slopes.	VIIs	J	C	3r4	High-----	Severe---	Severe---	Moderate-	Severe.
WaE	Waca cobbly coarse sandy loam, 9 to 30 percent slopes.	VIe	B	C	3o2	Moderate-	Moderate-	Severe---	Moderate-	Severe.
WaF	Waca cobbly coarse sandy loam, 30 to 50 percent slopes.	VIIe	J	C	3r4	High-----	Moderate-	Severe---	Moderate-	Severe.
WcE	Waca-Rock outcrop complex, 9 to 30 percent slopes.	VIs	B	C	3x6	Moderate-	Moderate-	Severe---	Severe---	Severe.
WcF	Waca-Rock outcrop complex, 30 to 50 percent slopes.	VIIs	J	C	3r4	High-----	Moderate-	Severe---	Severe---	Severe.

1/ Unsuitable.

TABLE 7.--CRITERIA FOR GROUPING SOILS

[Asterisks indicate the key

Vegetative group symbol	Major soil limitation	Effective depth	Surface layer texture	Subsoil 1/ permeability
A----------	None----------	*36 inches or more---	*Sandy loam through silty clay loam.	*Moderately rapid through slow.
B----------	Droughtiness-------	36 inches or more---	*Sand, loamy sand, gravelly sandy loam, very gravelly cobbly.	Very rapid through very slow.
E----------	Wetness----------	20 inches or more---	Sand through clay---	Rapid through slow--
G----------	Shallowness 6/ -------	*10 through 36 inches or 10 through 20 inches.	*Sand; loamy sand; gravelly sandy loam; very gravelly, cobbly, sandy loam through silty clay loam.	Moderately rapid through very slow.
J----------	(7/)----------	Any depth----------	Any texture----------	Very rapid through very slow.

1/ Subsoil refers to B horizon, or to the 10- to 40-inch control section in soils that do not have a B horizon.

2/ Drainage refers to natural drainage. If drainage has been altered, refer to the drainage class that most nearly reflects condition following drainage improvement.

3/ Use current saline and alkali levels that are present in the field. Levels may be higher or lower than indicated on maps. Capability unit designations may be based on general assumptions that do not uniformly reflect current, short-term growing conditions.

4/ Generally applies to a depth of 20 inches.

FOR VEGETATIVE PURPOSES

factors for each group]

Drainage 2/	Salinity and alkalinity 3/	Reaction 4/	Erosion	Available water capacity 5/
*Moderately good through good.	*None through slight.	Medium acid through moderately alkaline (pH 5.6-8.4).	Slight through moderate.	5 inches or more.
Excessive through moderately good.	None through slight.	Strongly acid through moderately alkaline (pH 5.1-8.4).	Slight through moderate.	*5 inches or less.
*Somewhat poor through very poor.	None through slight.	Medium acid through moderately alkaline (pH 5.6-8.4).	Slight through moderate.	2 inches or more.
Moderately good through somewhat excessive.	None through slight.	Medium acid through moderately alkaline (pH 5.6-8.4).	Slight through moderate.	3 inches or more.
Excessive through very poor.	None through strong.	Any reaction--------	Slight through severe.	Any capacity.

5/ Limits are for total available water capacity for that part of the soil generally available to roots, or to a depth of 60 inches if no severe intervening restrictions of soil or water are present. Refer to California Soil Handbook, Chapter 3, section 3.423.

6/ Shallow over unfractured rock or hardpan.

7/ All soils not suitable for routine cultivation, seeding, and planting. Includes all class VII and VIII soils; very cobbly soils; rocky soils in classes III, IV, and V; and very stony soils in classes II, III, IV, and V. All require onsite investigation.

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HYDROLOGIC GROUPS.--Four hydrologic groups are recognized in watershed planning. They indicate the estimated runoff potential of soils. Groupings are based on soil properties that influence infiltration into a bare soil after prolonged wetting. These properties are depth to a seasonal high water table, intake rate, permeability after prolonged wetting, and depth to very slowly permeable layer. The influence of ground cover is treated independently and is not considered in determining hydrologic groupings.

Group A. Soils have high infiltration rate when thoroughly wetted and low runoff potential: chiefly deep, well-drained to excessively drained sands or gravel. These soils have a high rate of water transmission.

Group B. Soils have moderate infiltration rate when thoroughly wetted and moderately low runoff potential: chiefly moderately deep and deep, moderately well drained and well drained soils that are moderately fine textured to moderately coarse textured and have moderately slow to moderately rapid permeability. These soils have a moderate rate of water transmission.

Group C. Soils have slow infiltration rate when thoroughly wetted and moderately high runoff potential: chiefly well drained and moderately well drained soils that have a slowly to very slowly permeable layer (fragipan, hardpan, or bedrock) at a depth of 20 to 40 inches; soils that are moderately fine textured to fine textured; or soils that have a moderately high water table and may be somewhat poorly drained. These soils have a slow rate of water transmission.

Group D. Soils have very slow infiltration rate when thoroughly wetted and high runoff potential; chiefly clays that have a high swell potential; soils that have a permanent high water table; soils that have a claypan or clay layer at or near the surface; or soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

TIMBER MANAGEMENT GROUPS.--The timber management group is a grouping of soils that are suited to about the same timber crops and management. An explanation of these groups is given under the heading "Timber Management," page 63.

EROSION HAZARD.--Man has disturbed the soil and cover in the watershed of the Tahoe Basin and thus has accelerated erosion and sedimentation, increased the flood hazard in some areas, and increased the flow of nutrients into Lake Tahoe.

Erosion hazard is the relative hazard of removal of surface soil by running water. It represents the combined effect of the length and shape of slope, the climate, and the erodibility of the soil. Erodibility is based on the ease with which soil particles can be detached and transported and on the infiltration and permeability of the soil.

Some soils are more highly susceptible to erosion than others. Table 6 shows the relative erosion hazard by water within the Basin. Ratings are expressed as slight, moderate, and high (16, 18). In establishing the ratings, it was assumed that the cover has been removed and the soil was bare of vegetation. If cover were considered a factor, fire damage or other disturbance to vegetation would alter the estimate, or change the potential hazard on the specified soil.

FROST-HEAVE POTENTIAL.--The potential of a soil to heave is related to the amount of fine silt it contains and the presence of water in the soil. Frost-heave potential must be considered in the design of roads, sidewalks, runways, or any other structure supported or abutted by a soil that freezes.

Frost action is a limitation in the soils of the Tahoe Basin. As shown in table 6, the frost-heave potential is rated for all the soils. Ratings are expressed as slight, moderate, and severe. They are based on the percentage of fine silt in the soils to a depth of 2 feet.

In calculating the ratings, it is assumed that there is a source of water during the freezing period and that the below-freezing temperature has penetrated the soil. Criteria used in rating frost-heave potential are shown in table 8 (5).

TABLE 8.--CRITERIA FOR RATING SOILS FOR FROST-HEAVE POTENTIAL

Factors affecting potential	Potential		
	Slight	Moderate	Severe
Percentage, by weight, of fine silt (0.02-0.002 mm.) in soil material less than 3 inches in diameter.	Less than 3 percent------	3 to 10 percent---------	More than 10 percent.
Unified classification---	GW, GP, SW, SP----------	GM, GC, Pt--------------	SM, SC, ML, CL, OL, MH, CH, OH.

ROAD LOCATION.--The degree of limitation of each soil in the Tahoe Basin for use as an unsurfaced road, as related to road construction and maintenance, is shown in table 6. The limitations are expressed as slight, moderate, and severe. They were determined by examining profiles of undisturbed soils in areas not artificially drained and estimating performance of the soil material, when mixed, in an entire profile. It was assumed that the surface layer, because it is higher in organic-matter content, would be removed. The effects of frost action were not considered. (See criteria table for frost-heave potential.) Criteria used in rating soils for road location are shown in table 9 (7, 14, 19).

TABLE 9.--CRITERIA FOR RATING SOILS FOR ROAD LOCATION

Factors affecting limitation	Limitation		
	Slight	Moderate	Severe
Unified classification----	GW, GP, GM, GC, SW, SP, SM.	ML, CL, GM, GC, SC----------	MH, CL or CH, OL, OH, Pt.
Soil depth----------	More than 40 inches-	20 to 40 inches----------	Less than 20 inches.
Slope----------	0 to 9 percent------	9 to 15 percent----------	More than 15 percent.
Depth to seasonal high water table.	More than 5 feet----	3 to 5 feet----------	Less than 3 feet.
Stones and cobblestones---	Less than 5 percent-	5 to 15 percent----------	More than 15 percent.

EXCAVATION.--Rock outcrop, cobblestones, stones, or bedrock, or a water table within a depth of 5 feet hinders excavation (pl. IV, bottom). Table 6 shows for each soil in the Tahoe Basin Area the degrees of limitation in excavating for pipelines, roads, channels, and other engineering structures. Limitations are described as slight, moderate, and severe. The degrees of limitation are based on the amount of exposed rock, cobblestones, and stones; the volume of cobblestones and stones within the profile; the depth to a hardpan or to hard bedrock; and the depth to the water table.

In determining the degrees of limitation shown in table 6, it is assumed that soft or weathered rock can be excavated easily by commonly used earthmoving equipment, and that the presence of gravel, in any amount, does not appreciably affect ease of excavation.

Criteria used in rating soils for excavation are shown in table 10 (14).

TABLE 10.--CRITERIA FOR RATING SOILS FOR EXCAVATION

Soil properties or qualities affecting limitation	Limitation		
	Slight	Moderate	Severe
Cobblestones or stones within profile. Percentage by volume.	Less than 5 percent--	5 to 15 percent----------	More than 15 percent.
Depth to hardpan or hard bedrock.	More than 60 inches--	40 to 60 inches----------	Less than 40 inches.
Depth to water table------	More than 60 inches--	40 to 60 inches----------	Less than 40 inches.

DWELLINGS.--Soils in the Basin have been evaluated in terms of their limitations for the construction of single family dwellings, without basements, or of other structures that have similar requirements. The degrees of limitation are shown in table 6. They are expressed as slight, moderate, and severe. Emphasis is on features that affect foundations, but slope, seasonal wetness, and other conditions not exclusively related to foundations are considered. Also considered are soil properties, such as depth to bedrock, that influence installation of utility lines. Onsite investigation is needed for specific placement of buildings and utility lines.

The ratings shown in table 6 are based on characteristics of undisturbed soils to a depth of 5 feet, or, in shallow soils, as far down as bedrock.

Criteria used in rating soils for dwellings are shown in table 11 (7, 14). Potential frost action and shrink-swell potential are not considered. Table 8 shows criteria for determining frost-heave potential. Shrink-swell potential is not an important factor in the Tahoe Basin Area. Most of the soils contain only a small amount of clay and have no significant volume change with a change in moisture content.

TABLE 11.--CRITERIA FOR RATING SOILS FOR DWELLINGS

Factors affecting limitation	Limitation		
	Slight	Moderate	Severe
Soil drainage	Excessively drained, somewhat excessively drained, well drained, and moderately well drained.	Somewhat poorly drained	Poorly drained and very poorly drained.
Seasonal water table (high for more than 2 months).	Below 30 inches	Below 20 inches	Above 20 inches.
Slope	0 to 9 percent	9 to 15 percent	More than 15 percent.
Unified classification	GW, GP, SW, SP, GM, GC, SM, SC.	ML, CL	CH, MH, OL, OH, Pt.
Stones (by volume)	0 to 5 percent	5 to 15 percent	More than 15 percent.
Depth to bedrock	More than 40 inches	20 to 40 inches	Less than 20 inches.

Table 12 shows criteria that can be used in determining the suitability of a soil as a source of excavated material for road fill (5, 7, 19). This information should be supplemented by onsite investigation at the proposed site.

Meiss, Shakespeare, and Tahoma soils in the Tahoe Basin Area and the Jabu moderately fine subsoil variant are fair to poor as a source of road fill. The rest of the soils are good sources of roadfill.

TABLE 12.--CRITERIA FOR RATING SOILS AS A SOURCE OF ROAD FILL

Factors affecting suitability	Suitability		
	Good	Fair	Poor
AASHO classification	A-1, A-2, A-3	A-4, A-5	A-6, A-7.

Soil as a source of topsoil is of interest to nurserymen, landscape architects, highway engineers, and others concerned with establishing vegetation on slopes, road shoulders, waterways, lawns, golf courses, and other disturbed areas (19).

Table 13 shows criteria that can be used in evaluating a potential source of topsoil (14).

The Tahoma stony sandy loam in the Tahoe Basin Area is a fair source of topsoil. The rest of the soils and all the land types are poor sources.

TABLE 13.--CRITERIA FOR RATING SOILS AS A SOURCE OF TOPSOIL

Soil properties or qualities affecting suitability	Suitability		
	Good	Fair	Poor
Texture (USDA)	Sandy loam, fine sandy loam, very fine sandy loam, or loam.	Clay loam, sandy clay loam, or silt loam.	Sand, loamy sand, silty clay loam, silty clay, or clay.
Gravel by volume	Less than 15 percent	15 to 35 percent	More than 35 percent.
Cobblestones, 3 to 10 inches in diameter.	None	Less than 3 percent	More than 3 percent.
Reaction (pH)	6.1 through 7.8	5.1 to 6.0 or 7.9 to 8.4	Less than 5.0 or more than 8.4.
Salinity EC saturation extract (mmhos/cm)	Less than 4	4 to 8	More than 8.
Thickness of soil material in place.	More than 40 inches	20 to 40 inches	Less than 20 inches.

TIMBER MANAGEMENT[3/]

Lumbering was an important industry in the Lake Tahoe Basin during the boom period of mining at Virginia City and other locations in Nevada. Large volumes of lumber were harvested for use as construction material in the mining camps. Also, during this period, large forest fires swept over much of the lower elevation of the Basin. Thus, a large part of the timbered area was burned over or heavily cut over.

Since this early period, timber harvesting has been controlled and stands have become reestablished. The stands now serve as beautiful scenic foregrounds and backdrops around Lake Tahoe. The composition of these stands ranges from Jeffrey pine and white fir at the lower elevations to red fir, western white pine, and some mountain hemlock at the higher elevations. Lodgepole pine occurs at all elevations, but is chiefly in moist areas. Quaking aspen is also common in moist areas.

Trees of one kind or another grow on most of the soils in the Basin, but only about 70 percent of the total survey area, or 145,460 acres, is commercial forest. Approximately 35 percent of this acreage is administered by the Forest Service.

The timber stands in the Lake Tahoe Basin are vital in maintaining the watershed and are necessary for recreational and esthetic values. Harvesting, as well as planting, is important in maintaining healthy and esthetically pleasing stands.

In order to assist managers in planning and managing timberland, all the soils in the Basin suited to commercial production of conifers have been grouped according to their suitability for specified trees. Each group is made up of soils that have similar characteristics, respond to similar management, and are subject to similar hazards in the production of wood crops.

Each group is identified by a three-part symbol, for example, 3o2. The first numeral denotes the timber suitability class, which expresses site quality, or growth potential. The lower case letter denotes the subclass, which identifies the major hazard or limitation. The last number identifies the specific timber management group.

The groups are listed in table 14. Rated for each group are the site quality, or growth potential,

3/ By GERALD L. ANDERSON, soil scientist, Forest Service.

TABLE 14.--TIMBER MANAGEMENT

Timber group, soil description, and map symbol	Site quality	Seedling mortality	Erosion hazard	Equipment limitation	Insects and diseases	Dominant species	Management
Group 2o1: Soils moderately deep and deep over volcanic rock; gravelly sandy loam surface layer and gravelly loam or gravelly clay loam subsoil; cobble-stones in places. FuD, FuE, JtD, JwD, JwE, TaD, TbD.	High-----	Slight---	Slight---	Slight-----	Slight----	White fir, Jeffrey pine, red fir.	Well suited to intensive management.
Group 3o2: Soils moderately deep and deep over volcanic rock or alluvial or glacial deposited material; gravelly coarse sandy loam or gravelly sandy loam texture. IgB, IsC, IsD, IsE, ShE, TcB, TcC, WaE.	Moderately high.	Moderate-	Slight---	Slight-----	Moderate--	White fir, Jeffrey pine, red fir.	Suited to intensive management.
Group 3o3: Soils, generally of sandy texture, moderately deep and deep over granitic rock or alluvial or glacial deposited material; stones or rock outcrop common in most areas. CaD, CaE, EbC, EbE, EcE, EfB, GeC, GeD, JaC, JaD, JeB, JeD, JhC, JgC, MkB, MkD, MmB.	Moderately high.	Moderate-	High-----	Moderate-	Moderate--	Jeffrey pine, white fir.	Suited to intensive management; in places stones or rock outcrop slightly hinders logging.
Group 3r4: Soils moderately deep and deep over granitic rock, volcanic rock, or glacial deposited material; gravelly sandy loam or gravelly loamy sand texture; stones or rock outcrop common in most areas. CaF, JwF, SkF, TeG, UmF, WaF, WcF.	Moderately high.	Moderate-	Very high.	Moderate-	Moderate--	White fir, Jeffrey pine, red fir.	Moderately well suited to intensive management; stones or rock outcrop and steep slopes limit logging.

TABLE 14.--TIMBER MANAGEMENT--Continued

Timber group, soil description, and map symbol	Site quality	Seedling mortality	Erosion hazard	Equipment limitation	Insects and diseases	Dominant species	Management
Group 3x5: Soils deep over glacial deposited material; gravelly sandy loam or gravelly loamy sand texture; many stones and boulders throughout. MsD, MsE, MtE, TdD, TeE, TkC.	Moderately high.	Moderate-	Moderate-	Moderate-	Moderate--	Jeffrey pine, white fir.	Moderately well suited to intensive management; stones and boulders hinder logging.
Group 3x6: Soils moderately deep over volcanic rock; gravelly sandy loam texture; rock outcrop in many places. UmD, UmE, WcE.	Moderately high.	Moderate-	Slight---	Moderate-	Moderate--	White fir, Jeffrey pine, red fir.	Moderately well suited to intensive management; rock outcrop hinders logging.
Group 3w7: Soils deep over alluvial or glacial outwash material; gravelly sandy loam or loam texture; seasonal water table within a depth of 3 feet. Co, Ev, Gr, JbD, Lo.	Moderately high for lodgepole pine.	Slight---	Slight---	Moderate to severe.	Slight----	Lodgepole pine.	High water table limits logging.
Group 4x8: Soils moderately deep and deep over granitic rock or glacial deposited material; loamy coarse sand texture; stones or rock outcrop in many places. MsG, MtG, RcF, RcG.	Moderate-	Moderate-	High-----	Severe-----	Moderate--	Jeffrey pine, white fir, red fir.	Poorly suited to intensive management; stones, rock outcrop, and steep slopes.
Group 5o9: Soils shallow over glacial deposited material or granitic rock; gravelly sandy loam or gravelly loamy sand texture; stones and rock outcrop common. TmE, TrE.	Low------	Severe---	Moderate-	Moderate---	Severe----	Jeffrey pine, white fir, red fir.	Poorly suited to intensive management; low site quality.
Group 5x10: Soils moderately deep and shallow over granitic rock or glacial deposited material; gravelly loamy coarse sand or gravelly sandy loam texture; stones or rock outcrop in many areas. GsF, RtF, RtG, TmF, TrF.	Low------	Severe---	Very high.	Severe----	Severe----	Jeffrey pine, white fir, red fir.	Very poorly suited to intensive management; low site quality, stones, rock outcrop, and steep slopes.

of specified trees; the factors to be considered in management, namely, seedling mortality, erosion hazard, limitations to the use of equipment, and pests and diseases; the dominant species; and the intensity of management needed. All are defined in the paragraphs that follow.

Site quality is a measure of productivity of soil for growing trees. It is measured by determining the height and age of trees and relating these figures to a standard age, for example, 100 years. Site quality, the first in the three-part symbol, is designated by the numerals 2, 3, 4, and 5. The numeral 2 denotes a rating of high, 3 moderately high, 4 moderate, and 5 low. In this survey, ratings in the column headed "Site quality" refer to Jeffrey pine, white fir, or lodgepole pine, whichever is dominant. The ratings indicate the height of the dominant trees at 100 years.

For Jeffrey pine (6):

> A rating of high indicates a height of more than 99 feet; moderately high, a height of 85 to 98 feet; moderate, a height of 71 to 84 feet; and low, a height of less than 71 feet.

For white fir (8):

> A rating of high indicates a height of more than 76 feet; moderately high, a height of 66 to 75 feet; moderate, a height of 56 to 65 feet; and low, a height of less than 56 feet.

For lodgepole pine (1):

> A rating of high indicates a height of more than 86 feet; moderately high, a height of 76 to 85 feet; moderate, a height of 66 to 75 feet; and low, a height of less than 66 feet.

The timber subclass, which denotes the major soil hazard or limitation and is the second part of the three-part symbol, is designated by the letters x, w, r, and o. The letter x denotes stones or rocks as the major limitation; w denotes wetness; and r denotes restrictions resulting from steep slopes or other factors related to relief. The letter o denotes no major limitation. If several limiting soil characteristics are mentioned, the most limiting is listed first. The rest are listed in order of importance.

Seedling mortality refers to the mortality of naturally occurring or planted tree seedlings as influenced by the kind of soil and the topography. It is described as slight, moderate, and severe. Seedling mortality is ordinarily lower on a deep, loamy, gently sloping soil than on a shallow, sandy, steep soil. In determining the ratings shown in table 14, it is assumed that plant competition is not a limiting factor.

Erosion hazard refers to the potential hazard of erosion. It is expressed as slight, moderate, and high. The length and steepness of slope, the aspect, and the texture of soil aggregates are considered. Soils under a protective cover of forest litter and duff generally do not erode. Therefore, in determining the ratings shown in table 14, it is assumed that cover has been removed through burning, logging, clearing, trampling by animals, or other disturbance. The susceptibility to erosion of cultivated forest soils is not considered.

Equipment limitation refers to characteristics of the soil that restrict or prevent use of the equipment commonly used in tending and harvesting trees. It is described as slight, moderate, and severe. The limitation is slight on Fugawee very stony sandy loam, 2 to 15 percent slopes, for example, but severe on Meeks extremely stony loamy coarse sand, 30 to 60 percent slopes.

The hazard of insects and diseases, rated as slight, moderate, and severe, depends on many properties of the soil, most of which are not well understood. Rooting depth, texture, impeded drainage, and inherent fertility are probably the most important factors. Observations in the Area indicate that the hazard is greatest on shallow, rocky soils.

CAPABILITY GROUPING

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive 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 for engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. In the Tahoe Basin Area the soils are grouped at only two levels; the capability class and the subclass.

The soils and climate and the socioeconomic conditions in the Tahoe Basin are such that the Area is not used for crop production. The class and subclass capability grouping is included in this publication to show how the soils in the Basin compare with soils elsewhere in the country. The class and subclass levels are defined 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.

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, VIe. 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 or range, woodland, wildlife, or recreation.

The eight classes in the capability system and the subclasses in the Tahoe Basin Area are described in the list that follows. The subclass designation for each mapping unit in the Area can be found in the "Guide to Mapping Units."

Class I soils have few limitations that restrict their use. No class I soils in the Tahoe Basin Area.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. No class II soils in the Area.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both. No class III soils in the Area.

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

- Subclass IVe soils are nearly level to moderately steep, deep, and moderately coarse textured.
- Subclass IVw soils are nearly level to gently sloping, moderately deep and deep, coarse textured to medium textured, and poorly drained.
- Subclass IVs soils are nearly level to moderately steep, deep, and coarse textured.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife. No class V soils in the Area.

Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife.

- Subclass VIe soils are deep and moderately deep, gently sloping to moderately steep, cobbly and stony, and moderately coarse textured to medium textured.
- Subclass VIs soils are moderately deep, strongly sloping to moderately steep, very stony, and moderately coarse textured to coarse textured; and deep, steep, very stony, and moderately coarse textured.

Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

- Subclass VIIe soils are shallow and moderately deep, strongly sloping to steep, gravelly and cobbly, moderately coarse textured to cobbly, medium textured.
- Subclass VIIw soils are severely limited by excess water and a short growing season.
- Subclass VIIs soils are deep and extremely stony; moderately deep, steep, very stony or very rocky, and moderately coarse textured to coarse textured; and deep, strongly sloping to steep, very stony, and coarse textured and have low available water capacity.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

- Subclass VIIIw soils are coarse sands, such as Beaches, that are subject to wave action.
- Subclass VIIIs soils are shallow to deep and hold less than 2 inches of available water. For example, Pits and dumps, Rock land, Rock outcrop and Rubble land, and Stony colluvial land.

A summary of the geology and geomorphic history of the Tahoe Basin will help to explain the relationship of parent material and relief (4) 4/ The Tahoe Basin is an intermountain basin formed by faulting rocks of the Sierra Nevada to the west and the Carson Range to the east. Lake Tahoe occupies the downdropped block, or graben, that is bordered by steeply dipping faults. The steep mountains on the east and west shores of Lake Tahoe are predominantly granitic rock and partly metamorphic rock. The northern end of the Basin is covered with volcanic rock of Tertiary age. Much of the southern and western parts of the Basin have been modified by glaciers. The southern end, Lake Valley, consists of moraines and a plain of glacial outwash deposited by the Upper Truckee River, Trout Creek, and other streams. The northeast end of the Basin, Incline Village, is a large alluvial fan formed from First, Second, and Third Creeks.

The level of Lake Tahoe has fluctuated in the past. Glacial ice temporarily dammed the Truckee River and raised the lake level as much as 600 feet above the present 6,229 feet. Volcanic flows also dammed the Truckee River and raised the lake level to near 7,000 feet.

North of Kings Beach there are terrace deposits at an elevation of about 6,800 feet. Along the moraine that parallels the upper Truckee River, east of the Tahoe Airport, there are terrace deposits at about 6,400 feet elevation.

The following paragraphs describe the major factors of soil formation and explain some of the principal soil forming processes. They also define the current system of soil classification. Table 15 shows the classification of the soils in the Tahoe Basin Area according to that system. Tables 16, 17, and 18 show the results of analysis of selected soils in the Area.

Factors of Soil Formation

Soil has been defined as a natural formation of organic and mineral material (13), on the surface of the earth, in which plants grow. Soils differ in appearance, composition, management requirements, and productivity in different localities or even within very short distances in the same locality. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated; (3) the biological activity, including the plant and animal life in and on the soil; (4) the relief, or lay of the land, and drainage; and (5) the length of time the forces of formation have acted on the soil material. Each soil is affected by all five factors, but the relative effect and importance of each varies from one soil to another.

4/ MATTHEWS, R. A., and BURNETT, J. L. Geology and Land Use Planning in the Lake Tahoe Basin. [Publishing in progress. Calif. Div. of Mines and Geol.]

Parent Material

Parent material, the weathered rock or unconsolidated mass from which the soil forms, strongly influences the chemical and mineralogical composition of the soil. The soils of the Tahoe Basin Area formed in material weathered from granitic, metamorphic, and basic igneous rock, in glacial deposits and outwash, and in alluvium from mixed sources.

Detailed information about parent material and how it relates to the soils in the Area can be found under the heading "Processes of Soil Formation."

Climate

Cool temperatures and wet and dry seasons characterize the climate in the Tahoe Basin. Most of the precipitation falls as snow in winter. Summers are essentially dry. Occasional high-intensity thunderstorms are significant in causing accelerated erosion on soil bare of vegetation. Chemical weathering and some physical weathering are slow because of cool temperatures. For example, the mean annual soil temperature at a depth of 20 inches is only 42° to 46° F. A lack of soil moisture in summer when temperature conditions are more favorable for chemical action also slows down weathering processes.

Precipitation, mostly from melting snow, is sufficient to saturate the soil and remove bases.

Air temperatures are often low in winter, but the snow cover reduces the depth of freezing. The soils are mostly coarse textured and are not highly susceptible to frost heaving. Except for granulation of the surface horizon, soil structure is not greatly influenced by frost action.

Cool temperatures favor the accumulation of organic matter and the formation of a thick, dark-colored surface horizon in areas where tree and shrub cover is most abundant.

Living Organisms

Vegetation, burrowing animals, insects, earthworms, bacteria, and fungi are important in the formation of soils. Vegetation probably has the greatest influence. The vegetation in the Tahoe Basin is predominantly conifers and mountain shrubs.

Soils that formed under coniferous forest have a thin mat of litter and duff 1/2 inch to nearly 3 inches thick. Such material is acid and contributes to the acidity of the soil. Furthermore, because the conifer litter and duff do not decompose rapidly, the soil has a high carbon-nitrogen ratio, generally a 25 to 30 ratio in the A horizon. Also, the residue from the litter and duff makes the soil resistant to infiltration of water.

Tree roots break up the parent rock and extract bases from the soil. Bases are then returned in falling needles and leaves. Some mixing of the soil profile is by windthrow.

Rodents make runways in the snow which they fill with soil from below. After the snow melts, the surface is covered with an intricate pattern of the light-colored soil that filled the runways. These patterns are particularly noticeable in Elmira soils.

Logging, subdivisions, fires, cuts and fills in road building, dredging, and other activities of man have changed many soils. The natural cover has been disturbed. Natural or artificial replacement is difficult. The surface layer of soil in the Basin contains 2.5 to 8 tons of organic matter per acre-inch. This material is not all readily decomposed. Eventually, however, it will decompose and become a potential source of nutrients.

Relief

Relief, or the shape of the landscape, influences soil formation through its effect on drainage and erosion, and partly through variations in air drainage and in exposure to the sun and wind. Slopes are dominantly steep and thus favor rapid runoff, good to excessive drainage, and a high erosion potential. Less extensive are the gently sloping areas on terraces and on outwash and flood plain positions. The soils on flood plains are low lying, and drainage is poor.

Time

Geologically, much of the Tahoe Basin is young. The three main glacial periods are the Tioga, the Tahoe, and the pre-Tahoe. Almost all the soils in the Area are considered youthful; partly because on the natural steep slopes, geologic erosion has progressed at about the same rate as the soil forms. Cold temperatures slow some of the soil-forming processes. The soils do not weather so quickly and, consequently, have thin profiles and lack distinct horizons.

Processes of Soil Formation

Soil-forming processes in the Tahoe Basin Area are described as they have affected soils of the uplands, the moraines, the flood plains, and the terraces, outwashes, and fans.

Soils of the Uplands

Cagwin and Toem soils formed on the granitic uplands where soil formation and geologic erosion are nearly in balance. The soils are moderately steep to very steep, naturally erodible, and shallow to moderately deep. They have little profile formation except for an accumulation of organic matter in the A horizon. Base saturation is low, partly because the parent material has few bases. The parent material, granodiorite, is a coarse-grained, acid, igneous rock that weathered to angular coarse sand and fine gravel. Hardness of the rock varies. In areas of differential weathering, soils form in areas where the rock weathers to grus and rock outcrop forms in the areas of hard rock.

Fugawee, Jorge, Tahoma, Meiss, and Waca soils formed on volcanic uplands where profile formation is evident. In most places they have been influenced by volcanic ash. They are gently sloping to steep, are generally moderately deep to deep, and typically contain many fragments of gravel, cobblestones, and stones. The volcanic rock is fractured and contains highly weatherable minerals that are high in bases. Hence, these soils have higher base status than the granitic soils. The finer grained, more easily weathered rocks have broken down into soils that have a silt fraction three to four times that of the granitic soils. Fugawee and Tahoma soils have some clay accumulation, mainly kaolinite and halloysite, in the B horizon. Waca soils contain amorphous clay and have a high cation-exchange capacity. Tahoma and Jorge soils show some evidence of having weak, thixotropic properties.

Soils of the Moraines

The strongly sloping to very steep Meeks and Tallac soils formed on lateral, terminal, and ground moraines. The Meeks soil formed on moraines derived mostly from granitic sources, and the Tallac soil on moraines derived chiefly from metamorphic and volcanic rock. The difference in rock source causes major differences in these soils. The Meeks soil is coarse textured, stony, and bouldery, and the Tallac soil is moderately coarse textured, cobbly, and stony. The Tallac soil has a higher available water capacity and supports denser vegetation than the Meeks soil and has accumulated more organic matter in the A horizon. Both have weakly cemented silica pans in the substratum. The formation of the pan can be attributed to the following processes and conditions:

The moraines have compacted till at a depth of about 4 to 6 feet. This compacted till is relatively impervious to water. Excess water from winter rain and snowmelt have leached small amounts of bases and soluble silica downward to the compacted till. The soils dry out each summer, and the drying precipitates the bases and silica above the compacted till. The silica content has built up over a period of years to form the pan.

The excess water from snowmelt moves laterally across the pan and flushes bases from the soil. Most morainal ridges are naturally stable because they are protected from erosion by a surface paved with stones and boulders. This is especially true in the moraines derived from granitic rock sources.

Soils of the Terraces, Outwashes, and Fans

The soils in this group are Elmira, Gefo, Inville, and Jabu soils, the Jabu shallow variant, the Jabu moderately fine subsoil variant, gravelly phases of Meeks soils, and seeped phases of Tallac soils. These soils are nearly level to moderately steep. The Elmira and Gefo soils are deep, somewhat excessively drained, and coarse textured. The Elmira soil shows evidence of being older than Gefo soil. It has thin clay bands of silica coatings on the gravel in the lower part of the C horizon. The Gefo soil has accumulated more organic matter in the A horizon than the Elmira soil, because it occupies areas of recent deposition where the moisture regime was more favorable for vegetative growth during deposition.

Jabu soils and the Jabu shallow variant formed on terrace remnants of older glacial outwash. Through the years, these soils have had favorable moisture during the warmer months of the year and some minerals have weathered to form clay, mainly kaolinite and vermiculite. This clay has accumulated in the B horizon in sufficient quantity to form an argillic horizon. The clay changes little in volume between wetting and drying, and the subsoil is massive. Translocated clay fills most of the voids. Also some silt and silica have moved into the voids. Where most of the voids are filled, the B and C horizons are very dense, have high bulk densities, and show evidence of the formation of a fragipan. The material in these horizons is hard and brittle when dry, but slakes when moist. These processes of soil formation are evident deeper in the profile in the Jabu soil than in the Jabu shallow variant because the Jabu soil is well drained and the Jabu shallow variant is only moderately well drained and its profile stays moist longer.

Soils of the Flood Plains

Celio soils, the Elmira wet variant, and wet miscellaneous land types are on the flood plains. Slopes are nearly level to gently sloping. The water table is high. Water from the nearby melting snow keeps soil temperatures low. The soils have very little horizon differentiation except for an accumulation of organic matter in the A horizon. They are generally mottled and in a reduced condition. The Celio soil is an exception. It is at the higher elevations on the flood plain. A high water table moves through the Celio soil in winter and spring and then drops to a lower level in summer. Celio soils and the Elmira wet variant have prominent reddish-yellow mottles, as a result of oxidation.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (3) and revised later (12). The system currently used by the National Cooperative Soil Survey was adopted in 1965 (15). It is under continual study. Readers interested in the development of the system should refer to the latest literature available (10, 11).

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Following are assumptions pertinent to the classification of all soils in the Basin. The moisture control section of well-drained soils is dry for more than 60 consecutive days following the summer solstice. The mean annual soil temperature at a depth of 20 inches is below 47° F. in all soils in the Basin. The mean summer (June 21-September 21) soil temperature at a depth of 20 inches is above 60° in the alluvial and terrace soils adjacent to Lake Tahoe and below 59° in the upland soils and the soils influenced by a high water table. All soils have an epipedon in which base saturation is less than 50 percent. No soil has a mollic epipedon.

Table 15 shows the classification of each soil series of the Tahoe Basin Area by family, subgroup, and order according to the current System. A detailed description of each soil series is given in the section "Description of the Soils." Following are brief descriptions of the three soil orders in the Area.

Entisols

Entisols have no natural genetic horizons. Many have an ochric epipedon. Some are too young to have formed distinct horizons. Some are steep and actively eroding. Some are on flood plains or glacial outwash plains that frequently receive new deposits of alluvium. Others are old, but consist of minerals resistant to weathering or are in a climate too cold for active chemical weathering. Cagwin, Elmira, Graylock, and Toem soils are Entisols.

The steep, coarse-textured Cagwin, Graylock, and Toem soils were derived from granitic rock. They formed under cold temperatures; the summer soil temperature is below 59° F. These soils have no diagnostic features, but do have an ochric epipedon

TABLE 15.--SOIL SERIES CLASSIFIED ACCORDING TO THE CURRENT SYSTEM OF CLASSIFICATION

Series	Family	Subgroup	Order
Cagwin	Mixed	Typic Cryopsamments	Entisols.
Celio	Sandy-skeletal, mixed	Aquic Entic Cryumbrepts	Inceptisols.
Elmira	Mixed, frigid	Alfic Xeropsamments	Entisols.
Elmira wet variant	Sandy, mixed	Aquic Entic Cryumbrepts	Inceptisols.
Fugawee	Fine-loamy, mixed	Mollic Cryoboralfs	Alfisols.
Gefo	Sandy, mixed, frigid	Entic Xerumbrepts	Inceptisols.
Graylock	Sandy-skeletal, mixed	Typic Cryorthents	Entisols.
Inville	Loamy-skeletal, mixed, frigid	Ultic Haploxeralfs	Alfisols.
Jabu	Coarse-loamy, mixed, frigid	Ultic Haploxeralfs	Alfisols.
Jabu moderately fine variant	Fine-loamy, mixed, frigid	Ultic Haploxeralfs	Alfisols.
Jabu shallow variant 1/	Coarse-loamy, mixed, frigid	Ultic Haploxeralfs	Alfisols.
Jorge	Loamy-skeletal, mixed	Typic Cryoboralfs	Alfisols.
Meeks	Sandy-skeletal, mixed	Entic Cryumbrepts	Inceptisols.
Meiss	Medial	Lithic Cryandepts	Inceptisols.
Shakespeare	Loamy-skeletal, mixed	Aquic Cryoboralfs	Alfisols.
Tahoma	Fine-loamy, mixed	Typic Cryoboralfs	Alfisols.
Tallac	Loamy-skeletal, mixed	Entic Cryumbrepts	Inceptisols.
Tallac shallow variant	Loamy-skeletal, mixed, frigid	Duric Haplumbrepts	Inceptisols.
Toem	Mixed, shallow	Typic Cryopsamments	Entisols.
Umpa	Loamy-skeletal, mixed	Typic Cryochrepts	Inceptisols.
Waca	Cindery	Typic Cryandepts	Inceptisols.

1/ The Jabu shallow variant in the Tahoe Basin Area has a fragipan within a depth of 1 meter.

because of their light color. They are classified as Typic Cryopsamments and Typic Cryorthents.

The coarse-textured Elmira soils formed on glacial outwash and moraines, under cold temperatures; the summer soil temperature is above 59° F. Thin clay bands have formed and some silica has been deposited on gravel in the C horizon, but these features are not strong enough to qualify as diagnostic horizons. Elmira soils are seasonally dry for 60 consecutive days or more in most years. They are classified as Alfic Xeropsamments.

Inceptisols

Inceptisols have one or more diagnostic horizons that formed in the early stages of weathering. They have no significant eluviation or illuviation and, except for darkening of the epipedon, they lack prominent morphologic features. The conductivity of the saturation extract is less than 1 milliohm per centimeter at 25° C. Celio, Elmira wet variant, Gefo, Meeks, Meiss, Tallac, Tallac shallow variant, Umpa, and Waca soils are Inceptisols.

Celio soils and the Elmira wet variant are poorly drained soils that are saturated with water within a depth of 30 inches most of the year. The cold water keeps the soil temperature below 59° F. in summer. The only diagnostic horizon in these soils is an umbric epipedon. The Elmira wet variant has a sandy control section, and the Celio soil has a sandy-skeletal control section. Celio soils have a silica pan, but the pan is below a depth of 40 inches, which is too deep in the profile to qualify as a diagnostic horizon. The Elmira wet variant and Celio soils are classified as Aquic Entic Cryumbrepts.

Meeks and Tallac soils formed on glacial moraines and outwash. Soil temperatures are cold; the summer soil temperature is 54° to 57° F. The only diagnostic horizon in these soils is an umbric epipedon. Both soils have a silica-cemented pan, but the pan is below a depth of 40 inches, which is too deep to qualify as a diagnostic horizon. Meeks soils have a sandy-skeletal control section, and Tallac soils have a loamy-skeletal control section. These soils are classified as Entic Cryumbrepts.

The Tallac shallow variant is similar to other Tallac soils, but the silica-cemented pan is within a depth of 40 inches and is therefore a diagnostic horizon. It is classified as a Duric Haplumbrept.

The steep, moderately coarse textured Umpa soils were derived from volcanic rock. They formed under a cold climate; the summer soil temperature is below 59° F. Umpa soils have an ochric epipedon and a cambic horizon and a loamy-skeletal control section. They are classified as Typic Cryochrepts.

The steep, medium textured and moderately coarse textured Meiss and Waca soils were derived from volcanic rock. They have been affected by volcanic ash. They have an umbric epipedon and contain more than 60 percent vitric pyroclastic material in the

silt, sand, and gravel fractions. They have a bulk density of 0.70 to 0.85 grams per cubic centimeter in the epipedon or cambic horizon, and the exchange complex is dominated by amorphous material. These soils formed under a cold climate; summer soil temperature is below 59° F. Meiss soils differ from Waca soils in having a lithic contact with rock within a depth of 20 inches. Meiss soils are classified as Lithic Cryandepts, and Waca soils as Typic Cryandepts.

Alfisols

Alfisols have an ochric epipedon and an argillic horizon. They have a frigid temperature regime or a base saturation of 35 percent or more above the following critical depths: 50 inches below the upper boundary of the argillic horizon, 72 inches below the surface soil, or immediately above a lithic or paralithic contact. Not all Alfisols in the Area have a 15 percent clay increase within 1 inch of the upper boundary of the argillic horizon. Fugawee, Inville, Jabu, Jabu moderately fine variant, Jabu shallow variant, Jorge, Shakespeare, and Tahoma soils are Alfisols.

Inville and Jabu soils, the Jabu moderately fine subsoil variant, and the Jabu shallow variant, are nearly level to strongly sloping, moderately coarse textured soils on glacial outwash terraces and alluvial fans. They formed under cold temperatures; the summer soil temperature is above 59° F. These soils are seasonally dry for 60 consecutive days or more in most years. They have an ochric epipedon and a weakly expressed argillic horizon. Base saturation is less than 75 percent in some subhorizons within 30 inches of the upper boundary of the argillic horizon. Jabu soils have a fragipan, but the pan is below a depth of 40 inches and is therefore too deep to qualify as a diagnostic horizon. The Jabu shallow variant has a fragipan within a depth of 40 inches, but there are no provisions for placement of soils that have a fragipan in this subgroup of Alfisols. Inville and Jabu soils, the Jabu moderately fine subsoil variant, and the Jabu shallow variant are classified as Ultic Haploxeralfs.

The gently sloping to steep Fugawee, Jorge, and Tahoma soils are on volcanic uplands. They formed under cold temperatures; the summer soil temperature is below 59° F. These soils have an ochric epipedon and a weakly expressed argillic horizon. Jorge and Tahoma soils have an A1 horizon in which moist value is more than 3.5. Fugawee soils have an A1 horizon in which moist value is less than 3.5. Jorge and Tahoma soils are classified as Typic Cryoboralfs. Fugawee soils are classified as Mollic Cryoboralfs.

The moderately steep to steep Shakespeare soils are on metamorphic uplands. They formed under similar climate and have generally the same diagnostic horizons as Fugawee, Jorge, and Tahoma soils. Shakespeare soils differ from those soils in having mottles of 2 chroma or less within a depth of 30 inches. They are classified as Aquic Cryoboralfs.

Laboratory Analyses

The chemical and physical properties of selected soils representing nine series in the Tahoe Basin Area are shown in tables 16, 17, and 18. The samples were analyzed at the Soil Survey Laboratory in Riverside, California. The methods and procedures used in the analysis are explained in Soil Survey Investigations Report No. 1 (17).

An asterisk preceding the series name in table 16 indicates that the profile is a modal type for the Area.

Little clay has formed in the soils of the survey area. Most of the soils have only a trace to a moderate amount of mica, kaolinite, and vermiculite clay. Waca soils have an undetermined amount of amorphous material.

CLIMATE[5/]

The climate of the Tahoe Basin Area is one of abundant sunshine in summer and frequent cloudiness in winter; moderate to heavy precipitation, about two-thirds of which is snowfall; and a wide range in temperature. Subzero readings can be expected in most winters, and highs in the upper 80's are not uncommon in summer.

The average annual temperature ranges from the upper 30's in the colder parts of the Basin to the middle and upper 40's in the warmer parts. The valleys at high elevations are generally the coldest, and the lower elevations, particularly near the Lake, the warmest. Extremes range from highs in the middle 90's in summer to lows of -15° to -20° F. in winter. In July the average maximum ranges from 72° to 82° and the average minimum from 42° to 48°. In January, the average maximum ranges from 36° to 41° and the average minimum from 15° to 24°. Summarized climatic data, based on records kept at Tahoe City, are shown in table 19. The probability of the last freezing temperature in spring and the first in fall is shown in table 20.

The growing season, usually extending from the middle of June to late in August, is only 50 to 75 days. This is the period between the last 32° reading in spring and the first in fall. The 28° growing season, extending from about the first of June to late in September, is 75 to 125 days.

5/ By C. R. ELFORD, ESSA State climatologist, National Weather Service, U.S. Department of Commerce.

TABLE 16.--PHYSICAL DATA FOR SELECTED SOILS

[Analyses by Soil Survey Laboratory, Riverside, California. The symbol < means more than; > means less than]

Series and laboratory number	Horizon	Depth	Particle-size distribution										Coarse fragments 1/		
			Total			Sand					Silt				
			Sand (2-0.05 mm.)	Silt (0.05-0.002 mm.)	Clay (<0.002 mm.)	Very coarse (2-1 mm.)	Coarse (1-0.5 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.)	(0.02-0.002 mm.)	>2 mm.	2-19 mm.	19-76 mm.
		In.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
*Cagwin: 68584-68592.	A11	0-4	83.7	13.4	2.9	24.1	22.7	9.9	16.9	10.1	7.2	6.2	23	23	--
	A12	4-8	84.8	12.4	2.8	25.4	23.5	10.0	17.3	8.6	6.3	6.1	39	39	--
	AC	8-12	84.9	12.1	3.0	23.3	23.1	10.3	18.5	9.7	6.4	5.7	33	33	--
	C1	12-20	85.1	12.3	2.6	28.6	24.0	9.4	15.7	7.4	6.4	5.9	39	39	--
	C2	20-26	88.4	8.9	2.7	34.9	25.1	8.8	13.5	6.1	4.4	4.5	44	44	--
*Celio: 68678-68684.	A11	0-8	85.7	10.5	3.8	30.8	27.9	10.5	11.7	4.8	4.7	5.8	46	32	14
	A12	8-16	81.6	14.5	3.9	23.3	26.6	12.1	13.1	6.5	6.0	8.5	47	29	17
	C1	16-23	83.4	13.1	3.5	21.2	28.8	13.3	13.9	6.3	5.4	7.7	56	35	21
	IIC2	23-45	94.3	3.4	2.3	19.0	40.8	20.4	11.8	2.3	1.4	2.0	50	42	9
	2/IIC3	45-56													
	IIC4	56-67	98.5	.7	.8	67.0	27.0	3.2	1.1	.2	.1	.6	46	39	7
	IIC5	67-80	98.5	.8	.7	16.0	39.8	21.6	18.9	2.1	.6	.2	27	21	6
*Elmira: 68565-68575.	A11	0-2	83.3	11.1	5.6	31.7	27.6	10.1	10.3	3.6	3.6	7.5	24	24	---
	A12	2-7	81.0	12.0	7.0	28.4	27.4	10.4	10.6	4.2	4.0	8.0	25	19	6
	C1	7-19	79.7	12.3	7.9	19.2	29.2	13.0	13.2	5.1	4.4	8.0	18	18	--
	C2	19-27	78.2	12.7	9.1	18.2	26.6	12.7	14.5	6.2	4.6	8.1	31	19	12
	C3	27-31	79.8	11.0	9.2	17.2	31.7	13.7	12.9	4.3	3.2	7.8	47	17	30
	C4	31-35	79.8	11.1	9.1	19.6	29.5	12.4	13.5	4.8	3.7	7.4	45	28	17
	C5	35-44	83.9	8.6	7.5	27.1	32.1	10.6	10.5	3.6	2.9	5.7	43	16	26
	C6	44-59	----	----	----	----	----	----	----	----	----	----	28	21	7
	IIIC7	59-72	87.1	8.7	4.2	23.9	33.0	13.9	13.0	3.3	4.3	4.4	27	12	16
Gefo: 68674-68677.	A11	0-4	87.6	9.0	3.4	25.4	24.9	14.9	17.2	5.2	4.3	4.7	28	28	--
	A12	4-12	87.5	8.7	3.8	25.8	23.9	14.7	18.0	5.1	4.3	4.4	26	26	--
	C1	12-26	86.0	10.0	4.0	16.5	23.7	17.0	22.1	6.7	5.2	4.8	26	26	--
	C2	26-39	85.0	10.4	4.6	12.6	23.7	17.1	24.6	7.0	5.1	5.3	26	26	--
Jabu: 68652-68663.	A1	0-2	77.7	14.5	7.8	17.5	19.8	12.4	19.5	8.5	6.9	7.6	13	13	--
	A3	2-6	80.6	12.3	7.1	31.5	18.4	9.7	15.2	5.8	5.4	6.9	14	14	--
	B1t	6-10	77.4	13.4	9.2	15.9	22.0	12.4	18.7	8.4	6.3	7.1	15	15	--
	B21t	10-20	77.0	12.8	10.2	11.4	21.3	13.6	22.1	8.6	5.8	7.0	15	15	--
	IIB22tb	20-29	78.8	10.6	10.6	12.6	17.9	12.8	26.4	9.1	4.7	5.9	27	19	18
	IIB23tb	29-37	81.1	7.6	11.3	9.5	20.2	15.7	28.4	7.3	3.6	4.0	26	10	15
	IIB24tb	37-45	81.3	8.3	10.4	12.8	23.1	14.9	24.2	6.3	4.1	4.2	44	8	37
	IIIBx1	45-52	83.8	10.6	5.6	11.2	23.7	14.2	24.6	10.1	6.3	4.3	7	7	--
	IIIBx2	52-66	72.2	21.8	6.0	10.4	17.3	10.6	22.1	11.8	10.4	11.4	10	10	--
	IVC1	66-72	57.3	29.0	13.7	8.9	15.5	10.1	16.5	6.3	7.3	21.7	6	6	--
	VC2	72	81.2	12.0	6.8	20.0	21.6	11.7	18.9	9.0	6.4	5.6	9	9	--

TABLE 16.--PHYSICAL DATA FOR SELECTED SOILS--Continued

Series and laboratory number	Horizon	Depth	Particle-size distribution										Coarse fragments 1/		
			Total			Sand					Silt				
			Sand (2-0.05 mm.)	Silt (0.05-0.002 mm.)	Clay (<0.002 mm.)	Very coarse (2-1 mm.)	Coarse (1-0.5 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.)	(0.02-0.002 mm.)	>2 mm.	2-19 mm.	19-76 mm.
		In.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Jabu shallow variant: 68627-68642.	A11	0-3	74.7	19.1	6.2	14.6	20.8	12.5	18.3	8.5	7.2	11.9	16	16	--
	A12	3-8	71.3	18.9	9.8	9.5	18.5	13.1	20.0	10.2	8.9	10.0	16	16	--
	B11t	8-11	70.7	19.1	10.2	8.7	18.0	13.2	20.2	10.6	8.6	10.5	11	11	--
	B12tx	11-14	72.9	17.2	9.9	16.3	19.2	12.1	16.8	8.5	7.6	9.6	18	18	--
	B13tx	14-19	69.3	19.8	10.9	11.2	18.3	12.3	18.8	8.7	8.7	11.1	11	11	--
	B14tx	19-29	62.3	20.6	17.1	7.0	12.8	11.0	20.3	11.2	9.3	11.3	9	9	--
	B21tx	29-44	67.5	16.9	15.6	11.3	16.2	12.1	18.9	9.0	7.0	9.9	12	12	--
	B22tx	44-64	75.4	11.8	12.8	13.9	19.1	13.1	20.4	8.9	6.1	5.7	25	25	--
	B31tx	64-75	76.8	12.0	11.2	16.8	21.3	13.7	18.1	6.9	5.5	6.5	33	33	--
	B32tx	75-91	76.1	15.5	8.4	16.1	20.2	13.1	18.0	8.7	7.1	8.4	18	18	--
Tallac: 68685-68690.	A11	0-15	68.5	26.4	5.1	11.2	16.9	10.5	16.7	13.2	13.1	13.3	14	3	11
	A12	15-21	67.3	28.5	4.2	9.1	17.0	10.8	16.9	13.5	14.7	13.8	43	22	21
	C1	21-31	63.6	32.2	4.2	10.8	16.9	9.8	14.4	11.7	15.1	17.1	47	26	20
	C2	31-42	76.5	19.7	3.8	17.4	23.2	12.7	14.8	8.4	10.5	9.2	48	37	11
	C3si	42-65	73.6	23.3	3.1	7.5	18.7	13.5	20.4	13.5	13.1	10.2	35	23	12
Toem: 68704-68712.	A11	0-2	88.6	8.8	2.6	41.2	25.2	8.1	10.4	3.7	4.4	4.4	35	35	--
	A12	2-9	85.5	10.9	3.6	26.0	25.0	10.9	16.5	7.1	5.7	5.2	33	33	--
	C1	9-17	85.6	11.4	3.0	27.0	24.0	9.8	16.1	8.1	5.9	5.5	41	41	--
Waca: 68727-68734.	A11	0-9	66.4	28.9	4.7	19.2	14.5	7.8	14.1	10.8	11.6	17.3	--	--	--
	A12	9-14	66.1	29.1	4.8	14.7	14.1	9.1	15.8	12.4	11.6	17.5	--	--	--
	A13	14-21	66.6	28.7	4.7	14.1	14.0	9.1	16.2	13.2	12.1	16.6	--	--	--
	C1	21-31	67.6	28.4	4.0	12.7	15.1	9.9	17.2	12.7	11.2	17.2	--	--	--
	C2	31-36	68.2	27.6	4.2	11.1	17.4	10.7	17.6	11.4	10.7	16.9	--	--	--

1/ Coarse fragments are removed from soil sample and their percentage calculated before distribution of sand, silt, and clay is determined.

2/ Strongly cemented hardpan.

TABLE 17.--PHYSICAL AND CHEMICAL DATA FOR SELECTED SOILS

[Analyses by Soil Survey Laboratory, Riverside, California]

Series	Depth	Organic carbon	Nitrogen	C/N ratio	Extractable iron as FE	Bulk density			Coarse fragment conversion factor (Cm)	Water content		Linear extensibility		Reaction	
						1/3 bar	Oven dry	1/3 bar (estimated)		1/3 bar	15 bar	Fine earth	Whole soil	H20	CaCl2
	In.	Pct.	Pct.		Pct.	Gm./cc.	Gm./cc.	Gm./cc.		Pct.	Pct.	Pct.	Pct.	pH	pH
Cagwin:	0-4	3.39	0.109	31	---	0.92	1.03	---	0.90	20.1	5.2	3.8	3.4	5.8	4.9
	4-8	1.65	.054	31	---	1.28	1.28	---	.77	10.6	3.2	---	---	5.8	4.9
	8-12	1.17	-----	--	---	1.29	1.31	---	.80	9.6	3.0	.5	.4	5.7	5.0
	12-20	.66	-----	--	---	1.32	1.32	---	.76	6.5	2.4	---	---	5.7	5.0
	20-26	.37	-----	--	---	1.39	1.39	---	.71	4.6	2.2	---	---	5.8	5.1
Celio:	0-8	3.53	.145	24	2.7	----	----	1.30	.70	----	6.0	---	---	5.4	4.9
	8-16	2.12	.107	20	2.8	----	----	1.35	.69	----	6.4	---	---	5.5	5.2
	16-23	1.19	.081	15	2.7	----	----	1.40	.60	----	5.5	---	---	5.6	5.2
	23-45	.47	-----	--	1.6	----	----	1.50	.63	----	2.3	---	---	5.5	5.4
	45-56	----	-----	--	---	----	----	1.80	----	----	---	---	---	5.6	5.4
	56-67	----	-----	--	.4	----	----	1.70	.65	----	.7	---	---	5.5	5.3
	67-80	----	-----	--	.3	----	----	1.70	.81	----	.7	---	---	5.5	5.2
Elmira:	0-2	3.77	.137	28	---	----	----	.45	.95	----	5.7	---	---	5.3	4.5
	2-7	1.94	.070	28	---	1.27	1.28	----	.86	11.1	4.6	.3	.2	5.9	5.0
	7-19	.52	-----	--	---	1.34	1.34	----	.90	9.3	4.6	---	---	5.9	5.1
	19-27	.34	-----	--	---	1.38	1.39	----	.81	11.4	5.1	.2	.2	5.8	5.0
	27-31	.15	-----	--	---	1.36	1.37	----	.69	14.6	4.8	.2	.2	5.8	5.1
	31-35	.14	-----	--	---	1.23	1.24	----	.71	13.8	5.2	---	---	5.8	5.2
	35-44	----	-----	--	---	----	----	1.45	.74	14.3	4.4	.3	.2	5.7	5.0
	44-59	----	-----	--	---	----	----	1.45	.82	----	2.7	---	---	5.8	4.9
	59-72	----	-----	--	---	----	----	1.20	.83	----	2.5	---	---	---	---
Gefo:	0-4	2.47	.094	26	.6	----	----	1.35	.83	----	3.9	---	---	5.6	4.9
	4-12	1.13	.047	24	.8	----	----	1.50	.84	----	3.7	---	---	5.9	5.2
	12-26	----	-----	--	.8	----	----	1.47	.59	----	2.9	---	---	6.1	5.5
	26-39	----	-----	--	.7	----	----	1.54	.83	----	2.7	---	---	6.1	5.4
Jabu:	0-2	2.73	.115	24	1.5	.90	.95	----	.95	20.2	6.2	1.8	1.7	6.0	5.5
	2-6	1.02	.052	20	1.5	1.36	1.36	----	.92	13.0	5.0	---	---	6.2	5.6
	6-10	.71	-----	--	1.8	1.31	1.32	----	.92	11.4	5.5	.3	.2	5.7	5.3
	10-20	.47	-----	--	1.9	1.39	1.39	----	.91	9.0	5.6	---	---	5.4	4.7
	20-29	.30	-----	--	2.9	1.57	1.57	----	.82	14.3	6.2	---	---	5.4	4.7
	29-37	.22	-----	--	3.5	1.45	1.46	----	.84	17.4	6.5	.2	.2	5.5	4.9
	37-45	.28	-----	--	2.6	1.50	1.50	----	.60	17.2	6.9	---	---	5.4	4.8
	45-52	.18	-----	--	1.6	1.64	1.64	----	.95	9.5	4.0	---	---	5.4	4.7
	52-66	.10	-----	--	.6	1.92	1.92	----	.93	9.7	3.4	---	---	5.6	4.8
	66-72	----	-----	--	1.3	1.40	1.45	----	.97	29.4	7.9	1.2	1.1	5.4	4.8
	72	----	-----	--	.5	----	----	1.40	.95	----	3.5	---	---	6.1	5.6
Jabu shallow variant:	0-3	2.58	.092	28	1.2	.94	.98	----	.94	12.5	6.3	1.4	1.3	5.2	4.6
	3-8	1.43	.045	32	1.4	1.36	1.36	----	.91	10.8	4.4	---	---	5.6	5.0
	8-11	1.05	-----	--	1.4	1.47	1.47	----	.93	12.6	2.8	---	---	5.9	5.1
	11-14	.97	-----	--	1.4	1.46	1.47	----	.89	12.8	4.6	.2	.2	5.8	5.1
	14-19	.27	-----	--	1.5	1.76	1.76	----	.92	12.0	4.7	---	---	5.7	5.2
	19-29	.19	-----	--	1.5	1.72	1.72	----	.94	11.5	7.3	---	---	5.7	5.2
	29-44	.18	-----	--	1.2	1.86	1.91	----	.91	13.2	6.8	.9	.8	5.7	5.2
	44-64	.12	-----	--	1.4	1.71	1.78	----	.82	16.9	6.4	1.3	1.1	5.6	5.1
	64-75	.09	-----	--	1.5	1.78	1.82	----	.76	13.7	3.6	.7	.6	5.7	5.3
	75-80	----	-----	--	.9	1.70	1.74	----	.87	13.9	4.8	.8	.7	6.5	6.0

504-718 O - 74 - 6

TABLE 17.--PHYSICAL AND CHEMICAL DATA FOR SELECTED SOILS--Continued

Series	Depth	Organic carbon	Nitrogen	C/N ratio	Extractable iron as FE	Bulk density			Coarse fragment conversion factor (Cm)	Water content		Linear extensibility		Reaction	
						1/3 bar	Oven dry	1/3 bar (estimated)		1/3 bar	15 bar	Fine earth	Whole soil	H20	CaC12
	In.	Pct.	Pct.		Pct.	Gm./cc.	Gm./cc.	Gm./cc.		Pct.	Pct.	Pct.	Pct.	pH	pH
Tallac:	0-15	3.92	0.195	20	1.2	----	----	1.35	0.93	----	8.2	---	---	5.9	5.4
	15-21	2.97	.162	18	1.1	----	----	1.40	.71	----	7.4	---	---	6.0	5.4
	21-31	1.61	.110	15	1.1	----	----	1.50	.67	----	6.5	---	---	6.0	5.4
	31-42	.79	-----	--	1.0	----	----	1.50	.66	----	4.3	---	---	5.9	5.4
	42-65	.29	-----	--	1.1	----	----	1.70	.75	----	4.2	---	---	5.7	5.3
Toem:	0-2	4.63	.168	28	.4	1.04	1.09	----	.82	12.6	7.1	1.6	1.3	5.8	5.1
	2-9	1.40	.520	3	---	1.22	1.22	----	.82	10.1	4.0	---	---	6.5	5.6
	9-17	.58	-----	--	.3	1.49	1.50	----	.72	5.8	2.9	.2	.2	6.1	5.3
Waca:	0-9	4.85	1.78	27	1.0	.90	.91	----	.80	27.8	13.8	.4	.2	6.2	5.5
	9-14	1.97	1.09	18	---	.62	.63	----	.82	----	11.8	.5	.4	6.2	5.5
	14-21	1.63	.089	18	1.1	.88	.88	----	.75	21.9	12.7	---	---	6.3	5.4
	21-31	1.60	-----	--	1.1	----	----	.76	.78	----	14.4	---	---	6.2	5.3
	31-36	1.44	-----	--	1.0	----	----	.71	.64	----	13.9	---	---	5.9	5.1

TABLE 18.--CHEMICAL DATA FOR SELECTED SOILS

[Analyses by Soil Survey Laboratory, Riverside, California]

Series	Depth	Extractable bases (milliequivalents per 100 grams of soil)				Sum of bases	Extractable acidity	CEC		KCL extractable Al	Base saturation		
		Ca	Mg	Na	K			NH_4OAc	Sum		NH_4OHc	Sum + extractable	Sum + bases
	In.					Meq./100 gm.	Meq./100 gm.	Meq./100 gm	Meq./100 gm.	Meq./100 gm.	Pct.	Pct.	Pct.
Cagwin:	0-4	4.0	0.7	0.1	0.4	5.2	9.0	12.5	14.2	---	41	36	--
	4-8	2.5	.3	---	.3	3.1	8.5	9.4	11.6	---	33	27	--
	8-12	1.6	.1	---	.2	1.9	7.1	7.2	9.0	---	27	21	--
	12-20	1.2	.2	---	.2	1.6	6.3	5.9	7.9	---	27	20	--
	20-26	.7	.1	.1	.2	1.1	4.1	4.0	5.2	---	27	21	--
Celio:	0-8	1.7	.1	.1	.2	2.1	14.8	16.4	16.9	.7	12	12	74
	8-16	.5	.1	---	.2	.8	12.7	9.7	13.5	.1	8	6	89
	16-23	.5	.1	---	.1	.7	10.7	7.5	11.4	.1	9	6	88
	23-45	.1	---	---	.1	.3	3.8	2.7	4.1	.1	10	6	74
	45-56	.1	---	---	---	.2	---	2.1	----	.1	11	---	70
	56-67	.1	---	---	---	.2	---	1.8	----	.1	12	---	69
	67-80	.1	---	.1	.1	.3	---	1.3	----	.1	26	---	77
Elmira:	1/ 0-2	2.8	.4	.1	.4	3.7	2.0	13.3	5.7	.8	27	64	82
	2-7	2.7	.3	---	.3	3.3	7.1	10.1	10.4	---	33	31	--
	7-19	1.6	.2	---	.2	2.0	5.1	6.8	7.1	---	29	28	--
	19-27	1.9	.3	.1	.3	2.6	4.3	6.8	6.9	---	38	37	--
	27-31	2.0	.3	---	.4	2.7	3.9	6.1	6.6	---	45	41	--
	31-35	2.2	.4	.1	.5	3.2	3.3	6.6	6.5	---	48	49	--
	35-44	1.6	.3	.1	.5	2.5	3.2	5.1	5.7	---	49	43	--
	44-59	1.4	.3	.1	.2	2.0	1.8	4.6	3.8	---	43	52	--
	59-72	1.3	.3	.1	.2	1.9	2.2	4.2	4.1	---	45	46	--
Gefo:	0-4	2.5	.3	---	.3	3.1	7.7	10.9	10.8	---	28	28	--
	4-12	1.9	.2	.1	.3	2.5	6.5	7.4	9.0	---	33	27	--
	12-26	1.1	.1	.1	.2	1.5	4.0	4.3	5.5	---	34	27	--
	26-39	1.0	.2	.1	.2	1.5	2.2	5.6	3.7	---	26	40	--
Jabu:	0-2	6.1	.4	---	.4	6.9	9.0	12.8	15.9	---	54	43	--
	2-6	3.4	.3	---	.3	4.0	9.0	9.9	13.0	---	40	30	--
	6-10	2.1	.3	---	.2	2.6	8.6	7.9	11.2	---	33	23	--
	10-20	2.0	.3	.1	.1	2.5	6.3	7.1	8.8	.5	35	28	83
	20-29	2.3	.4	.1	.1	2.9	5.9	6.5	8.8	.3	44	32	90
	29-37	1.9	.3	.1	.1	2.4	4.9	5.0	7.3	.2	47	32	92
	37-45	2.2	.4	.1	.1	2.8	5.9	5.9	8.7	.3	47	32	90
	45-52	2.0	.3	.1	.1	2.5	2.8	5.1	5.3	.2	49	47	92
	52-66	2.8	.4	.1	.1	3.4	1.4	4.5	4.8	.2	75	70	94
	66-72	9.2	1.7	.2	.1	11.2	2.3	14.8	13.5	.4	75	82	96
	72-100	2.5	.5	.1	.1	3.2	---	3.8	----	---	84	---	--
Jabu shallow variant:	0-3	---	---	---	---	---	10.8	----	10.8	.8	--	---	--
	3-8	---	---	---	---	---	8.3	----	8.3	.8	--	---	--
	8-11	2.4	.2	---	.2	2.8	7.5	8.3	10.3	---	34	27	--
	11-14	2.0	.3	.1	.2	2.6	8.3	8.6	10.9	---	30	23	--
	14-19	2.6	.4	.1	.2	3.3	4.1	6.7	7.4	---	49	44	--
	19-29	5.2	1.1	.1	.1	6.5	---	8.2	----	---	79	---	--
	29-44	4.4	1.0	.1	.1	5.6	---	7.6	----	---	73	---	--
	44-64	6.7	1.5	.1	---	8.3	3.3	10.3	11.6	---	81	71	--
	64-75	4.9	1.1	.1	---	6.1	---	7.9	----	---	77	---	--
	75-91	4.1	.9	.1	---	5.1	---	5.9	----	---	87	---	--
	91-114	2.9	.7	.1	---	3.7	---	4.0	----	---	93	---	--

See footnote at end of table.

TABLE 18.--CHEMICAL DATA FOR SELECTED SOILS--Continued

Series	Depth	Extractable bases (milliequivalents per 100 grams of soil)				Sum of bases	Extractable acidity	CEC		KCL extractable AL	Base saturation		
		Ca	Mg	Na	K			NH_4OAc	Sum		NH_4OAc	Sum + extractable	Sum + bases
	In.					Meq./ 100 gm.	Meq./ 100 gm.	Meq./ 100 gm	Meq./ 100 gm.	Meq./ 100 gm.	Pct.	Pct.	Pct.
Tallac:	0-15	7.1	0.4	0.1	0.5	8.1	15.9	19.0	24.0	---	42	33	---
	15-21	4.5	.4	.1	.5	5.5	13.2	15.5	18.7	---	35	29	---
	21-31	2.4	.2	---	.5	3.1	12.6	12.4	15.7	---	25	19	---
	31-42	1.3	.1	---	.4	1.8	7.2	7.6	9.0	---	24	20	---
	42-65	1.4	.1	.1	.6	2.2	5.3	7.8	7.5	---	28	29	---
Toem:	0-2	8.3	.9	---	.4	9.6	8.0	17.4	17.6	---	55	54	---
	2-9	6.1	.8	---	.5	7.4	5.3	11.2	12.7	---	66	58	---
	9-17	2.4	.4	---	.3	3.1	4.3	6.6	7.4	---	47	42	---
Waca:	0-9	5.0	.6	.1	.9	6.6	23.7	23.6	30.3	---	27	21	---
	9-14	3.2	.4	.1	.9	4.6	21.2	21.0	25.8	---	21	17	---
	14-21	4.2	.5	.1	.7	5.5	20.4	21.8	25.9	---	25	21	---
	21-31	5.5	.4	.1	.7	6.7	21.7	24.1	28.4	---	27	23	---
	31-36	5.9	.5	.1	.7	7.2	20.0	25.5	27.2	---	28	26	---

1/ Sample is 0.1 percent dithionite extractable aluminum.

TABLE 19.--TEMPERATURE AND PRECIPITATION

[From records kept at Tahoe City for the period 1931-60. Elevation 6,230 feet]

Month	Temperature				Precipitation				
	Average daily		Two years in 10 will have at least 4 days with--		Average total	One year in 10 will have--		Days with snow cover	Average depth of snow on days with snow cover
	Maximum	Minimum	Maximum temperature equal to or higher than--	Minimum temperature equal to or lower than--		Less than--	More than--		
	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Number	Inches
January---	36	18	46	6	6.1	1.9	12.9	24	19
February--	38	19	48	6	5.3	1.2	12.0	25	30
March-----	43	22	54	10	4.0	1.0	7.8	29	27
April-----	51	27	63	17	2.1	.2	6.4	16	26
May-------	59	32	73	25	1.4	.2	3.1	3	8
June------	68	38	80	30	.6	(1/)	1.5	(2/)	1
July------	78	44	86	37	.3	0	.7	0	--
August----	77	43	86	36	.1	0	.8	0	--
September-	70	39	82	30	.4	0	.7	0	--
October---	58	32	70	25	1.9	.1	5.9	1	6
November--	46	25	57	15	3.2	.1	8.4	7	6
December--	40	21	49	8	5.6	1.2	11.9	22	9
Year----	55	30	3/ 87	4/ -1	30.9	18.1	45.8	127	21

1/ Trace. 2/ Less than one-half day. 3/ Average annual maximum. 4/ Average annual minimum.

TABLE 20.--PROBABILITY OF LAST FREEZING TEMPERATURE IN SPRING AND FIRST IN FALL

TAHOE CITY, CALIF.

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----	May 5	May 15	May 25	June 18	June 29
2 years in 10 later than---	Apr. 23	May 7	May 17	June 12	June 25
5 years in 10 later than---	Mar. 31	Apr. 20	May 3	May 30	June 17
Fall:					
1 year in 10 earlier than--	Oct. 27	Oct. 23	Oct. 8	Sept. 8	July 27
2 years in 10 earlier than-	Nov. 2	Oct. 28	Oct. 14	Sept. 15	Aug. 8
5 years in 10 earlier than-	Nov. 15	Nov. 6	Oct. 25	Sept. 29	Aug. 31

Total precipitation for the year is about 20 inches along the eastern shore of the Lake and 40 to 50 inches at high elevations along the western edge of the survey area. The annual total varies considerably from year to year. In about 1 year in 20, it is only 55 to 65 percent of the average, but in another year it is as much as 140 to 155 percent. A measurable amount of precipitation can be expected on 70 to 80 days each year. The number of days on which the measurement is 0.1 inch or more ranges from 40 near the Lake to 60 at the high elevations. The number of days on which it is 0.5 inch or more ranges from 10 to 30.

Snowfall for the year averages as much as 300 inches at some high elevations, but only about 100 inches in the northeast corner of the Area. The greatest depth at the lower elevations, where readings are available, ranges from 100 to 125 inches as often as 1 year in 10. At some high elevations, snow is as much as 20 feet deep. An accumulation this deep contains 100 inches or more of water.

Data indicate that annual evaporation probably ranges from less than 45 inches at high elevations to as much as 60 inches in the northeastern part of the Area. The potential evapotranspiration as calculated by the Thornthwaite method, is about 18 to 20 inches for the year, and 5 to 10 inches for the growing season. The actual evapotranspiration, as limited by natural precipitation, is 9 to 12 inches for the year and 2 to 6 inches for the growing season. The reserve moisture is gone by early in July unless it has been replenished from other sources.

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GLOSSARY

Acre-foot. The quantity of water, soil, or other material that will cover 1 acre to a depth of 1 foot.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

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.

Bulk density, soil. Mass per unit bulk volume of soil that has been dried to a constant weight at 105° C.

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.

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.

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

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

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

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

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

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

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

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

Cemented.--Hard and brittle; little affected by moistening.

Diagnostic horizon. Horizon showing specific soil characteristics that identify certain classes of soils. A diagnostic horizon at the surface is an epipedon.

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.

Duripan. A subsurface horizon cemented with silica to the degree that, after the soil is air dried, fragments do not slake after prolonged soaking in water or hydrochloric acid.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Glacial erratics. A transported rock fragment, free or as part of a sediment, that differs from the underlying bedrock. The term is generally applied to fragments transported by glacier ice or by floating ice.

Glacial outwash (geology). Cross-bedded gravel, sand, and silt deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Gravelly soil material. From 15 to 50 percent of material by volume, consists of rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.

Grus. An accumulation of fragmental products derived from the weathering of granite. The grus in the Tahoe Basin Area has not been moved, and it has retained the structure of the original rock.

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 he 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.

Igneous rock. Rock that has been formed by the cooling of molten mineral material. Examples: Granite, syenite, diorite, and gabbro.

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.

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

Metamorphic rock. Rock of any origin that has been completely changed physically by heat, pressure, and movement. Such rock is nearly always crystalline.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are these: Terminal, lateral, medial, and ground.

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 millimeters 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.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition.

Pan. A layer in a soil that is firmly compacted or very rich in clay. Frequently the word "pan" is combined with other words that more explicitly indicate the nature of the layers; for example, hardpan, fragipan, claypan, and traffic pan.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.

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 type, 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.

Poorly graded. A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

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

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."

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

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

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

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

Solum. The upper part of a soil profile, above the 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.

Stones. Rock fragments greater than 10 inches in diameter if rounded, and greater than 15 inches along the longer axis if flat.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters

that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are--platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grain (each grain by itself, as in dune sand) or massive (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subgrade (engineering). The substratum, consisting of in-place material or fill material, that is prepared for highway construction; does not include stabilized base course or actual paving material.

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

Substratum. Technically, the part of the soil below the solum.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil.

Terrace (geological). An old alluvial plain, (ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

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."

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be 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.

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

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. Other information is given in tables as follows:

Approximate acreage and proportionate extent, table 1, page 7.
Engineering uses of soils, tables 2 and 3, pages 40 through 51.
Soil resource interpretations, table 6, and related criteria tables 7 through 13, begin on page 54.
Timber management, table 14, page 64.
Physical and chemical data, tables 16, 17, and 18, pages 73 through 78.

Map symbol	Mapping unit	Described on page	Land capability
Be	Beaches	9	VIIIw
CaD	Cagwin-Rock outcrop complex, 5 to 15 percent slopes	9	VIs
CaE	Cagwin-Rock outcrop complex, 15 to 30 percent slopes	9	VIs
CaF	Cagwin-Rock outcrop complex, 30 to 50 percent slopes	10	VIIs
Co	Celio gravelly loamy coarse sand	11	IVw
EbC	Elmira gravelly loamy coarse sand, 0 to 9 percent slopes	12	IVs
EbE	Elmira gravelly loamy coarse sand, 9 to 30 percent slopes	12	IVs
EcE	Elmira stony loamy coarse sand, 9 to 30 percent slopes	12	IVs
EfB	Elmira-Gefo loamy coarse sands, 0 to 5 percent slopes	13	IVs
Ev	Elmira loamy coarse sand, wet variant	14	IVw
Fd	Fill land	14	VIs
FuD	Fugawee very stony sandy loam, 2 to 15 percent slopes	15	VIs
FuE	Fugawee very stony sandy loam, 15 to 30 percent slopes	15	VIs
GeC	Gefo gravelly loamy coarse sand, 2 to 9 percent slopes	16	IVs
GeD	Gefo gravelly loamy coarse sand, 9 to 20 percent slopes	16	IVs
Gr	Gravelly alluvial land	16	IVw
GsF	Graylock extremely stony loamy coarse sand, 30 to 50 percent slopes	17	VIIs
IgB	Inville gravelly coarse sandy loam, 0 to 5 percent slopes	18	IVe
IsC	Inville stony coarse sandy loam, 2 to 9 percent slopes	18	IVe
IsD	Inville stony coarse sandy loam, 9 to 15 percent slopes	18	IVe
IsE	Inville stony coarse sandy loam, 15 to 30 percent slopes	18	IVe
JaC	Jabu coarse sandy loam, 0 to 9 percent slopes	19	IVe
JaD	Jabu coarse sandy loam, 9 to 20 percent slopes	20	IVe
JbD	Jabu coarse sandy loam, seeped, 2 to 15 percent slopes	20	IVw
JgC	Jabu sandy loam, moderately fine subsoil variant, 0 to 9 percent slopes	23	IVe
JhC	Jabu stony sandy loam, moderately fine subsoil variant, 2 to 9 percent slopes	23	IVe
JeB	Jabu coarse sandy loam, shallow variant, 0 to 5 percent slopes	22	IVe
JeD	Jabu coarse sandy loam, shallow variant, 5 to 15 percent slopes	22	IVe
JtD	Jorge-Tahoma cobbly sandy loams, 2 to 15 percent slopes	24	VIe
JwD	Jorge-Tahoma very stony sandy loams, 2 to 15 percent slopes	24	VIs
JwE	Jorge-Tahoma very stony sandy loams, 15 to 30 percent slopes	24	VIs
JwF	Jorge-Tahoma very stony sandy loams, 30 to 50 percent slopes	25	VIs
Lo	Loamy alluvial land	25	IVw
Mh	Marsh	25	VIIw
MkB	Meeks gravelly loamy coarse sand, 0 to 5 percent slopes	26	VIs
MkD	Meeks gravelly loamy coarse sand, 5 to 15 percent slopes	26	VIs
MmB	Meeks stony loamy coarse sand, 0 to 5 percent slopes	27	VIs
MsD	Meeks very stony loamy coarse sand, 5 to 15 percent slopes	27	VIIs
MsE	Meeks very stony loamy coarse sand, 15 to 30 percent slopes	27	VIIs
MsG	Meeks very stony loamy coarse sand, 30 to 60 percent slopes	27	VIIs
MtE	Meeks extremely stony loamy coarse sand, 15 to 30 percent slopes	28	VIIs
MtG	Meeks extremely stony loamy coarse sand, 30 to 60 percent slopes	28	VIIs
MxE	Meiss cobbly loam, 9 to 30 percent slopes	28	VIIe
MxF	Meiss cobbly loam, 30 to 50 percent slopes	28	VIIe
Px	Pits and dumps	29	VIIIs
Ra	Rock land	29	VIIIs
RcF	Rock outcrop-Cagwin complex, 30 to 50 percent slopes	29	VIIs
RcG	Rock outcrop-Cagwin complex, 50 to 70 percent slopes	29	VIIs
RtF	Rock outcrop-Toem complex, 30 to 50 percent slopes	29	VIIs

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Land capability
RtG	Rock outcrop-Toem complex, 50 to 70 percent slopes	29	VIIs
Rx	Rock outcrop and Rubble land	29	VIIIs
ShE	Shakespeare gravelly loam, 9 to 30 percent slopes	31	VIe
SkF	Shakespeare stony loam, 30 to 50 percent slopes	31	VIIe
Sm	Stony colluvial land	31	VIIIs
TaD	Tahoma stony sandy loam, 2 to 15 percent slopes	32	IVe
TbD	Tahoma very stony sandy loam, 2 to 15 percent slopes	32	VIs
TcB	Tallac gravelly coarse sandy loam, seeped, 0 to 5 percent slopes	33	IVe
TcC	Tallac gravelly coarse sandy loam, seeped, 5 to 9 percent slopes	33	IVe
TdD	Tallac stony coarse sandy loam, 5 to 15 percent slopes	33	VIe
TeE	Tallac very stony coarse sandy loam, 15 to 30 percent slopes	33	VIs
TeG	Tallac very stony coarse sandy loam, 30 to 60 percent slopes	34	VIIs
TkC	Tallac very stony coarse sandy loam, seeped, 2 to 9 percent slopes	34	VIs
TmE	Tallac gravelly coarse sandy loam, shallow variant, 9 to 30 percent slopes	35	VIIe
TmF	Tallac gravelly coarse sandy loam, shallow variant, 30 to 50 percent slopes	35	VIIe
TrE	Toem-Rock outcrop complex, 9 to 30 percent slopes	35	VIIs
TrF	Toem-Rock outcrop complex, 30 to 50 percent slopes	36	VIIs
UmD	Umpa very stony sandy loam, 5 to 15 percent slopes	36	VIs
UmE	Umpa very stony sandy loam, 15 to 30 percent slopes	37	VIs
UmF	Umpa very stony sandy loam, 30 to 50 percent slopes	37	VIIs
WaE	Waca cobbly coarse sandy loam, 9 to 30 percent slopes	37	VIe
WaF	Waca cobbly coarse sandy loam, 30 to 50 percent slopes	38	VIIe
WcE	Waca-Rock outcrop complex, 9 to 30 percent slopes	38	VIs
WcF	Waca-Rock outcrop complex, 30 to 50 percent slopes	38	VIIs

U.S. GOVERNMENT PRINTING OFFICE : 1974 O—504-718

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