Soil Survey of

Modoc National Forest Area, California

United States Department of Agriculture
Forest Service and Soil Conservation Service

in cooperation with
The Regents of the University of California
(Agricultural Experiment Station)

How To Use This Soil Survey

General Soil Map

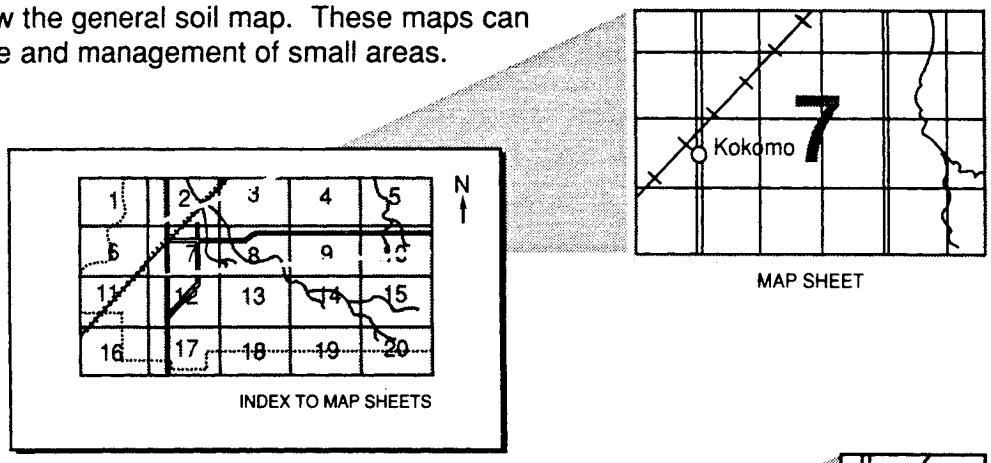
The general soil map, which is the small scale map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

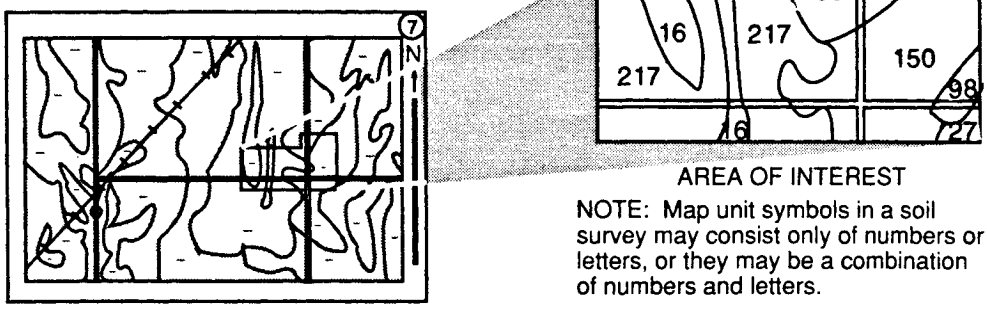
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

Modoc National Forest Area, California

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, and state agencies including the Agricultural Experiment Stations. The fieldwork and technical quality control for this survey were conducted by the Forest Service. The correlation of the soils was conducted by the Soil Conservation Service in consultation with the Forest Service. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1978-1982. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. This survey was made cooperatively by the Forest Service and the Soil Conservation Service. The soil survey area consists of most of the Modoc National Forest (except that area of the forest that was published in the Surprise Valley-Home Camp Soil Survey Area, and a few minor areas of the forest that will be published with the Big Valley Soil Survey and Butte Valley-Tule Lake Soil Surveys at a later date). The soil survey area also includes some private land holdings, the Lava Beds National Monument and the Clear Lake National Wildlife Refuge.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Looking east towards Cedar Pass through Warner mountains. The mid section is the Modoc Plateau being the dominant landscape covered with juniper and sagebrush. Lower portion shows a road cut through Gwin family soils overlying volcanic tuff material.

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Foreward

The Modoc National Forest (703) Soil Survey Area is in the extreme northeastern corner of California and encompasses parts of Modoc, Siskiyou, and Lassen counties. The total survey area is about 2,758 square miles or about 1,764,960 acres. This survey was designed to facilitate broad forestwide resource management planning and to increase the knowledge of our environment. It contains predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil.

This soil survey has been prepared primarily for forest and rangeland resource planners and managers. It is useful for preliminary project planning, for identifying general soil management considerations, and for evaluation of more intensive soil survey needs. The survey should be used for detailed resource management planning and project level planning and design only after field verification.

Great differences in soil properties can occur even within short distances. Soil may be shallow to bedrock and incapable of producing commercial timber. They may be seasonally wet or subject to flooding. A low available water capacity makes a soil poorly suited to reforestation. A high water table makes a soil suitable for use as summer range.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each soil map unit is shown on detailed soil maps. Each kind of soil in the survey area is described, and information is given about each soil for specific uses.

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

Diane Henderson

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Modoc National Forest

Acknowledgements

So many people have helped to bring this document to present form that I felt compelled to write an acknowledgement that is not the norm for Soil Resource Inventory Manuscripts. The hardest job of writing an acknowledgement is that you are bound to forget some of the names inspite of the best efforts to credit indiviuals who contributed.

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SURAJ AHUJA
Forest Soil Scientist

Location of the Modoc National Forest Area, California

Soil Survey of Modoc National Forest Area, California

Parts of Modoc, Siskiyou, and Lassen Counties

By Kenneth R. Luckow and Suraj P. Ahuja, Forest Service

Soils surveyed by Suraj Ahuja, Richard O. Hanes, Kenneth R. Luckow, Thomas Sheehy and Desiderio Zamudio

United States Department of Agriculture, Forest Service and Soil Conservation Service, in cooperation with the Regents of the University of California (Agricultural Experiment Station)

General Nature of the Survey Area

This section briefly discusses the geomorphology, geology, climate, and vegetation of the survey area.

Geomorphology

The Modoc National Forest Survey Area includes the major part of the Modoc Plateau geomorphic province and, to a lesser extent, areas of the Cascade Range and Great Basin geomorphic provinces (4, 7). It is characterized by several landforms consisting of northwest- to north-trending, block-faulted mountain ranges on the east and southwest areas of the survey; broad basalt lava flow plateaus throughout the center and most of the northern part; and the Medicine Lake Highlands which is a shield volcano on the west central edge of the survey area. Land areas of gentle slopes include the lava plains that were formed by extensive basalt outflows; the alluvial plains consisting of nearly level intermittant lake basins, sloping alluvial fans, and high alluvial terraces. The steeper areas include the dissected mountain ranges and the fault- or erosion- formed escarpments. Numerous escarpment faces drop from the Modoc plateau level to the Alturas area alluvial valley floor below, a difference in elevation of about 600 feet (Figure 1).

Eagle Peak in the southeastern part of the survey area has the highest elevation: almost 9900 feet. The lowest elevation of about 4200 feet is found on the northwestern area of the survey. The soils vary in any one of the different landforms, creating complex patterns of soils.

The survey area is drained by three main drainages. The headwaters of the Pit River are in the Warner Mountains on the eastern part of the survey area. The North Fork of the river starts east of the town of Davis Creek and flows south to join the South Fork near the town of Alturas where the two forks form the Pit River. The South Fork of the river flows west and turns south near the town of Likely. The Pit River flows through the Warm Springs Valley in a southwesterly direction that eventually leads into Lake Shasta, then into the Sacramento River, and finally into the Pacific Ocean. Goose Lake and its contributing watershed is considered part of the Pit River drainage system. This area is now a closed basin, but reportedly it drained into the Pit River twice since 1871.

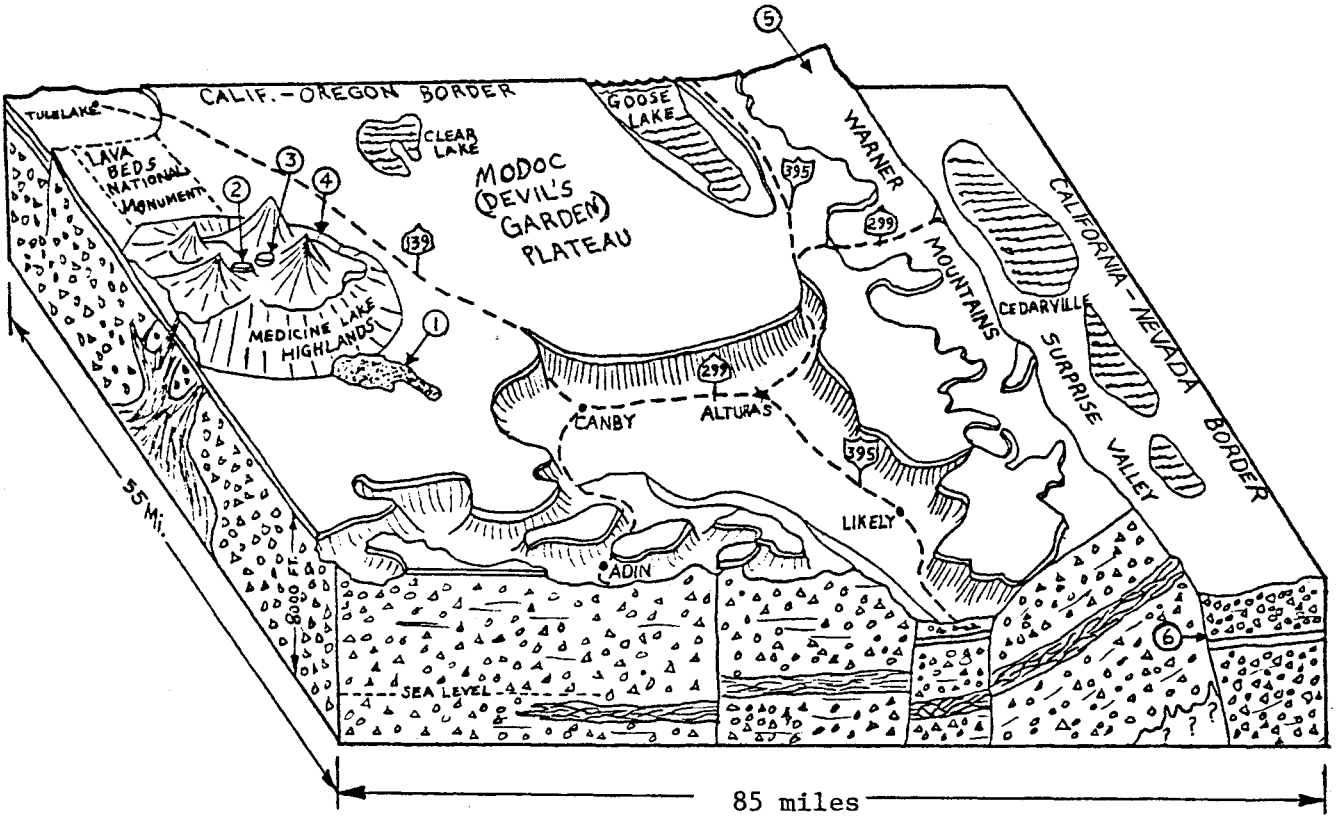
Most of the northcentral and northwestern area of the survey area drains into the Klamath River Basin near the headwaters of the Klamath River. This eventually ends up in the Pacific Ocean near Eureka, California. The third major drainage system occurs on the eastern slopes of the Warner Mountain range on the eastern edge of the survey area. This area drains into Upper, Middle and Lower Alkali Lakes which are considered closed basins within the Great Basin.

Geology and Geomorphic History

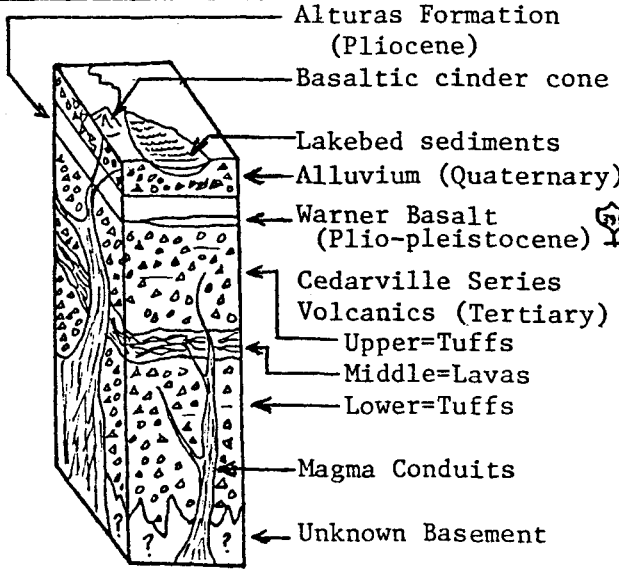
The geology of the survey area is strongly influenced by faulting and by volcanic and erosional activity. Tremendous volcanic activity has occurred here during the past 60 million years or so up to the present time. Vast quantities of lava, mainly of basaltic nature, and associated

Figure 1

Schematic Geology of the Modoc National Forest and Vicinity to the Lassen County line



Composite Stratigraphic Section



Legend and Points of Interest

1"≅16.5 Miles (Horizontal Scale)
1"≅8700 Feet (Vertical Scale)
Vertical Exaggeration ≅ 10X

Towns
U.S.F.S. Headquarters
Major Highways
Lakes

① Burnt Laval Flow
② Medicine Lake
③ Medicine Lake Glass Flow
④ Glass Mtn. Obsidian Flow
⑤ Highgrade Mining District
⑥ Surprise Valley Fault

pyroclastic materials flowed, or were deposited, over the landscape in almost continuous interbedded masses.

Three major geomorphic provinces evolved from these activities in this survey area. They are the Cascade Range, Great Basin and Modoc Plateau geomorphic provinces. The Cascade Range geomorphic province is characterized in this area by the Medicine Lake Highlands.

The Medicine Lake Highlands is a broad shield volcano approximately twenty miles in diameter which rises almost four thousand feet above the level of the surrounding plateau. It is composed primarily of andesitic lava flows of Teritary age (between 3 million to 60 million years ago). The original peak of the volcano collapsed to form an elliptical caldera measuring about four by six miles. The caldera rim was subsequently surmounted and entirely obscured, still in the Tertiary period, by a rampart of small secondary parasitic volcanoes including Glass Mountain, Mount Hoffman, Medicine Mountain, Little Mount Hoffman, Red Shale Butte, and Lyons Peak. The parasitic volcanoes are also composed mainly of andesite flows. Some are apparently composite cones consisting of both flows and pyroclastics.

In recent geologic time eruptions on the floor of the caldera and from some of the secondary volcanoes have released an acidic suite of rocks including spectacular domes and flows of rhyolitic obsidian, rhyodacite, and dacite as well as a relatively thin to thick extensive mantle of rhyolitic pumice. Basalts of the Modoc Basalt series have erupted on the flanks of the volcano in recent geologic time. The Burnt Lava Basalt flow has been radiocarbon dated from charred wood found in it at about 1100 years old. The Black (Callaghan) and Point Pot Crater basalt flows are thought to be only slightly older. These recent flows correspond to similar recent basalt flows in the Lava Beds National Monument to the north. The Medicine Lake Highlands Shield volcano, the largest volcano in California, is considered still active and is currently among the top five candiates for potential future volcanism in California.

The Modoc Plateau geomorphic province comprises the relatively flat and monotonous central portion of the survey area, also known as the Devil's Garden. It is capped by fissure erupted basalts of Late Miocene to Late Pleistocene age (about 25,000 years to 20 million years ago) which resemble but cannot be correlated with the much thicker and older Columbia Plateau basalts. On the average, the basalt capping on the Devil's Garden, or Modoc Plateau, is about 400 feet thick. The maximum thickness known is about 1,000 feet. At the southern margin of the plateau the basalt may be as little as fifteen feet thick. A very thick sequence of pyroclastics and minor intercolated lava flows of gross andesitic composition, which has been correlated with the Cedarville series of the Warner Mountains, underlies the basalt capping of the entire plateau.

Geologically recent basaltic cinder cones occur sporadically on the surface of the plateau, usually along the frequent northwest-southeast trending normal faults which regularly interrupt the otherwise level terrain. Apparently the faults acted as conduits for the magma. Fissure erupted basalts of the recent Modoc Basalt Series cover extensive areas of the Modoc Plateau in the vicinity of the Medicine Lake Highlands west of Highway 139. Some of these were "pahoehoe" (ropy) flows and contain lava tube ice-caves similar to those in the Lava Beds National Monument to the north. Generally speaking, faults, cinder cones, and Modoc series basalt flows are rare or non-existent in the eastern portion of the Modoc Plateau and common in the western portion.

The Modoc Plateau geomorphic province extends westward under the Medicine Lake Highlands Volcano and in the east phases gradually into the gentle west slope of the Warner Mountains and into the Adin Mountains to the south.

The Warner Mountains in the eastern portion of the survey area is an extreme western extension of the Basin and Range Geomorphic Province. The Warner Range is a westward tilting fault block bounded on the west by the Modoc Plateau and the Goose Lake and Warm Springs Valley depressions, and on the east by Surprise Valley, a graben, from which it is separated by the Surprise Valley Fault, a major normal fault. The range trends almost exactly north-south and is roughly eighty miles long and ten miles wide. Surprise Valley also trends north-south and has approximately the same areal dimensions. Probable vertical displacement on the Surprise Valley Fault is on the order of 5000 feet. Proven verticle displacement is slightly more than 3500 feet. The fault is not older than Late Miocene age (about 11 million to 20 million years old).

Lithologies in the Warner Mountains are almost entirely volcanic. Pyroclastics account for most of the mass of the range, intercalated flows of andesite and later overlying basalt over most of the remainder. Minor obsidian flows, rhyolitic intrusives, lahars (volcanic mud flows), ignimbrites (welded tuffs), and fluvial, alluvial, and lacustrine sediments of volcanic origin also occur. Glacial deposits probably occur but are difficult to identify positively. Rhyolitic intrusive bodies and breccias in the Warner Mountains north of Fandango Valley are gold bearing and form the basis of the old Highgrade gold mining district.

Stratigraphy in the Warners is quite simple. A thick sequence of andesitic pyroclastics and minor intercalated andesitic lava flows, known as the Cedarville Volcanic Series is overlain more or less conformably by a much thinner sequence of basaltic lava flows known as the Warner Basalt. The Alturas Formation, consisting of a Pliocene age (about 3 million to 11 million years old) lake bed composed of fluvial, and alluvial sediments, locally underlies the Pleistocene age (about 25,000 to 3 million years old) member of the Warner Basalt. Locally the basalt is overlain by rhyolite flows (possibly ignimbrites) which are in some areas overlain by later obsidian flows. The coarser grained rhyolitic intrusives are associated with the rhyolite flows.

The Cedarville Series is tremendously thick, and although it is very well displayed on east slopes of the Warner Range, its base is nowhere exposed. Thus its maximum age and thickness remain unknown. It is at least 3500 feet thick and over 30 million years old.

Strata in the Warners exhibit a consistent westward dip, that is, they have been elevated in the east and depressed in the west with the result that the western slope is gradual, culminating gently in the nearly 9900 foot high crest of the range. The eastern slope, however, is extremely precipitous, decending abruptly, within three or four miles into Surprise Valley which has a mean elevation of about 4500 feet. Refer to figure 1 for a schematic overview of the major geologic formations and their general locations.

The Adin Mountains[1] are a series of anticlines and synclines that have been block faulted. The axis of the synclines and anticlines trends north-northwest. The amount of displacement due to faulting is presently unknown but it is estimated to exceed one thousand feet.

Lithologically, the Adin Mountains are a sequence of non-marine deposits that are unconformably overlain by a thick sequence of pyroclastics, welded tuffs, ignimbrites and basaltic flows. This sequence is overlain by a Miocene age (about 11 million to 25 million years old) andesitic/basalt flow.

Climate

The Modoc National Forest Survey Area is more than 100 miles inland from the Pacific Ocean, and much of the topography within that distance consists of rugged mountain ranges. The north-south alignment of these mountain ranges cause orographic precipitation from moist pacific air on the western slopes and produces a rain shallow effect on the east slopes. Where the air is again lifted by the local mountains within the area, precipitation totals and intensities tend to increase.

While the average temperature normally decreases with elevation, this relation is not always so in the case of extreme temperatures. Both maximum and minimum temperatures are influenced by features of local topography. Low temperatures, especially, can change sharply within short distances because of drainage or blockage of cold air.

Winter in the survey area is marked by the frequent passage of low pressure systems and the predominance of maritime polar air. Precipitation is frequent but generally is light on the Modoc plateau and somewhat heavier in the mountains. High pressure areas between the storm centers are often associated with polar continental air.

Under clear skies there is rapid radiational cooling at night. This generally results in low minimum temperatures. Much of the winter precipitation falls as snow. Snow cover can last for long periods at the higher elevations. Snowfall is lighter and temperatures are higher at lower elevations, and the snow generally does not stay on the ground so long.

In spring, precipitation gradually decreases after February or March as the storm centers move northward. There is, however, a secondary maximum in May. This increase is associated with the passage of cold lows across the area.

In summer there are few storms except for occasional thundershowers. Precipitation is very light. Summers are usually warm.

The higher elevation mountain areas receive approximately 20 to 45 inches of precipitation while the surrounding lower elevation Modoc Plateau, foothills and valleys receive between 10 to 25 inches. During the winter months, the valleys and surrounding plateaus generally have mild temperatures and are relatively free of snow. Occasionally there are long severe winters, with deep snows and low temperatures at more than 30 degrees below zero.

Precipitation in the Warner Mountains ranges from about 16 to 35 inches annually and increases with elevation. The Modoc Pleateau receives 10 to 25 inches annually, increasing from the low in the northwest and southern portion to the high in the northeast portion. The Medicine Lake Highlands receive the highest annual precipitation, ranging from about 25 to 45 inches. The Big Valley area has an annual precipitation ranging from about 14 inches in the lower elevations to 25 inches in the Adin Mountains.

[1] The above Geology section prepared by Randy Sharp, Geologist, Modoc National Forest.

Rainfall intensities range from low to moderate. Based on a two year 24 hour storm event, rainfall intensities range from 1.4 to 3.0 inches. The majority of the Modoc Plateau and Adin Mountains can expect 1.4 to 1.6 inches in 24 hours, the Warner Mountains from 1.4 to 1.8 inches and the Medicine Lake Highlands can expect between 2.0 to 3.0 inches from a two year 24 hour storm event.

The relative humidity in the area changes seasonally. Cool weather and frequent precipitation in winter result in fairly high relative humidity. In January, in the Alturas area, the average relative humidity is 75 percent. On the average, the relative humidity is 15 to 20 percent on a midsummer afternoon and about 40 percent at night. Dry northerly or easterly winds occasionally cause the humidity to drop below 10 percent. This can create a serious fire hazard.

Because of the broad, open topography of the plateaus, winds occasionally are strong. Although available data is limited, it is estimated that in areas of typical exposure, a wind of 55 miles or more per hour occurs every other year with even stronger winds on mountain ridges and crests.

The growing season, as defined by 32°F. temperatures in spring and fall, ranges from 80 to 110 days throughout most of the lower elevation Modoc Plateau tablelands and adjoining foothills. In the higher elevation mountains little data is available to accurately determine the length of the frost free growing seasons. Based on what data is available, and that normal air temperatures drop an average of about 3.5°F. for each 1000 feet rise in elevation, we can estimate that the frost free season is 30 days or less in the highest elevations to around 80 or 90 days in the lower mountain elevations approaching 5500 feet.

There is a 50 percent probability that the last freeze in spring will occur on June 9 and that the first freeze in fall will occur on August 30 at Alturas. When defined by 28° temperatures in spring and fall, the growing season ranges from 120 to 140 days. There is a 50 percent probability that the last 28° reading in spring will occur on May 26 and that the first freeze in fall will occur on September 23 at Alturas.

Potential evapotranspiration is defined as the amount of moisture that would be lost from the soil by evaporation and transpiration under existing conditions of temperature and solar radiation and with an adequate supply of soil moisture available. At Alturas solar radiation readings, as measured in Langleys per day, have been found to be among the highest in the state. The mean summer solar radiation, in Langleys per day, were 738 at Alturas as compared to an average of 675 in the Sierra Nevada Mountains, 625 in the Coastal Mountain Ranges and 485 at Huntington Beach. The percentage of possible days of sunshine ranges from about 45 percent in winter to 90 percent in summer in Modoc County. Studies show that in the course of a year the potential evapotranspiration totals from 21 to 25 inches in Modoc County. During the growing season, as defined by 32° temperature values, the potential evapotranspiration amounts to 12 to 18 inches.

The only records of evaporation available near the area are from Tule Lake, and because of temperatures in winter, the record doesn't cover the entire year. Based on extrapolation from available records, it appears that the annual evaporation from a Class A pan in the survey area is between 60 and 65 inches, about 80 percent of which is lost during May through October. Lakes or reservoirs probably lose only 73 percent to 74 percent as much by evaporation as does a Class A pan, making the annual total loss for these larger bodies of water around 45 inches.

Vegetation

Vegetation throughout the survey area is highly variable and dependent on climatic and soil conditions. Generally speaking, the Rangeland vegetation found on the shallow soils in this survey area is composed of scattered western juniper, low sagebrush, various short season perennial bunchgrasses and a few forbs. The soil surface is also normally quite rocky where this type of vegetation occurs. Vegetation on the deeper, well-drained range soils normally consists of bitterbrush, big sagebrush and rabbitbrush along with short and intermediate season perennial bunchgrasses. In addition many of these deeper, well-drained rangeland soils may have an overstory of western juniper and/or mountain mahogany. The less than well drained soils found on flood plains, draingageways and intermittent shallow lake beds contain mainly water loving vegetation such as silver sagebrush, sedges, rushes, Timothy, Kentucky bluegrass, willows and Aspen in addition to the other short and intermediate season perennial bunch grasses and forbs.

Woodland vegetation in the low elevation mesic soils of about 4200 to 5500 feet elevation is mainly composed of ponderosa pine with less amounts of incense-cedar, western juniper, white fir and black oak. Normally there is a significant amount of browse type understory vegetation such as bitterbrush, big sagebrush, greenleaf manzanita, and various perennial grasses sand forbs and sedges. The mid-elevation (about 5500 to 7000 feet) frigid timbered soils are mainly composed of white fir stands or white fir and ponderosa pine stands. Understory vegetation is not as plentiful and in many cases is essentially non-

existant. The high elevation (about 7000 to 9900 feet) cryic soils contain such timber as red fir, lodgepole pine, white fir, western white pine, mountain hemlock, and white bark pine at the highest elevations.

Understory vegetation is typically prostrate manzanita plus a few forbs and grasses and sedges.

For an overview of the existing and/or potential vegetation by common names and where they are located in the survey area refer to the General Soil Map Unit Descriptions found on pages 9 thru 18, their reference to Range Sites, if applicable, and the General Soil Map found near the back of this report. For more detailed descriptions of the existing or potential vegetative composition by common names by soil type and where they are located, refer to the detailed soil map unit descriptions under Physiographic Position; Slope; and Elevation, Typical Vegetation; and Precipitation, and Range Site (if applicable) and the SRI 3 Soil Maps.

How This Survey Was Made

This Order 3 soil survey (10) has followed the directives and guidelines in Forest Service Manuals and Handbooks. It has also followed the concepts, procedures, and guidelines of the National Cooperative Soil Survey as specified in the *Soil Survey Manual* (14, 15), the *National Soils Handbook* (13), and the soil classification system as stated in *Soil Taxonomy* (16).

Soil Scientists began the inventory by collecting, studying, and correlating all the existing data and information concerning the survey area that is related to soil genesis and morphology. This includes lithological, geomorphological, topographical, climatic, vegetative, and existing soil survey data both within and adjoining the survey area.

This data and information was assimilated and transferred to a single base map of suitable scale and accuracy forming a schematic map. With the schematic map and aerial photo field sheets (stereo-pair coverage) in hand, the soil scientist made a reconnaissance study of the survey area. At this time, the delineations on the schematic map were checked for accuracy of content and location. The aerial photos were studied steroscopically and the photo images were compared to the conditions found on the ground to insure that later recognition by photo interpretation would be credible. Lithologic, geomorphic, soil, and vegetative characteristics were recognized and recorded in field notes, on the schematic map, and on the aerial photo field sheets.

Using the augmented and corrected schematic map, field notes, and an understanding of how the photo images relate to actual conditions on the ground, the soil scientist delineated map units on the aerial photographs. The map units corresponded to segments of the landscape having similar landform, vegetative cover, and soils as determined by a knowledge of ground conditions and by steroscopic aerial photo interpretation. These aerial photos with the delineated map units and delineation symbols became the exploratory or preliminary soils map.

With the aerial photo (exploratory soil maps) and a field stereoscope in hand, the soil scientist examined on the ground as many delineations of each map unit as was feasibly possible, considering the access and time allowed to complete the survey. In this way, each different map unit was examined, studied, and described by aerial photo interpretations and on-the-ground investigation. However, because of the design of the survey, Order 3 in intensity, and the time and period allotted for its completion, every delineation of each different map unit was not visited and examined on the ground. Those delineations with no easy access were rarely visited other than by aerial photo interpretation. In this way, possibly one-quarter to one-third of the delineations on the field sheets and maps would not have been entered and examined by an on-the-ground investigation. This is one of the main aspects of this survey that limits its reliability. It is one reason that the survey is not suitable for project planning without field verification.

As each map was visited and examined, individual soils were recognized, studied, described, classified, and enough data was collected to furnish the information needed to make interpretations and predictions concerning the use and management of each soil. However, due to the small photo mapping scale (approximately 1:60,000), the exact location of each soil type was normally not delineated. The map units usually consist of a group of soils that occupy a particular portion of the landscape which has been delineated on the aerial photo field sheets. Depending on the area location and extent of the individual soils that are components of the delineated map units, a map unit is usually called an association or complex of soil components. A few of the map units are consociations (i.e., the mapping unit being made up of only one named soil type). The soil scientist makes a field and aerial photo examination to estimate the soil component percentage composition for each map unit. These map units do not necessarily consist of similar soils. They consist of geographically associated soils that may be, and usually are, quite different in their characteristics and their suitability for use and management. These are other aspects of the survey that limits its suitability for project planning without field verification.

This field examination and study, and the associated correction and refinement when needed of the soil map unit line delineations on the aerial photo field sheets, produces the Order 3 intensity soil maps called for in this system of survey.

The interpretations and predictions concerning use and management found in this report are based on the soil scientist's knowledge and understanding of the conditions recognized and measured in the time and period allotted to this inventory. By classifying the soils, the soil scientist can also, with acceptable reliability, bring information concerning use and management of a particular soil from other survey areas where this same soil occurs and has been recognized and studied. Because of the time allocation for the completion of this survey, these use and management interpretations and predictions should be considered as first or second approximations due to the relatively few examinations and measurements that have been made. This is another aspect

of the survey that limits its reliability and suitability for project planning without field verification.

Despite the cautions that have been made in the above paragraphs concerning the use of this survey information for project level planning, it is adequate and reliable for its intended and designed purpose: a base for a Forest-wide system of land management planning, and for reconnaisance level use of project level planning.

Some of the boundaries on the soil maps of the Modoc National Forest Survey Area do not match those on the soil maps of adjacent soil surveys and/or many of the soil names do not agree. The differences are the result of the intensity of mapping, the very limited extent of some soils, and the use of soil family names instead of series names where this survey joins with the Modoc County-Alturas Area survey, and the soon to be completed Susanville Area, Big Valley Area, Butte Valley-Tule Lake Areas in California and Lake County Area, Oregon surveys. Where this survey joins the Surprise Valley-Home Camp Area, California and Southern Klamath County Area, Oregon soil surveys, the differences are mainly the result of improvements in the classification of soils and the not-so-similar east-west mountain crest soils, slopes and miscellaneous land types. Soil classification names used are those described in Soil Taxonomy, Agriculture Handbook No. 436, December 1975. The manuscript does not refer to the order Andisols and new suborder and great groups added in the Vertisols in 1992 version.

General Soil Map Units

The general soil map shows 22 map units which consist of many individual soils and miscellaneous land types. Each map unit contains soils with similar parent rock material, soil temperature regimes and similar use and management. A map unit typically is made up of one or more soils of major extent and several soils of minor extent. Map units are named for the major soils occurring in the unit. The soils in one unit can occur in other units. The soils are classified at the family level, or at a higher taxonomic level.

The map furnishes a broad perspective of the soils in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. General areas which are capable of timber production or for range can be identified on the map. Likewise, general areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Some of the boundaries on the general soil map of the Modoc National Forest Survey area do not match those on adjacent soil surveys, and most of the soil names do not agree. This is due mainly to the intensity of mapping and due to the use of soil family names rather than soil series names. All the Family names pertain to the "Soil Taxonomy" 1965 edition.

Because of the generalization of map units and the small scale of the map, the location of specific soils are not shown. The map and map unit information is not suitable for Forest or project level land management planning. They give a very general overview of soil conditions and are suitable for State or Regional planning.

The general map units in this survey have been grouped into seven general kinds of landscape and capabilities for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

Lower Elevation Predominantly Woodland Soils Mainly on 0 to 40 Percent Slopes.

The two map units in this group make up about 18 percent of the survey area. The soils are on undulating basalt plateaus and mountain uplands of volcanic origin. The soils are moderately deep (20 to 40 inches) and deep(greater than 40 inches), except Deven family soils which are shallow (less than 20 inches) over soft to hard volcanic tuff. The parent material is basalt and volcanic tuff derived mainly from basic igneous rocks.

The elevation ranges from 4300 to 6000 feet. The average annual precipitation is 16 to 25 inches. The mean annual air temperature is 44 to 48°F and the frost free period is 80 to 110 days. Vegetation is primarily commercial timber with ponderosa pine being the major species. The soils are used mostly for timber production and transitory range.

1. Lawyer-Elmore families

This soil unit is predominately on nearly level to undulating basalt plateaus, with lesser amounts on mountain uplands. These soils are moderately deep and deep over soft to hard basalt bedrock. Elevation ranges from 4,300 to 6,000 feet, and annual precipitation ranges from 16 to 25 inches. Slopes range from 1 to 60 percent, but are predominantly less than 20 percent. The frost-free season is 80 to 110 days.

These soils support ponderosa pine and Jeffrey pine forests and may include some incense cedar, white fir, black oak, and western juniper. The Forest survey site class is 5 or 6. Understory vegetation may consist of squawcarpet, big sagebrush, rabbitbrush, bitterbrush, greenleaf manzanita, muleears, and various perennial grasses and sedges.

This unit makes up approximately 16.0 percent of the survey area. It consists of approximately 55 percent Lawyer soils and 25 percent Elmore soils. The Jacket, Deven, Gwin, Pass Canyon, and Fordice families and rock outcrop make up most of the remaining 20 percent of this unit.

The Lawyer soils are moderately deep and deep to basalt bedrock. They are well drained and permeability is moderately slow. They have a thick, brown to reddish brown, stony loam or loam surface over a very cobbly clay loam to extremely cobbly clay loam subsoil.

The Elmore soils are moderately deep and deep to basalt bedrock. They are well drained, and permeability is moderately slow. They have a thick, dark brown to reddish brown loam or gravelly loam surface over a clay loam or gravelly clay loam subsoil.

2. Jacket-Deven-Hiibner families

This unit occurs in the Adin mountains on the southern portion of this survey area. It is on mountain uplands of 1 to 60 percent slopes, and elevation of 4,400 to 5,800 feet. The annual precipitation ranges from 16 to 20 inches, and the frost-free season is 80 to 110 days.

The Jacket and Hiibner soils support ponderosa and Jeffrey pine forests and may include some incense cedar, black oak and western juniper. The Forest survey site class is 5 and 6, for the Jacket and Hiibner soils respectively. Understory vegetation may consist of snowberry, service- berry, big sagebrush, greenleaf manzanita, mountain mahogany, bitterbrush, vetch, lupine, and various perennial grasses and sedges. The Deven soils are rangeland soils, and support vegetation and available forage amounts consistent with Range Sites 23 and 8.

This unit makes up approximately 2.0 percent of the survey area. It consists of approximately 35 percent Jacket soils, 25 percent Deven soils and 20 percent Hiibner soils. The remaining 20 percent of this unit is primarily made up of Ruckles, Pass Canyon, Keating, Fordice, Elmore, and Lawyer families.

The Jacket soils are moderately deep in this unit. They are well drained, have slow permeability, and are over volcanic tuff. They have a dark brown and reddish brown loam surface over a clay loam to clay subsoil.

The Deven soils are 10 to 20 inches deep and are well drained. Permeability is slow, and the Deven soils here are over soft to hard volcanic tuff. They have a thin, brown, cobbly loam or clay loam surface over a clay or clay loam subsoil.

The Hiibner soils are moderately deep and are well drained. Permeability is slow, and these soils are over volcanic tuff or basalt. They have a brown, stony loam to very cobbly loam surface over a very cobbly clay subsoil.

Lower Elevation Rangeland Soils Mainly on 0 to 40 Percent Slopes.

The six map units in this group make up about 45 percent of the survey area. The soils are on basalt or volcanic plateaus and mountain uplands of volcanic orgin. About 85 percent of the total acreage in this group is composed of shallow soils over a silica duripan, or over basalt of tuff bedrock. The Searles, Simpson, Supan, Los Gatos and Keating family soils are moderately deep to deep over basalt or tuff bedrock and make up about 15 percent of the total acreage in this group. The soils in this group are all well drained. The shallow soils have loam or clay loam surface textures with surface gravel, cobble and stone size rock fragments. The deeper soils have a loam or clay loam surface texture and are mostly free of surface rock fragments.

The elevation ranges from 4,200 to 6,400 feet. The average annual precipitation is 10 to 20 inches and the average annual air temperature is 44 to 50°F. The frost-free period ranges from 80 to 110 days.

The soils are used mostly for range.

3. Bakeoven family-lava flow-Searles family

This unit occurs primarily in the northwest quarter of the survey area. This unit is mainly on basalt plateaus with relatively recent basalt lava flows. Much of this unit has a recent thin (1 to 12 inch) deposit of pumice on the surface. Scattered volcanic cinder cones with steep sideslopes are found here also. Slopes are mainly 1 to 20 percent in this unit, and annual precipitation ranges from 10 to 16 inches. Elevation ranges from 4,200 to 5,000 feet. The frost-free season is 90 to 110 days.

The Bakeoven and Searles soils are rangeland soils and support vegetation and available forage amounts consistent with Range Sites 4, 7, 16, and 17. Other uses are for wildlife, aesthetic values, and watershed.

This unit makes up approximately 3.9 percent of the survey area. It is about 30 percent Bakeoven soils, 20 percent lava flow rock, and 20 percent Searles soils. The remaining 30 percent of this unit is made up primarily of the Wenatchee, Castlevale, Gwin, and Stukel families and mesic, Lithic Xerorthents.

The Bakeoven soils are 7 to 20 inches deep over basalt bedrock and are well drained. Permeability is moderately rapid. They normally have a dark grayish brown and grayish brown, very cobbly fine sandy loam surface and subsurface. If a pumice overburden is present, it will have a very gravelly coarse sandy loam or very gravelly loamy coarse sand surface texture.

Lava flow consists of hard fractured vesicular basalt flow rock and collapsed, exposed lava tubes.

The Searles soils are moderately deep over basalt bedrock and are well drained. Permeability is moderately slow. They have a brown, gravelly sandy loam surface over a cobbly loam to extremely cobbly clay loam subsoil. If a pumice overburden is present, it will have a very gravelly coarse sandy loam or very gravelly loamy coarse sand surface texture.

4. Puls-Indian Creek-Simpson families

This unit occurs primarily on the Modoc Plateau geomorphic province, in the central and northwest portions of the survey area on nearly level to undulating basalt plateaus. A strongly cemented to indurated silica duripan, which ranges in thickness of only a few millimeters up to about two feet, overrides the basalt bedrock in

most of this unit. Slopes range from 0 to 10 percent, and elevation ranges from 4,200 to 5,200 feet. Annual precipitation ranges from 10 to 14 inches, and the frost-free season ranges from 80 to 110 days.

The Puls, Indian Creek and Simpson family soils are rangeland soils and support vegetation and available forage amounts consistent with Range Sites 1, 7, and 12, respectively.

This unit makes up approximately 8.8 percent of the survey area. It is about 30 percent Puls, 20 percent Indian Creek, and 15 percent Simpson soils. The remaining 35 percent of the unit is made up primarily of the Packwood, Ditchcamp, Barnard, Cowiche, Wrentham, Bakeoven, Deven, Alicel, and Dishner families and rock outcrop.

The Puls soils are 10 to 20 inches deep to a silica duripan. They are well drained, and have very slow permeability. They have a pinkish gray, very stony clay loam surface soil over a clay subsoil. The effective rooting depth is normally less than 10 inches in this soil due to a very hard or extremely hard, very dense clay layer overriding the silica duripan. Roots cannot effectively penetrate this dense clay layer.

The Indian Creek soils are 10 to 20 inches deep to a silica duripan. They are well drained and have very slow permeability. They normally have a brown to light brown, cobbly clay loam surface over a clay subsoil.

The Simpson soils are moderately deep and are well drained. Permeability is slow. These soils are over basalt bedrock. They normally have a brown loam or clay loam surface over a silty clay loam, silty clay, or clay subsoil.

5. Deven-Bieber-Pass Canyon families

This unit occurs on basalt plateaus throughout the survey area but is most prominate in the north central portion. About half of this unit is directly over basalt bedrock, and the other half has a strongly cemented to indurated thin silica duripan, which normally overrides basalt bedrock. Slopes range from 0 to 20 percent, and elevation ranges from 4,300 to 6,000 feet. Annual precipitation ranges from 14 to 20 inches, and the frost-free season ranges from 80 to 110 days.

These soils are rangeland soils and support vegetation and available forage amounts consistent with Range Site 8, and with less amounts of Range Sites 1, 4, and 23.

This unit makes up approximately 20.5 percent of the survey area. It is about 30 percent Deven, 20 percent Bieber, and 20 percent Pass Canyon soils. The remaining 30 percent of this unit is made up primarily of the Barnard, Packwood, Roval, and Puls families and mesic, Lithic Xerorthents and rock outcrop.

The Deven soils are 10 to 20 inches deep, well drained, and over hard basalt bedrock. Permeability is slow. They normally have a thin brown cobbly loam or clay loam surface over a clay or clay loam subsoil.

The Bieber soils are 7 to 20 inches deep to a relatively thin silica duripan which normally overlies basalt bedrock. These soils are well drained, and permeability is very slow. They normally have a thin brown very cobbly loam surface over a clay subsoil.

The Pass Canyon soils are 8 to 20 inches deep over basalt bedrock. They are well-drained, and permeability is moderately slow. They normally have a dark grayish brown, very cobbly loam surface over a clay loam or cobbly clay loam subsoil.

6. Gwin-Ruckles-Pass Canyon families

This unit occurs primarily on sideslopes and toeslopes of mountain uplands in the southern and eastern portions of the survey area. Slopes range from 2 to 70 percent, and elevation ranges from 4,400 to 6,400 feet. Annual precipitation ranges from 14 to 20 inches, and the frost-free season is 80 to 110 days.

These soils are rangeland soils and support vegetation and available forage amounts consistent with Range Site 8, with lesser amounts of Range Site 1 and 23. Other uses are for wildlife and watershed.

This unit makes up approximately 1.4 percent of the survey area. It is about 30 percent Gwin, 25 percent Ruckles, and about 20 percent Pass Canyon soils. The remaining 25 percent of this unit is made up primarily of the Bieber and Fordice families, mesic, Lithic Xerorthents, and rock outcrop.

The Gwin soils are 8 to 20 inches deep over basalt, andesite, or tuff. They are well drained, and permeability is moderately slow. They normally have a dark grayish brown, very cobbly loam surface over an extremely cobbly clay loam subsoil.

The Ruckles soils are 10 to 20 inches deep over basalt or tuff. They are well drained, and permeability is slow. They normally have a brown, very cobbly loam surface over a very gravelly clay or very cobbly clay subsoil.

The Pass Canyon soils are 8 to 20 inches deep over basalt bedrock. They are well drained, and permeability is

moderately slow. They normally have a dark grayish brown, very cobbly loam surface over a clay loam or cobbly clay loam subsoil.

7. Supan-Los Gatos-Pass Canyon families

This unit occurs primarily on basalt plateaus in the north central portion of the survey area. Slopes range from 1 to 35 percent but are mainly less than 20 percent. Elevation ranges from 4,300 to 6,000 feet, and annual precipitation ranges from 14 to 18 inches. The frost-free growing season is 80 to 110 days.

These soils are rangeland soils and support vegetation and available forage amounts consistent with Range Sites 13 and 8 with lesser amounts of range sites 4 and 1. The Supan and Los Gatos soils provide very favorable conditions for increaser species such as western juniper, and some areas of this unit have become quite dense with a western juniper overstory.

This unit makes up about 5.8 percent of the survey area. It is about 30 percent Supan, 20 percent Los Gatos, and 20 percent Pass Canyon soils. The remaining 30 percent of this unit is made up primarily of the Ridd, Stuke, Gwin, and Casuse families and rock outcrop.

The Supan soils are moderately deep and deep over basalt bedrock. They are well drained, and permeability is moderately slow. They normally have a thick brown loam surface over a gravelly clay loam, clay loam, or very gravelly clay loam subsoil.

The Los Gatos soils are moderately deep over basalt or tuff. They are well drained, and permeability is moderate. They normally have a brown gravelly loam surface over a clay loam or gravelly clay loam subsoil.

The Pass Canyon soils are 8 to 20 inches deep over basalt bedrock. They are well drained, and permeability is moderately slow. They normally have a dark grayish brown, very cobbly loam surface over a clay loam or cobbly clay loam subsoil.

8. Deven-Keating-Pass Canyon families

This unit occurs on basalt plateaus and on mountain uplands throughout the survey area. Slopes range from 1 to 60 percent, and elevation ranges from 4,300 to 6,000 feet. Annual precipitation ranges from 14 to 20 inches, and the frost-free season is 80 to 110 days.

These soils are rangeland soils and support vegetation and available forage amounts consistent with Range Sites 8 to 18, with lesser amounts of Range Sites 23, 13 and 1. Other uses of this unit are for wildlife and for watershed.

This unit makes up about 5.2 percent of the survey area. It is about 35 percent Deven, 30 percent Keating, and 15 percent Pass canyon soils. The remaining 20 percent of this map unit is made up primarily of the Hiibner, Bieber, Barnard, Ridd, and Ruckles families.

The Deven soils are 10 to 20 inches deep and are either over soft to hard volcanic tuff or basalt bedrock in this unit. They are well drained, and premeability is slow. They normally have a thin brown cobbly loam or clay loam surface over a clay or clay loam subsoil.

The Keating soils are moderately deep over volcanic tuff or basalt bedrock. They are well drained, and permeability is slow. They normally have a thin dark grayish brown, cobbly clay loam surface over a clay loam to clay subsoil.

The Pass Canyon soils are 8 to 20 inches deep over hard to soft volcanic tuff or basalt bedrock in this unit. They are well drained, and permeability is moderately slow. They normally have a dark grayish brown very cobbly loam surface over a clay loam or cobbly clay loam subsoil.

Predominantly Nearly Level Alluvial Soils That Are Subject to Flooding.

The one map unit making up this group represents about 4 percent of the survey area. It is dominated by deep or very deep (greater than 60 inches) clayey soils primarily on clay basins and drainages of basalt plateaus. The soils are moderately well drained to somewhat poorly drained. The average annual temperature is 44 to 49°F.

9. Aikman-Cardon families

This unit occurs on nearly level basalt plateaus in alluvial clay basins and drainages. The majority of this unit is in the central part of the survey area. Slopes are 0 to 2 percent, and elevation ranges from 4,300 to 6,000 feet. Annual precipitation ranges from 12 to 20 inches, and the frost-free season is 80 to 110 days. These soils are subject to spring flooding.

These soils are rangeland soils and support vegetation and available forage amounts consistent with Range Sites 24, 25, and 26. Other uses are for wildlife wetland developments and farming.

This unit consists of about 55 percent Aikman and 15 percent Cardon soils. The remaining 30 percent of this

unit is made up primarily of the Carlisle, Jacknife, and Barnard families, Aquolls, and Xerofluvents.

The Aikman soils are mainly greater than 40 inches with some pedons 20 to 40 inches deep and are normally over basalt or clayey alluvium. They are moderately well drained, and premeability is very slow. They normally have a dark gray silty clay surface over a silty clay or clay substratum.

The Cardon soils are greater than 40 inches deep and are formed from clayey alluvium derived mainly from basalt or andesite. They are somewhat poorly drained, and permeability is very slow. They normally have a very dark gray clay surface over a clay substratum or stratified clay to clay loam substrutum.

Lower to Mid Elevation Dominately Woodland Soils Which Have formed in Relatively Recent Volcanic Parent Materials.

The five map units in this group make up about 10 percnet of the survey area. The soils are on basalt plateaus and sideslopes of volcanic mountain uplands. They are well drained to somewhat excessively drained. They have surface textures which range from sandy loams to loamy sands and contain from 10 to 50 percent cinder and/or pumice gravels. The soils are normally moderately deep to deep over cinders, pumice, basalt or andesite, except for the Lithic Xerumbrepts which are shallow over basalt bedrock. The parent material is derived from pyroclastic volcanic ejecta and from basic igneous rocks.

The elevation ranges from 4,200 to 7,000 feet. The average annual precipitation is 16 to 45 inches, and the average annual temperature is 44 to 49°F. The frost free period ranges from 60 to 110 days.

The soils are used mainly for timber and wildlife with less emphasis on range.

10. Alcot-Sadie-Germany deep families

This unit consists of deep soils located essentially east and south of the Burnt Lava Flow Virgin Area on the western edge of the survey area. It is on basalt plateaus and lower sideslopes of cinder cones at elevations of 4,350 to 5,500 feet. Slopes range from 1 to 20 percent. Annual precipitation ranges from 20 to 30 inches, and the frost-free growing season is 80 to 110 days.

These soils support a mixed conifer forest which consists of ponderosa pine, white fir, incesnse cedar, and sugar pine, with a forest survey site index of 3 to 4. Understory vegetation may consist of greenleaf manzanita, ceanothus, rabbitbrush, snowberry, bitterbrush, big sagebrush, arrowleaf balsamroot, and some perennial grasses and sedges.

This unit makes up about 0.7 percent of the survey area. It is about 30 percent Alcot, 30 percent Sadie, and 25 percent Germany soils. The remaining 15 percent of this unit is made up primarily of the Elmore and Lawyer families, Lithic Xerumbrepts and lava flow rock.

The Alcot soils are greater than 40 inches deep. They are somewhat excessively drained, and premeability is moderately rapid. They normally have a yellowish brown, gravelly sandy loam surface over a very gravelly sandy loam substratum which normally grades to extremely gravelly loamy coarse sand with depth.

The Sadie soils are greater than 40 inches deep. They are well drained, and premeability is moderately rapid. They normally have a yellowish brown, gravelly sandy loam surface over a gravelly coarse sandy loam subsoil and substratum.

The Germany soils in this unit are greater than 40 inches deep. They are well drained, and premeability is moderately rapid. They normally have a dark yellowish brown, fine sandy loam surface soil over a cobbly fine sandy loam to very cobbly fine sandy loam subsoil and substratum.

11. Alcot-Holland families, pumice overburden

This unit is composed of moderately deep and deep soils with a recent pumice deposition of 4 inches to greater than 40 inches thick. It is on basalt plateaus and lower sideslopes of volcanic mountain uplands in the west central portion of the survey area. Slopes range from 1 to 40 percent, and elevation ranges from 4,200 to 5,500 feet. Annual precipitation ranges from 16 to 25 inches, and the frost-free growing season is 80 to 110 days.

These soils support an open forest canopy of ponderosa pine and Jeffrey pine, with some incense cedar and white fir. Forest survey site class is normally 5 to 6. Understory vegetation may consist of bitterbrush, big sagebrush, rabbitbrush, greenleaf manzanita, squawcarpet, and various perennial grasses and sedges.

This unit makes up about 1.7 percent of the survey area. It is about 45 percent Alcot and 25 percent Holland soils. The remianing 30 percent of this unit is made up primarily of the Neer, Skalan, and Menzel families and rock outcrop.

The Alcot soils in this unit are greater than 40 inches deep and contain a relatively recent pumice deposition of 10 inches to greater than 40 inches thick. The pumice normally consists of a grayish brown, gravelly coarse loamy sand over a very pale brown, extremely gravelly coarse sand. The underlying soil, if present, is a very gravelly sandy loam to a very gravelly loamy sand. The Alcot soils are somewhat excessively drained, and premeability is rapid in the pumice deposit and moderately rapid below.

The Holland soils are moderately deep and deep contain a relatively recent pumice deposition of 4 to 20 inches thick. The pumice normally consists of a grayish brown, gravelly coarse loamy sand over a very pale brown, extremely gravelly coarse sand. The underlying soil normally consists of a loam, clay loam, or gravelly clay loam. The Holland soils are well drained, and permeability is rapid in the pumice deposit and moderately slow below.

12. Lava flow - Germany family - Lithic Xerumbrepts

This unit is composed of shallow and moderately deep soils and lava flow rock on relatively recent hummocky basalt lava flow plateaus south and east of the Medicine Lake Highlands. Slopes are mainly 1 to 10 percent, and elevation ranges from 4,300 to 5,000 feet. Annual precipitation ranges from 16 to 25 inches, and the forost-free growing season is 80 to 110 days.

This unit consists of exposed basalt lava flow rock, heavily scattered throughout the unit in reef-like formations. The Germany soil is normally found in small 0.1 to 2.0 acre isolated depressions among the lava flow rock, while the Lithic Xerumbrepts soils are normally found on the upper areas of this unit and immediately adjacent to or on the flow

rock. The Germany soils support open forest canopy stands of ponderosa pine and Jeffrey pine, with a forest survey site class of 5 to 6. The Lithic Xerumbrepts soils can support very open stands of ponderosa pine with a Forest survey site class of 6 where this soil is about 14 to 20 inches in depth. Where this soil is shallower than about 14 inches in depth it supports range type vegetation with vegetation and available forage amounts generally consistent with Range Site 8, with less amounts of range Site 1.

This unit makes up about 4.9 percent of the survey area. It is about 25 percent lava flow rock, 20 percent Germany, and 20 percent Lithic Xerumbrepts soils. The remaining 35 percent of this unit is composed primarily of the Pass Canyon, Elmore, Gwin, Lawyer, and Sadie families and mesic, Lithic Xerorthents.

Lava flow rock consists of relatively recent, hard fractured vesicular basalt flow rock and collapsed lava tubes in broken reef-like formations. An amazing amount of ponderosa pine and various shrubs are growing out of these fractured lava flow rock formations in many areas.

The Germany soils are moderatley deep in this unit. They are well drained, and permeability is moderately rapid. They normally have a dark yellowish brown, fine sandy loam surface soil over a cobbly fine sandy loam to very cobbly fine sandy loam subsoil and substratum.

The Lithic Xerumbrepts soils are 10 to 20 inches deep over basalt bedrock. They are well drained, and permeability is moderately rapid. They normally have a brown, very cobbly sandy loam surface over extremely cobbly sandy loam subsurface.

13. Stonewell-Yallani families

This unit is composed of moderately deep and deep soils on volcanic mountain uplands on the south side of the Medicine Lake Highlands. Slopes range from 2 to 70 percent, and elevation ranges from 4,600 to 7,000 feet. Annual precipitation ranges from 25 to 45 inches, and the frost-free growing season is 60 to 90 days.

These soils support dense stands of white fir forest or mixed conifer forest of white fir, red fir, incense cedar, sugar pine, and ponderosa pine. Forest survey site class is 4 to 5. Understory vegetation is normally very sparse and may consist of greenleaf manzanita, snowbrush, squawcarpet, mint, currant, ceanothus, chinquapin, and few perennial grasses and sedges.

This unit makes up about 1.3 percent of the survey area. It is about 40 percent Stonewell and 35 percent Yallani soils. The remaining 25 percent of this unit is composed primarily of the Sheld, Ahart, and Xynbar families and frigid, Lithic Xerorthents and rock outcrop.

The Stonewell soils are greater than 30 inches deep. They are well drained, and premeability is moderately rapid. They normally have a dark grayish brown, gravelly sandy loam surface over a very gravelly sandy loam, extremely gravelly loamy sand, or extremely gravelly sand substratum.

The Yallani soils are greater than 30 inches deep. They are well drained, and permeability is moderately rapid. They normally have a brown gravelly sandy loam surface over an extremely cobbly fine sandy loam or extremely cobbly loam subsoil.

14. Stonewell-Yallani-Inville families, pumice overburden

This unit is composed of deep soils with a recent pumice deposition of 6 inches to greater than 40 inches thick. It is on volcanic mountain uplands on the north and east sides of the Medicine Lake Highlands. Slopes range from 2 to 40 percent, and elevation ranges from 5,300 to 6,500 feet. Annual precipitation ranges from 20 to 40 inches, and the frost-free growing season is 60 to 90 days.

These soils support open to semi-dense stands of white fir, or mixed conifer forests of white fir, ponderosa pine, incense cedar, and sugar pine or lodgepole pine forests. Forest survey site class fluctuates from 4, where the pumice deposit is thin, to 6 or 7, where the pumice doposit is deep. Understory vegetation may consist of greenleaf manzanita, rabbitbrush, ceanothus, bitterbrush, squawcarpet, and few perennial grasses and sedges.

This unit makes up about 1.2 percent of the survey area. It is about 40 percent Stonewell, 25 percent Yallani, and 15 percent Inville soils. The remaining 20 percent is made up mainly of frigid, Lighic Xerorthents and rock outcrop.

The Stonewell soils are deep and contain a relatively recent pumice deposition of 6 inches to greater than 40 inches thick. The pumice deposit normally consists of a grayish brown, gravelly coarse loamy sand over a very pale brown, extremely gravelly coarse sand. The underlying soil, if present, is normally a very gravelly sandy loam, extremely gravelly loamy sand, or extremely gravelly coarse sand. They are somewhat excessively drained, and permeability is rapid in the pumice deposit and moderately rapid below.

The Yallani soils are deep and contain a relatively recent pumice deposition of 6 to 20 inches thick. The pumice deposit normally consists of a grayish brown, gravelly coarse loamy sand over a very pale brown, extremely gravelly coarse sand. The underlying soil normally consists of an extremely cobbly fine sandy loam or extremely cobbly loam. It is well drained, and permeability is rapid in the pumice deposit and moderately rapid below.

The Inville soils are deep and contain a relatively recent pumice deposition 8 to 20 inches thick. The pumice deposit normally consists of a grayish brown, gravelly loamy sand or very gravelly loamy coarse sand over extremely gravelly coarse sand or gravelly loamy sand. The underlying soil normally consists of a very gravelly sandy loam to very gravelly loam. It is well drained, and permeability is rapid in the pumice deposit and moderate below.

Mid Elevation Soils on Gently Sloping to Extremely Steep Mountains in the Eastern Half of the Survey Area.

The three map units in this group make up about 14 percent of the survey area and are located primarily in the eastern and southern areas of the survey. The soils are on mountain uplands and are well drained. They have surface textures of loam or clay loam that are normally gravelly, cobbly or stony. The soils are shallow, moderately deep or deep over basic igneous rocks composed of basalt, andesite or tuff.

The elevation ranges from 5,400 to 7,500 feet. The average annual precipitation is 20 to 30 inches, and the average annual air temperature is 40 to 46°F. The frost free period ranges from 60 to 90 days.

The moderately deep and deep soils are used for timber, wildlife and transitory range, and the shallow soils are used mainly for range and wildlife.

15. Smarts-DeMasters-Patio families

This unit is composed of moderately deep and deep soils on mountain uplands. Slopes range from 1 to 90 percent, but are predominately less than 40 percent. Elevation ranges from 5,400 to 7,500 feet, and annual precipitation is mainly 20 to 30 inches. The frost-free growing season is 60 to 90 days.

These soils normally support dense stands of white fir, or mixed conifer forests of white fir, ponderosa pine, and incense cedar. Forest survey site class is 4 to 5. Understory vegetation is normally very sparse and may consist of greenleaf manzanita, snowberry, serviceberry, Ribes spp., currant spp., squawcarpet, and a few perennial grasses and sedges.

This unit makes up about 8.3 percent of the survey area. It is about 35 percent Smarts, 20 percent DeMasters, and 15 percent Patio soils. The remaining 30 percent of this unit is composed primarily of the Lamondi, Mascamp, Anatone, Cavanaugh, Merlin, Merkel, Gleason, and Wapal families and rock outcrop.

The Smarts soils are moderately deep and deep and are mainly over basalt. They are well drained, and permeability is moderately slow. They normally have a reddish brown, stony loam surface over a very cobbly

loam, very gravelly loam, and extremely gravelly clay loam subsoil.

The DeMasters soils are mainly deep over basalt. They are well drained, and permeability is moderately slow. They normally have a thick brown or reddish brown loam or gravelly loam surface over a gravelly clay loam to extremely cobbly clay loam subsoil.

The Patio soils are moderately deep and deep and are mainly over basalt, andesite, or obsidian. They are well drained, and permeability is moderate. They normally have a yellowish brown, very gravelly loam surface over an extremely gravelly loam or extremely cobbly loam subsoil.

16. Bertag-Smarts-Cavanaugh families

This unit is composed of moderately deep and deep soils on mountain uplands. Slopes range from 10 to 65 percent, and elevation ranges from 5,500 to 7,500 feet. Annual precipitaion ranges from 20 to 30 inches, and the frost-free growing season is 60 to 90 days.

These soils support dense stands of white fir, or mixed conifer forests of white fir, ponderosa pine, and incense cedar. Forest survey site class is 4 to 5. Understory vegetation is normally very sparse and may consist of snowberry, seviceberry, ceanothus, mulesears, currant spp., Ribes spp., squawcarpet, lupine, and few perennial grasses and sedges.

This unit makes up about 0.9 percent of the survey area. It is about 35 percent Bertag, 20 percent Smarts, and 15 percent Cavanaugh soils. The remaining 30 percent of this unit is composed primarily of the Patio, DeMasters, Mascamp, Manilla, and Merlin families.

The Bertag soils are moderately deep and deep and are mainly over tuff. They are well drained, and permeability is slow. They normally have a dark brown loam surface over a cobbly clay loam and gravelly clay subsoil.

The Smarts soils are moderately deep and deep and are over basalt or tuff. They are well drained, and permeability is moderately slow. They normally have a reddish brown, stony loam surface over a very cobbly loam, very gravelly loam, and extremely gravelly clay loam subsoil.

The Cavanaugh soils are greater than 30 inches deep over tuff or basalt bedrock. They are well drained, and permeability is slow. They normally have a dark brown cobbly loam and very cobbly loam surface over very cobbly clay loam to extremely gravelly clay subsoil.

17. Anatone-Bearskin-Merlin families

This unit is composed of shallow soils on mountain uplands and remnents of basalt plateaus. Slopes range from 1 to 90 percent, and elevation ranges from 5,500 to 7,500 feet. Annual precipitation ranges from 20 to 30 inches, and the frost-free growing season is 60 to 90 days.

These soils are rangeland soils and support vegetation and available forage amounts consistent with Range Site 9. Other uses are for wildlife, recreation, and watershed.

This unit makes up about 4.6 percent of the survey area. It is about 35 percent Anatone, 15 percent Bearskin, and 15 percent Merlin soils. The remaining 35 percent of this unit is made up primarily of the Smarts, Manila, Mascamp, Bertag, Patio, Ginser, Hades, and Vipont families, Rubble land, and Rock outcrop.

The Anatone soils are 8 to 20 inches deep over basalt, andesite, obsidian, or tuff. They are well drained, and permeability is moderate. They normally have a brown cobbly loam surface over a very cobbly loam subsurface.

The Bearskin soils are 10 to 20 inches deep over tuff or basalt. They are well drained, and permeability is moderately slow. They normally have a brown cobbly loam surface over a cobbly silty clay loam subsoil.

The Merlin soils are 8 to 20 inches deep over tuff or basalt. They are well drained, and permeability is slow. They normally have a grayish brown, very cobbly clay loam surface over a gravelly clay subsoil.

High Elevation Nearly Level to Extremely Steep Soils on the Medicine Lake Highlands and on the Warner Mountains.

The three map units in this group make up about 4 percent of the survey area. The soils are on the higher elevations of both the Medicine Lake shield volcano and the older Warner Mountain range. The soils are well drained to somewhat excessively drained. They have surface textures of sand, loamy sands, sandy loam and loam and are gravelly or cobbly. The soils are mainly moderately deep to deep, except for the Cheadle soil which is shallow. They formed from basic igneous rocks made up of andesite, basalt, tuff, cinders or obsidian.

The elevation ranges from 6,500 to 9,900 feet. The average annual precipitation is 25 to 45 inches, and the average annual air temperature is 34 to 40°F. The frost free period ranges from less than 30 days to about 70 days.

These soils are used for timber production and range. Other uses are for wildlife, aesthetic values, recreation and watershed.

18. Divers-Lapine-Kinzel families

This unit is composed of moderately deep and deep soils which may have a recent pumice deposition of up to 24 inches thick. It is in the Medicine Lake Caldera and volcanic mountain sideslopes of the Medicine Lake Highlands. Slopes range from 1 to 60 percent, and elevation ranges from 6,500 to 7,900 feet. Annual precipitation is 35 to 45 inches, and the frost-free season is 40 to 70 days.

These soils support red fir forest or mixed conifer forest of lodgepole pine, western white pine, red fir, and mountain hemlock. Forest survey site class is 5 to 6. Understory vegetation may include pentstemon, prostrate manzanita, mint, snowberry, and chinquapin, and is normally very sparse.

This unit makes up about 1.3 percent of the survey area. It is about 35 percent Divers, 30 percent Lapine, and 15 percent Kinzel soils. The remaining 20 percent of this unit is made up primarily of the Wuksi family and rock outcrop.

The Divers soils are greater than 30 inches deep over basalt or cinders. They are somewhat excessively drained, and permeability is rapid in the pumice overburden, if present, and moderately rapid below. They normally have a brown, very gravelly loamy coarse sand surface over an extremely cobbly sandy loam subsoil.

The Lapine soils are greater than 30 inches deep and are mainly over cinders. They are somewhat excessively drained, and permeability is rapid. They normally have a grayish brown, very gravelly coarse sand surface over extremely gravelly coarse sand, Extremely gravelly sandy loam, or extremely gravelly loamy coarse sand substratum.

The Kinzel soils are moderately deep over weakly cemented or compacted volcanic ash and cinders. They are well drained, and permeability is moderately rapid. They normally have a dark grayish brown, gravelly loamy sand surface over very cobbly sandy loam to extremely stony sandy loam subsoil.

19. Behanin deep-Gralic-Loberg families

This unit consists of moderately deep and deep soils on mid to upper sideslopes, ridges, and crests of mountains in the Warner Mountain range. Slopes range from 10 to 65 percent, and elevation ranges from 7,000 to 8,000 feet. Annual precipitation is 25 to 35 inches, and the frost-free season is 40 to 70 days.

These soils support open to dense stands of white fir and lodgepole pine forest or lodgepole pine and western white pine forest. Other trees may include Washoe pine, quaking aspen, and ponderosa pine. Forest survey site class is 5 to 6. Understory vegetation is very sparse and may include prostrate manzanita, snowberry, forbs, currant spp., and few perennial grasses.

This unit makes up about 0.7 percent of the survey area. It is about 25 percent Behanin, 20 percent Gralic, and 20 perent Loberg soils. The remaining 35 percent of this unit is made up primarily of Woodhurst, Gallatin, Supervisor, Friana, and Cheadle families and Rubble land.

The Behanin deep soils are over andesite, basalt, or tuff. They are well drained, and permeability is moderate. They normally have a very dark grayish brown, very gravelly loam surface over very stony loam and extremely gravelly loam subsurface.

The Gralic soils are greater than 30 inches deep over andesite or obsidian. They are well drained, and permeability is moderately rapid. They normally have a grayish brown, very gravelly fine sandy loam surface over very gravelly sandy loam and very gravelly loamy sand substratum.

The Loberg soils are moderately deep over tuff. They are well drained, and permeability is solw. They normally have a brown gravelly loam surface over a very gravelly clay loam subsoil.

20. Cheadle-Supervisor-Behanin Families

This unit consists of shallow and moderately deep soils on mid to upper sideslopes, ridges, and crests of mountain uplands on the Warner Mountain range. Slopes range from 5 to 100 percent. Elevation ranges from 7,000 to 9,900 feet. Annual precipitation is 25 to 35 inches, and the frost-free season is less then 30 days to 70 days.

These soils are either rangeland soils, or support semidense stands of white bark pine with some lodgepole pine, western white pine, and quaking aspen. The forest survey site class on the forested areas is 7 due to the very

short growing season and severe windswept exposures. The rangeland areas support vegetation and available forage amounts consistent with Range Sites 9 and 14. Other uses are for wildlife, aesthetic values, recreation, and watershed.

This unit makes up about 1.7 percent of the survey area. It is about 30 percnet Cheadle, 20 percent Supervisor, and 15 percent Behanin soils. The remaining 35 percent of this units is made up primarily of the Gallatin and Duncom families, Cryoborolls, wet, Lithic Cryochrepts, Rock outcrop, and Rubble land.

The Cheadle soils are 8 to 20 inches deep over andesite, obsidian, or tuff. They are well drained, and permeability is moderate. They normally have a dark grayish brown, very cobbly loam surface over a very cobbly loam or very cobbly clay loam subsurface.

The Supervisor soils are moderately deep over andesite, obsidian, or tuff. They are well drained, and permeability is moderate. They normally have a dark grayish brown, gravelly fine sandy loam surface over a very gravelly sandy loam subsoil.

The Behanin soils are moderately deep over andesite or tuff. They are well drained, and permeability is moderate. They normally have a very dark grayish brown, very gravelly loam surface over very stony loam and extremely gravelly loam subsurface.

Miscellaneous Areas With Little or No Soil Present.

The two miscellaneous units which make up this group are the Lava flow rock-Rock outcrop unit, and water. Together they make up over 5 percent of the survey area. The Lava flow rock and Rock outcrop is of basic igneous rock.

The miscellaneous units which make up this group are used mainly for aesthetic values, recreation, wildlife and watershed.

21. Lava flow rock-Rock outcrop

This miscellaneous land type occurs throughout the survey area, with the main areas of concentration being in and around the Medicine Lake Highlands and on the east side of the Warner Mountain range. It can be found on nearly level basalt plateaus to extremely steep mountain sideslopes.

This land type is used mainly for aesthetic values, recreation, some wildlife, and for watershed.

This unit makes up about 3.2 percent of the survey area. It is about 60 percent Lava flow rock and 15 percent Rock outcrop. The remaining 25 percent of this unit is composed primarily of the Bakeoven and Cheadle families, frigid, Lithic Xerorthents, Lithic Cryochrepts, and Rubble land.

Lava flow rock consists of relatively recent, hard vesicular basalt flow rock or obsidian flow rock.

Rock outcrop consists of basalt, andesite, or conglomerate tuff bedrock and may have minor accumulations of aeolian soil deposition in some fractures.

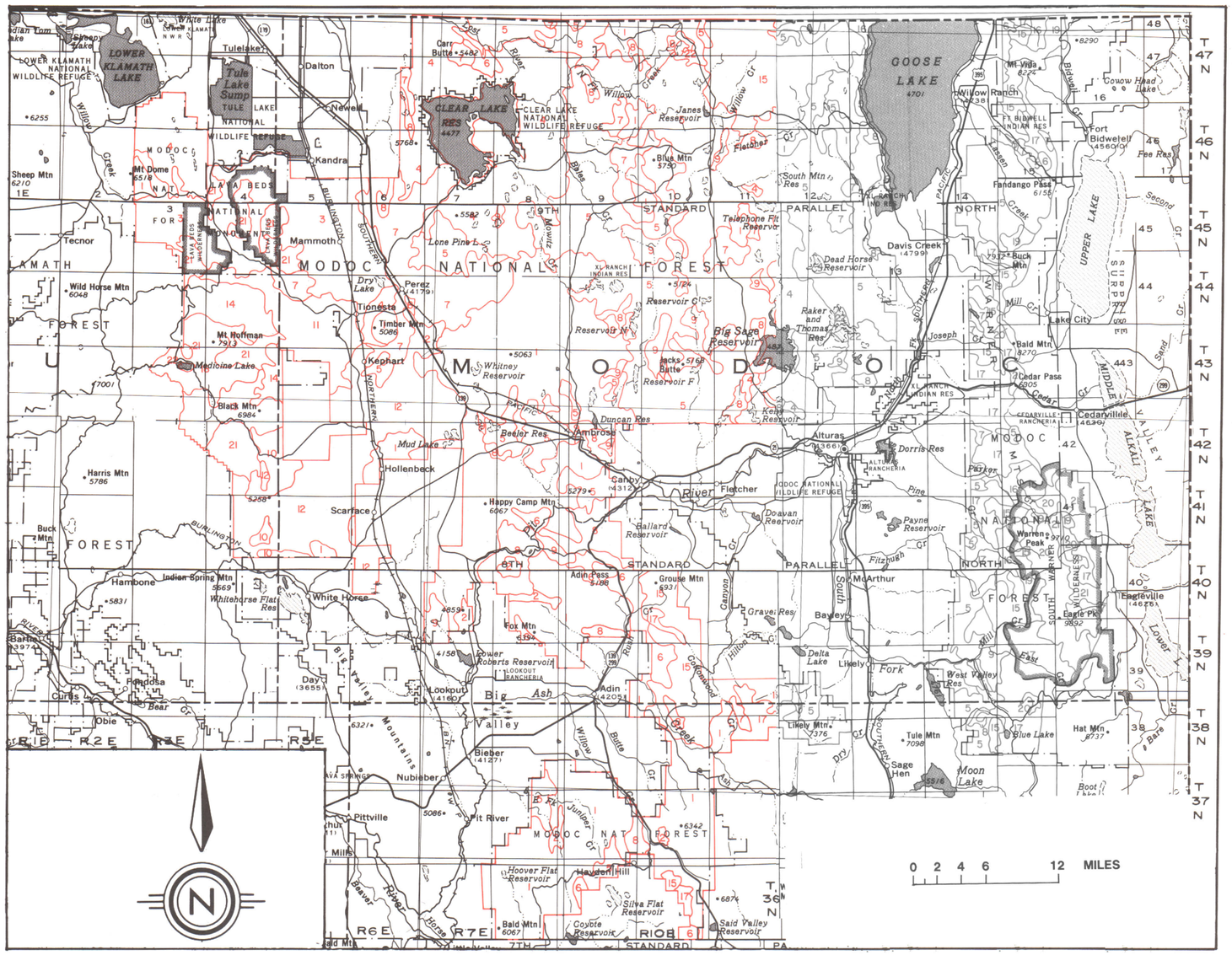
22. Water

This unit consists of large bodies of water which make up about 2.2 percent of the survey area. These areas are Medicine Lake, Clear Lake Reservoir, and Big Sage Reservoir.

MODOC NATIONAL FOREST, CALIF.

GENERAL SOIL MAP

(703 SOIL SURVEY AREA)



MAP UNIT LEGEND

LOWER ELEVATION DOMINATELY WOODLAND SOILS MAINLY ON 0 TO 40 PERCENT SLOPES

1. Lawyer - Elmore families: Moderately deep and deep, well-drained soils on basalt plateaus and mountain sideslopes.

2. Jacket - Deven - Hiibner families: Moderately deep and shallow, well-drained soils on mountain sideslopes.

LOWER ELEVATION RANGELAND SOILS MAINLY ON 0 TO 40 PERCENT SLOPES

3. Bakeoven family - Lava flow - Searles family: Shallow and moderately deep, well-drained soils and lava flow rock on basalt plateaus.

4. Puls - Indian Creek - Simpson families: Shallow soils over a silica durapan and moderately deep, well-drained soils on basalt plateaus.

5. Deven - Bieber - Pass Canyon families: Shallow, well-drained soils over basalt bedrock, or, over a silica durapan on basalt plateaus.

6. Gwin - Ruckles - Pass Canyon families: Shallow, well-drained soils primarily on mountain sideslopes.

7. Supan - Los Gatos - Pass Canyon families: Deep, moderately deep and shallow, well-drained soils primarily on basalt plateaus.

8. Deven - Keating - Pass Canyon families: Shallow and moderately deep, well-drained soils on mountain sideslopes and basalt plateaus.

DOMINATELY NEARLY LEVEL ALLUVIAL SOILS THAT ARE SUBJECT TO FLOODING

9. Aikman - Cardon families: Deep and moderately deep, moderately well-drained to somewhat poorly drained soils found primarily on alluvial depressions and drainages.

LOWER TO MID ELEVATION DOMINATELY WOODLAND SOILS WHICH HAVE FORMED IN RELATIVELY RECENT VOLCANIC PARENT MATERIALS

10. Alcot - Sadie - Germany deep families: Deep, well-drained to somewhat excessively drained soils on basalt plateaus and sideslopes of cinder cones.

11. Alcot - Holland families, pumice overburden: Moderately deep, well-drained to somewhat excessively drained soils on basalt plateaus and lower volcanic mountain sideslopes.

12. Lava flow - Germany family - Lithic Xerumbrepts: Lava flow rock, moderately deep and shallow, well-drained soils on geologically recent basalt plateaus.

13. Stonewell - Yallani families: Moderately deep and deep, well-drained soils on volcanic mountain sideslopes and ridges.

14. Stonewell - Yallani - Inville families, pumice overburden: Deep, well-drained soils on volcanic mountain sideslopes and ridges.

MID ELEVATION SOILS ON GENTLY SLOPING TO EXTREMELY STEEP MOUNTAINS IN THE EASTERN HALF OF THE SURVEY AREA

15. Smarts - DeMasters - Patio families: Moderately deep and deep, well-drained soils on mountain sideslopes and ridges.

16. Bertag - Smarts - Cavanaugh families: Moderately deep and deep, well-drained soils on mountain sideslopes.

17. Anatone - Bearskin - Merlin families: Shallow, well-drained soils on mountain sideslopes, ridges and crests.

HIGH ELEVATION NEARLY LEVEL TO EXTREMELY STEEP SOILS ON THE MEDICINE LAKE HIGHLANDS AND ON THE WARNER MOUNTAINS.

18. Divers - Lapine - Kinzel families: Moderately deep and deep, somewhat excessively drained and well-drained soils on volcanic mountain sideslopes and on the Medicine Lake Caldera.

19. Behanin deep - Gralic - Loberg families: Moderately deep and deep, well-drained soils on mid to upper mountain sideslopes, ridges and crests.

20. Cheadle - Supervisor - Behanin families: Shallow and moderately deep, well-drained soils on mid to upper mountain sideslopes, ridges and crests.

MISCELLANEOUS AREAS WITH LITTLE OR NO SOIL PRESENT

21. Lava flow rock - Rock outcrop: Lava flow rock and rock outcrop which occurs on low elevation Basalt plateaus to the highest elevation mountain sideslopes and ridges.

22. Water: large open bodies of water.

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Introduction to Map Unit Descriptions, Characteristics and Interpretations for Management

The map units on the soil maps attached to the back of this survey report represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. The map unit description contains additional information on the soil characteristics and interpretations for use and management.

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxanomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

All map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils and their normal percentage of inclusion in total are identified in each map unit description.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation to precisely define and locate the soils and miscellaneous areas is needed.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a soil family. Except for differences in texture of the surface layer or of the underlying material, all soils of a family have major horizons that are similar in composition, thickness, and arrangement.

Soils of one family can differ in texture of the surface layer or of the underlying material. They also can differ in slope, total depth, amount of surface rock fragments, and other characteristics that affect their use. On the basis of such differences, a soil family is divided into soil phases. Most of the areas shown on the soil maps are phases of soil families. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alcot family, 20 to 40 inch pumice overburden, 1 to 10 percent slopes, is one of several phases in the Alcot family.

Most map units are made up of two or more major soils or miscellaneous areas. These map units are called soil complexes or soil associations.

A soil complex consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Behanin deep-Gallatin families complex, 10 to 35 percent slopes, is an example.

A soil association is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soil or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Anatone-Smarts families association, 5 to 20 percent slopes, is an example.

This survey also includes two miscellaneous areas which show on the soil maps. These areas have little or no soil material and support little or no vegetation. These areas are: Lava flow rock symbolized by "V" on the soil maps, and open areas of water symbolized by "W" on the soil maps. In addition, three other miscellaneous areas were mapped in complex or association with one or two soil types on many soil map units. These include Rock outcrop, Rubble land and Lava flow. Anatone-Bearskin families-Rock outcrop association, 40 to 70 percent slopes is an example.

Table 4 gives the acreage and proportionate extent of each map unit. The Glossary defines many of the terms used in describing the soils.

In the following pages is a brief explanation of the detailed soil map unit descriptions, characteristics and their interpretations for management.

Mapping Unit Symbol and Name. This is a three digit numerical symbol of the mapping unit (which is also shown on the soil maps) followed by the name of the mapping unit. These mapping units are in numerical sequence beginning with number 101 and going thru 282. Six previously numbered map units no longer exist (i.e., 119, 143, 160, 172, 234, and 248) due to their close correlation and subsequent joining with other mapping units. Below the mapping unit name is given the included soils and miscellaneous land types and their overall percentage of the mapping unit.

Mapping Unit Components and Approximate Proportions. Components are listed and the approximate percentage of the mapping unit is given in parentheses. The percentage of the main components together with the percentage of inclusions listed above equal 100.

Physiographic Position, Slope, Elevation. This is a description of the landform and relative position of the soils and/or miscellaneous areas of the mapping unit plus the slope range and elevation range of the mapping unit.In those units, or a particular soil within a unit where spring flooding is common, it will state "subject to spring flooding".

Typical Vegetation, Precipitation (PPT). This shows the dominant climax vegetation types by common name that were observed and identified in the field when mapping these units. In some areas where wildfires or man's activities have resulted in some other vegetative successional stage, that vegetation may not be named. Precipitation in inches shown at the end of the typical vegetation description shows the annual precipitation zone this map unit has been mapped in based on isohytel lines developed by the California Department of Natural Resources - Hydrology Section and later modified to a minor extent by Mark Cleveland past Modoc National Forest Hydrologist.

Brief Soil Profile Description. The Brief Soil Profile Description is an abridged version of the typical pedon description given for each taxonomic unit. Listed are thickness in inches, dry color, texture, structure, dry consistence, and pH for three layers: Surface Layer (A horizons), Subsoil (B horizons), and Substratum (C Horizons). If an O horizon was described for the typical pedon, it is also included with the Surface Layer.

Effective Rooting Depth in Inches and Type of Underlying Material. The effective rooting depth in inches reflects the soil depth to a root limiting contact whether it be hard or soft bedrock, a duripan, or over a dense very hard to extremely hard clay layer as is the case with the Puls family. The type of underlying material identifies the type of bedrock or parent material normally found with that soil type in that mapping unit.

Soil Erodibility (K-factor). Indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on the soils surface texture and organic matter (up to 4 percent) and on soil permeability. The estimates are modified by the presence of rock fragments. Values of K in this survey range from 0.15 to 0.49. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion Hazard Maximum. This rating indicates the level of risk of soil loss by erosion and is based on the assumption that most or all of the vegetative surface cover has been removed due to management practices or to wildfire. The risk is low if the expected soil loss is small, moderate if standard and non-intensive measures are needed to control erosion, and high or very high if excessive soil loss is expected without intensive and/or expensive measures to control erosion. The process used for evaluating the potential of a soil within a mapping unit for erosion includes such soil characteristics as texture, structure, permeability, and depth at which permeability begins. The process also considers such other factors as slope and length of slope, distribution and form of precipitation, aspect and any remaining vegetative cover.

Soil profile permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability include: Very Slow, less than 0.06 inches; Slow, 0.06 to 0.2 inches, Moderately Slow, 0.2 to 0.6 inches; Moderate, 0.6 to 2.0 inches; Moderately Rapid, 2.0 to 6.0 inches; Rapid, 6.0 to 20 inches; and Very Rapid, greater than 20 inches.

Soil Drainage Class. This interpretation is the natural drainage class assigned to that soil type. It refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of

artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained - Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained - Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained - Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained - Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall or both.

Somewhat poorly drained - Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, or a combination of these.

Poorly drained - Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, or a combination of these.

Very poorly drained - Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded.

Soil Manageability Class. The ease of managing land depends on the kinds and intensities of cultivation and harvest techniques. It is also dependent on soil and topographic features, although the importance of these features is related to the type of management system. Nevertheless, there are certain features that affect the ease of management with mechanized equipment, regardless of the kind of management, even though some management systems may be affected more than others. The soil manageability classification rates soils and their topography on the basis of features which reduce the ease of equipment operation and increased required soil protection measures for most systems, particularly those commonly practiced in forestry and intensive range management.

There are four soil manageability classes. Classes 2, 3, and 4 are qualified by one or more management option modifiers. Soil manageability classes and their definitions are: Class 1 - Easy to manage. Soils in this class are on stable slopes of less than 30 percent. They are moderately deep or deep and do not have any more than slight management problems. No management option modifiers apply to this class. Class 2 - Readily manageable. Soils in this class are on slopes of 30 to 40 percent (depending on soil type) but have a moderate management option modification, such as moderate erosion potential. Possible symbols are 2s, 2ed, 2w, etc., but not 2g. Class 3 - Moderately difficult to manage. Soils in this class are on steep slopes (35 to 60 percent or 40 to 60 percent on some units) or have a substantial managmeent option modification, or both. Possible symbols are 3g, 3D, 3Pg, etc. Class 4 - Very difficult to manage. Soils in this class are on very steep slopes (greater than 60 percent). They may or may not have other management option modifiers. Possible symbols are 4G, 4Gpx, 4GD, etc.

Management option modifiers were chosen in the order in which they are listed below. Only one symbol could be chosen from each of the three following sets:

Set 1 modifier symbols include (G) slopes greater than 60 percent; (g) slopes 35 or 40 to 60 percent; (S) high potential for slope failure; (s) moderate potential for slope failure; (E) high or very high erosion hazard; (e) moderate erosion hazard.

Set 2 modifier symbols include: (D) total soil depth less than 10 inches; (d) soil depth 10 to 20 inches; (P) available water holding capacity less than 1.2 inches in the top 20 inches of soil; (p) available water holding

capacity between 1.2 and 2.4 inches in the top 20 inches of soil.

Set 3 modifier symbols include: (W) poorly drained soils; (w) somewhat poorly drained soils; (X) rock outcrop or surface boulders representing more than 15 percent of the area; (x) rock outcrop or surface boulders representing between 3 and 15 percent of the area.

Within each set uppercase modifier symbols were chosen before any lower case symbols could be selected.

Soil Manageability Group. Five soil manageability groups have been developed for utilization in broad planning. The groups rate soil map units. Only one group applies to a map unit. Soil manageability classes rate soil map unit components, and as many classes may apply to a map unit as there are major components in the soil map unit.

The soil manageability groups are defined by the soil manageability classes which apply to the components in a soil map unit. They are designated by Roman numerals in order to distinguish them from soil manageability class symbols, which are designated by Arabic numberals. The soil manageability group rating for each map unit is found directly below the soil manageability class rating of the first named soil type or miscellaneous land form of each map unit description.

The five soil manageability groups and their definitions are: Group 1A - Class 1 components predominate, with less than 30 percent Class 2 components and less than 10 percent Classes 3 and 4 components. Group I - Class 1 components predominate, with less than 50 percent Class 2 components, less than 20 percent Class 3 components, and less than 10 percent Class 4 components by area. Group II - Class 2 components predominate, with less than 50 percent Class 3 components by area. Group IV - Class 4 components predominate, or occupy at least 40 percent of the map unit area.

A soil map unit was always placed in the group with the lowest numeral in cases where the group definitions would allow it to be in more than one soil manageability group.

Forest Survey Site Class (Dunnings Site Class). Potential timber site productivity ratings for these timber site class determinations were made using age/height relationships of some representative trees and tree species from each soil map unit and soil type. This data was then compared with the potential density of stocking, or potential crown canopy closure. Various tree species productivity site curves were used, depending on the representative species being sampled, to arrive at the corresponding Dunnings site or Forest survey site ratings. Potential stocking densities were then determined, using ocular estimates of density and such soil and climatic factors as soil depth, available water-holding capacity, annual precipitation, and relative estimates of annual evapo-transpiration needs in each soil map unit. These two determinations were then correlated, to arrive at the potential timber site productivity of a given soil map unit and soil type within the map unit. Table 1 shows the relationship between yield in cubic feet per acre per year at culmination of mean annual increment (CMAI), forest survey site class (FSSC) symbol and Dunnings site class (DSC) measurements and potential crown closure (PCC) for Ponderosa pine (PP) and white fir (WF).

In areas where timber was absent due to wildfire or clearcutting, the soil type, depth and climatic conditions became the overriding influence in determining productivity. In most of these cases, however, there was still some evidence of measurable site productivity in the form of a few standing snags, decomposing stumps and logs, or sparsely populated encroaching timber.

Table 1. - Relationship Between Forest Survey and Dunning Site Classes at Various Potential Crown Covers.

Forest Survey Site Class Symbol	Yields in Cubic feet per acre per year	70 to 100% Potential Crown Closure	40 to 70% Potential Crown Closure	10 to 40% Potential Crown Closure
3	120-165	1 (PP), 2 (WF)		
4	85-120	2 (PP), 3 (WF)		
5	50-85	4, 5 (WF); 3, 4 (PP)	3 (WF)	
6	20-50	5 (PP)	4 (PP)	3 (PP)
7	<20			

Range site. Soils that have the capacity to produce the same kinds, amounts, and approximate proportions of range plants are grouped into range sites (11, 12, 13). A range site is the product of all environmental factors responsible for its development. These environmental factors include such things as soil type and depth, surface rock fragments, drainage, annual precipitation, elevation, slope, aspect, and growing season.

Soils that are capable of at least Dunnings site class 5 or forest survey site class 6 commercial timber production were not placed in a range site. Many of these soils that are capable for commercial timber production also produce range forage and are suitable for grazing. These timber soils are normally used only as transitory range for domestic livestock due to their more intensive timber and wildlife management.

A plant community existing within a range site that has not undergone abnormal disturbance is the potential, or climax, plant community for that site. Climax plant communities are not precise or fixed in their composition but vary, within reasonable limits, from year to year and from place to place.

Abnormal disturbance such as overuse by livestock, excessive burning, erosion, or plowing results in changes in the climax plant community or even complete destruction if disturbance is drastic enough. When the range site has not deteriorated significantly under such disturbance, secondary plant succession progresses in the direction of the natural potential or climax plant community for the site.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undersirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In the following pages, the sixteen range sites that occur in this survey area are briefly described and the potential plant communities on these sites are named. Because of the broad range of environmental factors in this survey area and the reconnaissance level of survey intensity, the potential plant community can be quite broad in terms of species composition and percent.

An estimate is also given of the total production which is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting

the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

The potential plant community including grasses and grasslikes, forbs, shrubs and trees that make up most of the potential natural plant community on each rangesite are listed by common name. The expected percentage of each species or group of species making up the characteristic vegetation is also given. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range Site 1. Very Shallow Stony Loam

This range site occurs in scattered localized areas throughout the survey area at elevations of 4,200 - 8,000 feet. Slopes normally range from 0-10 percent with a minor percentage of this range site on steeper slopes of up to 100 percent. On the majority of this range site the climate is cool and normally averages 10 to 18 inches of precipitation, most of which falls during the winter as snow. Annual precipitation can range up to 30 inches at the highest elevations where this range site occurs in the Warner Mountain Wilderness area. The frost free growing season ranges from about 40 to 110 days in most years.

The soils are very shallow, averaging 4 to 10 inches in depth to a root limiting contact and are normally characterized by a loamy surface with 30 to 80 percent (40 percent average) surface coarse fragments mostly of the 3/4" to 24" size. These soils are characterized by either very little development (Entisols), or, they are highly developed with a very strong (Abruptic) clay texture in the subsoil. These soils can be over hard bedrock, volcanic tuff or a duripan. The potential erosion hazard ranges from moderate to very high due mainly to the relatively high water runoff rates associated with this range site. The available water holding capacity is very low. These soils are very droughty and herbaceous plant growth normally ceases by mid June in most years.

The potential plant community on this site consists of about 45 to 70 percent grasses and grasslike plants, 5 to 15 percent forbes, and 15 to 35 percent shrubs and trees. Of the grasses and grasslike plants, bluegrasses make up about 35 to 55 percent of the plant community; and bluebunch wheatgrass, Thurbers needlegrass, bottlebrush squirreltail and onespike oatgrass which each make up 5 percent or less. Forbes include phlox species, western yarrow, buckwheat, hawksbeard and a few other species which together represent 5 to 15 percent of the total community. Shrubs and trees include low sagebrush, 10 to 20 percent; rabbitbrush, 3 to 5 percent; mountain mahogany, less than 2 percent; and western juniper, less than 5 percent.

The estimated total production per acre of air dry vegetation is 300 pounds in favorable years, 200 pounds in normal years and 100 pounds in unfavorable years.

Range Site 4. Shallow Loam

This range site occurs in scattered areas throughout the survey area at elevations of 4,300 to 5,500 feet. Slopes normally range from 0 to 15 percent but can go as high as 35 percent. The climate is cool and rainfall averages 10 to 16 inches, most of which falls during the winter as snow. The frost free growing season is 80 to 110 days in most years.

The soils are shallow and normally average 14 to 20 inches in depth to a root limiting contact. The surface is normally a loam and normally has few or no surface coarse fragments. The subsurface soil (below about 4 inches) ranges from clay loam to clay in texture and normally contains less than 35 percent by volume coarse fragments. These soils can be over hard bedrock, volcanic tuff, or a duripan. The erosion hazard potential is normally moderate. The available water holding capacity is low. These soils normally become dry and herbaceous plant growth ceases by the end of June in most years.

The potential plant community on this site consists of about 50 to 65 percent grasses and grasslike plants, 10 to 15 percent forbes, and 20 to 35 percent shrubs and trees. Of the grasses and grasslike plants, Idaho fescue makes up about 25 to 50 percent and bluebunch wheatgrass makes up about 10 to 35 percent of the plant community; bluegrasses, 2 to 10 percent; Thurbers needlegrass, 5 to 10 percent; bottlebrush squirreltail, 3 to 8 percent and prairie junegrass less than 3 percent. Forbes include arrowleaf balsam-root, 3 to 10 percent;

cutleaf balsamroot, 1 to 7 percent; and mule ears, hawksbeard, phlox species, buckwheat, lupine and other species which together make up about 6 to 10 percent. Shrubs and trees include big sagebrush, 5 to 25 percent; low sagebrush and western juniper, up to 20 percent each; bitterbrush, 2 to 10 percent; rabbitbrush, 1 to 5 percent; and up to 12 percent of other shrubs. Other trees and shrubs including ponderosa pine, up to 2 percent; and mountain mahogany, up to 5 percent may occasionally occur as a topoedaphic climax.

The estimated total production per acre of air dry vegetation is 1,100 pounds in favorable years, 800 pounds in normal years and 600 pounds in unfavorable years.

Range Site 7. Shallow Stony Loam, 10 to 14 inch precipitation zone

This range site occurs on the Modoc Plateau Geomorphic Province at elevations of 4,200 to 5,200 feet. Slopes are normally 0 to 15 percent. The climate is cool and arid averaging 10 to 14 inches of precipitation, most of which falls during the winter as snow. The frost free growing season is 80 to 110 days in most years.

The soils are shallow (10 to 20 inches deep) but generally average 10 to 15 inches in depth to a root limiting contact and are characterized by a loamy surface with 15 to 80 percent (average 35 percent) surface coarse fragments mostly of the 3" to 24" size. The subsurface soil (below about 2 to 4 inches) has a textural range from loam to clay and normally contains less then 35 percent by volume coarse fragments. These soils are over hard andesite or basalt bedrock, or silica duripan. The potential erosion hazard is normally moderate. The available water holding capacity is low to very low. These soils are very droughty and herbaceous plant growth normally ceases by mid June in most years.

The potential plant community on this site consists of about 50 to 60 percent grasses and grasslike plants, 10 to 20 percent forbes, and 20 to 30 percent shrubs and trees. Of the grasses and grasslike plants, bluebunch wheatgrass makes up about 25 to 35 percent and Idaho fescue makes up about 5 to 15 percent of the plant community; bluegrasses, 2 to 10 percent; and prairie junegrass, bottlebrush squirreltail and Thurbers needlegrass each making up less than 5 percent. Forbes include arrowleaf balsam-root, 1 to 5 percent; and lupine, hawksbeard, phlox species, buckwheat, western yarrow and other species together making up less than 20 percent. Shrubs and trees include low sagebrush, 15 to 25 percent; western juniper, up to 10 percent, and rabbitbrush, bitterbrush and shrubby buckwheat which make up less than 5 percent each. Other shrubs include big sagebrush and mountain mahogany which together can make up to 15 percent of the community and occur mostly around the Lava Beds National Monument area and further west.

The estimated total production per acre of air dry vegetation is 750 pounds in favorable years, 550 pounds in normal years and 350 pounds in unfavorable years.

Range Site 8. Shallow Stony Loam, 14 to 20 inch precipitation zone

About 80 percent of this range site occurs on the Modoc Plateau geomorphic province. Slopes normally range from 0 to 10 percent. Elevations are normally 4200-5500 feet. The other 20 percent of this range site occurs in mountain uplands with slopes ranging to 70 percent, and elevations up to 6000 feet and mainly on southerly or westerly aspects. The climate is cool and averages 14 to 20 inches of precipitation. Most of the precipitation falls during the winter as snow. The frost free growing season normally averages about 80 to 110 days in most years. It can drop to 60 days at the higher elevations.

The soils are shallow, averaging 10 to 20 inches in depth to a root limiting contact and are characterized by a loamy surface with 15 to 80 percent (35 percent average) surface coarse fragments of the 3/4" to 24" size. The subsurface soil (below about 2 to 4 inches) has a textural range from loam to clay and normally contains less than 35 percent by volume coarse fragments. These soils can be over hard bedrock, volcanic tuff, or a duripan. The water holding capacity is low to very low. The potential erosion hazard ranges from moderate to very high. The soils normally become dry, and herbaceous plant growth ceases by the end of June in most years.

The potential plant community on this site consists of about 50 to 60 percent grasses and grasslike plants, 10 to 20 percent forbes, and 20 to 30 percent shrubs and trees. Of the grasses and grasslike plants, Idaho fescue makes up about 35 to 45 percent and bluebunch wheatgrass makes up about 5 to 10 percent of the plant community; bluegrasses, 2 to 5 percent; bottlebrush squirreltail, 1 to 3 percent; and Thurbers needlegrass, 2 to 4 percent. Forbes include arrowleaf balsam-root, 3 to 5 percent; and lupine, hawksbeard, buckwheat, phlox species, western yarrow and other species together making up 15 percent or less. Shrubs and trees include low sagebrush and western juniper, up to 20 percent each, big sagebrush and bitterbrush, up to 10 percent each; ceaonothus species, up to 5 percent; and shrubby buckwheat, rabbitbrush and mountain mahogany, each making up less than 3 percent. Other trees include ponderosa pine which occasionally occur in very sparse stands making up to 5 percent of the community as a topoedaphic climax.

The estimated total production per acre of air dry vegetation is 1,000 pounds in favorable years, 750 pounds in normal years and 500 pounds in unfavorable years.

Range Site 9. Shallow Stony Loam, 20 to 35 inch precipitation zone

This range site occurs on higher elevations (above 5,500 feet) in mountain uplands. Slopes vary from about 5 to 80 percent but are predominately between 15 and 50 percent and on southerly to westerly aspects. The climate is normally cool and relatively moist receiving 20 to 35 inches of annual precipitation, most of which falls during the winter as snow. A small but significant amount of precipitation falls during the summer growing season from thunder showers, especially in the higher elevations (above 7,000 feet) near the eastern edge of the survey area. The frost free growing season ranges from less than 30 days at the highest elevations to about 90 days at the lower elevations in most years.

The soils are shallow, averaging 10 to 20 inches in depth to a root limiting contact and are characterized by a loamy surface with 15 to 70 percent (average 35 percent) surface coarse fragments of the 3/4" to 24" size. These soils are generally weakly developed and normally contain greater than 35 percent by volume coarse fragements in the sub-soil on the steeper sideslopes. The subsurface soil (below about 4-8 inches) ranges from loam to clay. These soils are mainly over basalt and andesite bedrock or conglomerated volcanic tuff. The potential erosion hazard ranges from moderate to very high due mainly to the relatively steep slopes and high water runoff rates associated with this range site. The available water holding capacity is very low or low.

The potential plant community on this site consists of about 50 to 60 percent grasses and grasslike plants, 10 to 20 percent forbes, and 20 to 30 percent shrubs and trees. Of the grasses and grasslike plants, Idaho fescue makes up about 20 to 35 percent of the plant community; California oatgrass up to 15 percent; sedges, 2 to 10 percent; and bottlebrush squirreltail, bluegrasses and needlegrass make up to 5 percent each. Forbes include mule ears, 5 to 20 percent; and arrowleaf balsam-root and other species together making up to 15 percent. Shrubs and trees include big sagebrush, 2 to 20 percent; low sagebrush, up to 15 percent; western juniper, up to 5 percent; and shrubby buckwheat, squawcarpet, snowberry, bitterbrush and mountain mahogany which make up to 5 percent or less each. Other trees include ponderosa pine and white fir which may occur in very sparse stands each making up less than 5 percent of the community as a topoedaphic climax.

The estimated total production per acre of air dry vegetation is 1,400 pounds in favorable years, 1,000 pounds in normal years and 700 pounds in unfavorable years.

Range Site 12. Loamy, 10 to 14 inch precipitation zone

This range site occurs mainly in the northwest part of the survey area on the Modoc Plateau Geomorphic Province at elevations of 4,200 to 5,400 feet. Slopes range from 0 to 35 percent but are predominately 0 to 15 percent. The climate is cool and arid averaging 10 to 14 inches of precipitation, most of which falls during the winter as snow. The frost free growing season is 80 to 110 days in most years.

The soils are generally moderately deep, averaging 20 to 40 inches in depth to a root limiting contact and are characterized by a loamy surface essentially free of coarse fragments greater than 3" in diameter. The subsurface soil (below about 6-10 inches) is loam, clay loam, or clay and is relatively free of coarse fragments except on the Clear Lake hills on the western edge of Clear Lake reservoir. The soils in this range site are normally over basalt or andesite bedrock. Water runoff is low to moderate and the plant available water holding capacity is moderate. These soils normally become dry, and herbeceous plant growth ceases by mid July in most years.

The potential plant community on this site consists of about 50 to 60 percent grasses and grasslike plants, 10 to 20 percent forbes, and 30 to 40 percent shrubs and trees. Of the grasses and grasslike plants, bluebunch wheatgrass makes up about 35 to 45 percent and Idaho fescue makes up about 10 to 15 percent of the plant community; bluegrasses and Thurbers needlegrass each make up 5 to 10 percent; and bottlebrush squirreltail and prairie junegrass each make up 2 to 5 percent. Forbes include arrowleaf balsam-root, 4 to 10 percent; and buckwheat, phlox species, lupine, western yarrow, vetch, hawksbeard and other species which together make up to 16 percent. Shrubs and trees include big sagebrush, 15 to 20 percent; western juniper, 5 to 15 percent; and bitterbrush and rabbitbrush, 2 to 5 percent each.

The estimated total production per acre of air dry vegetation is 1,300 pounds in favorable years, 900 pounds in normal years and 450 pounds in unfavorable years.

Range Site 13. Loamy, 14 to 20 inch precipitation zone

The majority of this range site occurs on the Modoc Plateau Geomorphic Province. Small isolated areas, however, occur throughout the survey area. Elevations range from 4,400 to 5,800 feet and slopes are normally 0 to 15 percent, but range to 35 percent. The climate is cool and annual precipitation averages 14 to 20 inches, most of which falls during the winter as snow. The frost free growing season is 80 to 110 days in most years.

The soils are generally moderately deep (20 to 40 inches) with minor amounts deeper than 40 inches to a root limitating contact. The surface soil is a loam and is relatively free of surface coarse fragments greater than 3" in diameter. The subsurface soil (below about 6-15 inches) is normally a clay loam or clay and normally contains less than 35 percent by volume coarse fragments. The soils can be over basalt or andesite bedrock, volcanic tuff, or a silica duripan. Water runoff is normally low and the potential erosion hazard is low to moderate. The plant available water holding capacity is moderate to high. These soils normally become dry, and herbaceous plant growth ceases by mid July in most years.

The potential plant community on this site consists of about 55 to 70 percent grasses and grasslike plants, 10 to 15 percent forbes, and 20 to 30 percent shrubs and trees. Of the grasses and grasslike plants, Idaho fescue makes up about 40 to 55 percent and bluebunch wheatgrass makes up about 5 to 15 percent of the plant community; prairie junegrass, 3 to 8 percent; bluegrasses, 2 to 6 percent; Thurbers needlegrass, 1 to 5 percent; and bottlebrush squirreltail, 1 to 2 percent. Forbes include mule ears, 1 to 5 percent; arrowleaf balsam-root, up to 5 percent; and cutleaf balsam-root, hawksbeard, lupine, phlox species and other species each of which makes up less than 4 percent. Shrubs and trees include big sagebrush, 15 to 25 percent; bitterbrush, 2 to 10 percent; and rabbitbrush, 1 to 2 percent; western juniper, up to 10 percent; mountain mahogany and bitter cherry, up to 2 percent each. Other trees include ponderosa pine, which may occur in very sparse stands making up to 5 percent of the community as a topoedaphic climax.

Some large areas of this range site have nearly solid stands of western juniper, plus mountain mahogany and big sagebrush which is mainly the result of increased wildfire suppression efforts over the past 60 years or so.

The estimated total production per acre of air dry vegetation is 1,600 pounds in favorable years, 1,150 pounds in normal years and 700 pounds in unfavorable years.

Range Site 14. Loamy, 20 to 35 inch precipitation zone

This range site occurs above 5,500 feet elevation in mountain uplands in the south and eastern areas of the survey. Slopes range from 0 to 60 percent, but are predominately 10 to 30 percent. The climate is cold with cold long winters and short summers. Annual precipitation is 20 to 35 inches, most of which falls during the winter as snow. A small but significant amount of the precipitation falls during the summer growing season from thunder showers, especially in the higher elevations (above 7,000 feet) near the eastern edge of the survey area. The frost free growing season ranges from less than 30 days at the highest elevations to about 90 days at the lower elevations in most years.

The soils are mainly moderately deep (20 to 40 inches) with minor amounts deeper than 40 inches to a root limiting contact. The surface soil is a loam, or fine sandy loam, and is relatively free of surface coarse fragments greater than 3" in diameter. Some areas of this range site in the higher elevations have up to 40 percent surface coarse fragments of the 1/4" to 3" size. The subsurface soil (below about 10 to 20 inches) is a loam or clay loam and normally contains between 10 to 50 percent by volume coarse fragments which normally increase in amount as the slope percent increases. These soils are mainly over basalt or andesite bedrock. The plant available water holding capacity is normally moderate. The water runoff rate ranges from low on relatively flat areas to high on steeper areas on southerly aspects subject to more rapid snow melt. The potential erosion hazard is mainly moderate to high.

The potential plant community on this site consists of about 60 to 75 percent grasses and grasslike plants, 10 to 15 percent forbes, and 10 to 25 percent shrubs and trees. Of the grasses and grasslike plants, Idaho fescue makes up about 45 to 65 percent and bluebunch wheatgrass makes up about 2 to 10 percent of the plant community; needlegrass and bluegrass, 1 to 5 percent each; and bottlebrush squirreltail, 1 to 2 percent. Forbes include arrowleaf balsam-root, 2 to 8 percent; lupine, 1 to 4 percent; and other species which make up to 10 percent. Shrubs and trees include big sagebrush, 5 to 15 percent; western juniper, up to 10 percent; ponderosa pine and white fir, up to 5 percent each; and bitterbrush, rabbitbrush, mountain mahogany and bitter cherry, up to 2 percent each.

The estimated total production per acre of air dry vegetation is 1,900 pounds in favorable years, 1,400 pounds in normal years and 900 pounds in unfavorable years.

Range Site 16. Gravelly Coarse Loam, 10 to 16 inch precipitation zone

This range site occurs mainly in the northwest corner of the survey area at elevations of 4,200 to 5,000 feet. A volcanic pumice overburden blankets the area. Slopes are mainly between 0 to 15 percent but range up to 40 percent. The climate is cool and relatively dry with 10 to 16 inches of precipitation, most of which falls during the winter as snow. The frost free growing season is 80 to 110 days in most years.

The soils are mainly moderately deep (20 to 40 inches) to a root limiting contact of basalt bedrock or lava flow rock. This range site is mainly the result of a geologically recent thin pumice deposit over an older loamy soil. Where only 1 to 3 inches of pumice was deposited it has been intermixed with the loam to form a gravelly or very gravelly coarse sandy loam surface. The thicker pumice deposits on this range site remain relatively undisturbed and generally have a texture of gravelly coarse loamy sand or sand consisting totally of pumice. The subsoil, or, buried soil is normally a loam to a heavy clay loam and may contain from 5 to 70 percent by volume coarse fragments consisting mainly of basalt. The plant available water holding capacity is mostly moderate. The water runoff rate is low and the potential erosion hazard is low to moderate. These soils normally become dry and herbaceous plant growth ceases by mid July in most years.

The potential plant community on this site consists of about 45 to 65 percent grasses and grasslike plants, 10 to 20 percent forbes, and 25 to 45 percent shrubs and trees. Of the grasses and grasslike plants, bluebunch wheatgrass makes up about 30 to 45 percent and Idaho fescue makes up about 5 to 20 percent of the plant community; Thurbers needlegrass and bottlebrush squirreltail each make up 3 to 15 percent; bluegrasses, up to 10 percent; and wildrye, up to 6 percent. Forbes include arrowleaf balsam-root, 2 to 8 percent. Shrubs and trees include bitterbrush, 10 to 20 percent; big sagebrush, 5 to 20 percent; rabbitbrush, 5 to 15 percent; western juniper, 3 to 15 percent; mountain mahogany, up to 10 percent, shrubby buckwheat, 1 to 4 percent; and up to 2 percent ponderosa pine. Mountain mahogany may occassionally occur in large nearly solid stands as a topoedaphic climax.

The estimated total production per acre of air dry vegetation is 1,200 pounds in favorable years, 800 pounds in normal years and 500 pounds in unfavorable years.

Range Site 17. Stony Loam, 10 to 14 inch precipitation zone

This range site occurs on the Modoc Plateau Geomorphic Province on the northwest corner of the survey area and to the southeast of Clear Lake reservoir. Elevations range from 4,200 to 4,700 feet. The climate is cool and arid with 10 to 14 inches of precipitation, most of which falls during the winter as snow. Slopes are mainly 0 to 10 percent. The frost free growing season is 80 to 110 days in most years.

The soils are mainly moderately deep (20 to 40 inches) to a root limiting contact of basalt bedrock or silica duripan. The surface soil is a loam or light clay loam and normally contains between 10 to 30 percent surface fragments greater than 3 inches in diameter. The subsurface soil (below about 4-8 inches) is a clay loam to clay and normally contains less than 35 percent by volume coarse fragments. Water runoff is low to moderate and the plant available water holding capacity is moderate. The erosion hazard potential is low to moderate. These soils normally become dry and herbaceous plant growth ceases by mid July in most years.

The potential plant community on this site consists of about 50 to 65 percent grasses and grasslike plants, 10 to 15 percent forbes, and 20 to 30 percent shrubs and trees. Of the grasses and grasslike plants, bluebunch wheatgrass makes up about 35 to 55 percent and Idaho fescue and Thurbers needlegrass can each make up to 10 percent of the plant community; bluegrasses, 3 to 8 percent; and bottlebrush squirreltail, up to 5 percent. Forbes include arrowleaf balsam-root and mule ears, 2 to 5 percent each; and phlox species, buckwheat, lupine, hawksbeard and other species which together make up to 10 percent. Shrubs and trees include big sagebrush; 15 to 20 percent; bitterbrush and western juniper, up to 10 percent each; mountain mahogany, up to 15 percent; ponderosa pine, up to 2 percent; and other shrubs, up to 10 percent.

The estimated total production per acre of air dry vegetation is 1,200 pounds in favorable years, 700 pounds in normal years and 350 pounds in unfavorable years.

Range Site 18. Stony Loam, 14 to 20 inch precipitation zone

This range site occurs on scattered areas throughout the survey area at elevations of 4,300 to 5,800 feet. Slopes range from 0 to 50 percent, but are mostly 5 to 40 percent. The climate is cool with 14 to 20 inches of precipitation, most of which falls during the winter as snow. The frost free growing season is 80 to 110 days in most years.

The soils are mainly moderately deep (20 to 40 inches) to a root limiting contact of basalt bedrock or volcanic tuff. The surface soil is a loam or light clay loam and normally contains between 10 to 30 percent surface coarse fragments greater than 3 inches in diameter. The subsurface soil (below 3-6 inches) is a clay loam to clay and normally contains less than 35 percent by volume coarse fragments. Water runoff is moderate to rapid and the plant available water holding capacity is moderate. The erosion hazard potential is normally moderate to high. These soils normally become dry and herbaceous plant ceases by mid July in most years.

Th potential plant community on this site consists of about 55 to 65 percent grasses and grasslike plants, 10 to 15 percent forbes, and 25 to 35 percent shrubs and trees. Of the grasses and grasslike plants, Idaho fescue makes up about 35 to 45 percent and bluebunch wheatgrass makes up about 5 to 10 percent of the plant community; bluegrasses, 2 to 8 percent; Thurbers needlegrass, up to 5 percent; and bottlebrush squirreltail; up to 2 percent. Forbes include mule ears and hawksbeard which each make up 2 to 4 percent; lupine, 1 to 3 percent; aster, 1 to 2 percent; and arrowleaf balsam-root, western yarrow buckwheat, grounsel and other species which together make up to 10 percent. Shrubs and trees include big sagebrush, 15 to 20 percent; western juniper, up to 15 percent; mountain mahogany, up to 15 percent; bitterbrush, snowberry and ponderosa pine, up to 5 percent each; rabbitbrush, 1 to 2 percent; and other shrubs, up to 10 percent.

The estimated total production per acre of air dry vegetation is 1,500 pounds in favorable years, 1,000 pounds in normal years and 600 pounds in unfavorable years.

Range Site 19. Stony Loam, 20 to 35 inch precipitation zone

This range site occurs mainly in mountain uplands in the south and eastern areas of the survey area on southerly and westerly aspects above 5,500 feet elevation. Slopes are predominately 10 to 40 percent. The climate is cool with long cold winters and short warm summers. Annual precipitation averages 20 to 35 inches, most of which falls during the winter as snow. A small but significant amount of the precipitation falls during the summer growing season from thrunder showers, especially in the higher elevations (above 7,000 feet) near the eastern edge of the survey area. The frost free growing season is less than 30 days at the highest elevations to about 90 days at the lower elevations in most years.

The soils are mainly moderately deep (20 to 40 inches) to a root limiting contact of basalt or andesite bedrock, or conglomerated tuff. The surface soil is a loam or clay loam and normally contains between 15 to 35 percent surface coarse fragments greater than 3" in diameter. The subsurface soil (below 4 - 10 inches) is a loam, clay loam or clay and may contain between 10 to 80 percent by volume coarse fragments. Water runoff is moderate to rapid and the plant available water holding capacity is low to moderate. The erosion hazard potential is moderate to high.

The potential plant community on this site consists of about 55 to 70 percent grasses and grasslike plants, 10 to 15 percent forbes, and 15 to 30 percent shrubs and trees. Of the grasses and grasslike plants, Idaho fescue makes up about 40 to 50 percent of the plant community; bluebunch wheatgrass, 2 to 8 percent; bluegrasses, 1 to 5 percent, needlegrass and bromes, up to 3 percent each; and bottlebrush squirreltail, up to 2 percent. Forbes include arrowleaf balsam-root, 1 to 5 percent; mule ears, 2 to 4 percent, lupine, up to 2 percent; other species, up to 10 percent. Shrubs and trees include big sagebrush, 10 to 15 percent; western juniper, up to 15 percent; mountain mahogany, up to 10 percent; bitterbrush, white fir and ponderosa pine, up to 3 percent each; and rabbitbrush and snowberry, up to 2 percent each.

The estimated total production per acre of air dry vegetation is 1,700 pounds in favorable years, 1,200 pounds in normal years and 700 pounds in unfavorable years.

Range Site 23. Shallow Stony Clay

The majority of this range site occurs mainly in the south centeral portion of the survey area in mountain uplands at elevations of 4,400 to 5,800 feet. Slopes range from 0 to 60 percent but are mostly 5 to 40 percent. The climate is cool with 14 to 20 inches of percipitation, most of which falls during the winter as snow. The frost free growing season is 80 to 110 days in most years.

The soils are shallow (10 to 20 inches) in depth to a root limiting contact of soft volcanic tuff which weathers to clay. Some soils are over basalt bedrock. The surface soil is a heavy clay loam or clay and normally contains

between 10 to 35 percent (except in map units 150 and 137 which contains less than 10 percent) surface coarse fragments mostly greater than 3" in diameter. The subsurface soil (below 2-4 inches) is normally a clay and contains less than 35 percent by volume coarse fragments. Water runoff is moderate to very rapid and the plant available water holding capacity is low. The erosion hazard potential is moderate to very high. These soils normally become dry and herbaceous plant growth ceases by late June in most years.

The potential plant community on this site consists of about 55 to 75 percent grasses and grasslike plants, 5 to 20 percent forbes, and 15 to 30 percent shrubs and trees. Of the grasses and grasslike plants, mountain brome makes up about 20 to 40 percent and Idaho fescue makes up about 10 to 25 percent of the plant community; bluegrasses, 3 to 10 percent; wildrye, up to 10 percent; and bottlebrush squirreltail, 2 to 5 percent. Forbes include lomatium, 3 to 5 percent; hawksbeard, 2 to 4 percent; lupine, 1 to 3 percent; and other species, up to 15 percent. Shrubs and trees include low sagebrush, 2 to 15 percent; big sagebrush and western juniper, up to 10 percent each; shrubby buckwheat and bitterbrush, up to 4 percent each; ponderosa pine up to 5 percent; and rabbitbrush and squawapple, up to 3 percent each.

The estimated total production per acre of air dry vegetation is 1,100 pounds in favorable years, 900 pounds in normal years and 600 pounds in unfavorable years.

Range Site 24. Clay Basin

This range site occurs primarily on the Modoc Plateau Geomorphic Province at elevations of 4,400 to 6,000 feet on broad relatively flat concave alluvial depressions. Slopes are 0 to 2 percent. The climate is cool with annual precipitation normally in the 12 to 20 inch range which mostly falls as snow during the winter. The frost free growing season is 80 to 110 days in most years.

The soils range from moderately deep to deep (20 to 40 plus inches) and may be over a silica duripan, basalt bedrock, or deeper alluvium. The surface soil is normally a silty clay or clay and is essentially free of surface coarse fragements (except possibly along the periphery of the units). These soils normally have a high shrink-swell potential and are characterized by surface cracks of 1/2 to 3 inches in width and extending down at least 20 inches after the soils become dry. The subsurface soil (below about 1 to 5 inches) is a clay but commonly grades into a clay loam or gravelly clay loam below about 35 to 40 inches. Spring runoff water tends to pond in these areas. The plant available water holding capacity is usually moderate. Because of the heavy dense clay and its high shrink-swell potential these soils become very hard and dense as they dry out. Herbaceous plant rooting depth normally does not extend beyond about 15 to 20 inches and plants usually cease growth by late June or early July in most years.

The potential plant community on this site consists of about 35 to 55 percent grasses and grasslike plants, 5 to 15 percent forbes, and 20 to 40 percent shrubs. Of the grasses and grasslike plants, slender wheatgrass makes up about 15 to 35 percent and wildrye and mat muhly each make up about 5 to 10 percent of the plant community; sedges and rushes, up to 4 percent; bluegrasses and meadow barley, up to 2 percent each; and bottlebrush squirreltail up to 5 percent. Forbes include buckwheat and yampah, up to 2 percent each, biscuitroot and other species which together make up to 12 percent. Shrubs include silver sagebrush, 20 to 35 percent; and rabbitbrush and low sagebrush, up to 10 percent each.

The estimated total production per acre of air dry vegetation is 1,200 pounds in favorable years, 700 pounds in normal years and 300 pounds in unfavorable years.

Range Site 25. Semi-Wet Meadow

This range site occurs on small localized alluvial basins and drainages throughout the survey area at elevations of 4,400 to 6,400 feet. Slopes are 0 to 5 percent. The climate is cool and precipitation varies from 12 inches to over 20 inches and mostly falls as snow during the winter. The frost free growing season is 60 to 110 days in most years.

The soils are poorly drained and greater than 40 inches in depth over basalt bedrock or deeper alluvium. The surface soil is normally a silty clay loam or clay loam, dark in color, and relatively free of coarse fragments. The subsurface soil (below about 4-8 inches) is normally a silty clay loam, clay loam, or clay with 0-35 percent by volume coarse fragments. The soils commonly have a perched watertable within about 2 to 3 feet of the surface. Because of the perched water table and the capillary action of the soil water, the soil has a natural sub-irrigation system which greatly affects the plant community and increases production yields. The plants in this range site normally stay green and growing throughout the growing season.

The potential plant community on this site consists of about 60 to 80 percent grasses and grasslike plants, 10 to 20 percent forbes, and 0 to 30 percent, shrubs and woody plants. The grasses and grasslike plants consist of sedges, rushes, wildryes, bluegrasses, wheatgrasses, barleys, timothy, mat muhly and spikerush which together makes up 60 to 80 percent of the total plant commu-

nity. Forbes include clover, western yarrow, iris, cinquefoil and other species which together make up 10 to 20 percent.

Shrubs and trees include willow, silver sagebrush, wildrose, quaking aspen and others which together can make up to 30 percent.

The estimated total production per acre of air dry vegetation is 5,500 pounds in favaorable years, 3,850 pounds is normal years and 2,200 pounds in unfavorable years.

Range Site 26. Wet Clay Basin

This range site occurs primarily on the Modoc Plateau Geomorphic Province at elevations of 4,400 to 6,000 feet on broad nearly level concave alluvial basins. Slopes are 0 to 2 percent. The climate is cool with annual precipitation normally in the 12 to 20 inch range which falls as snow during the winter. The frost free growing season is 80 to 110 days in most years.

The soils are mainly poorly drained, and are greater than 40 inches in depth over basalt bedrock, or deeper alluvium. The surface soil is normally a silty clay or clay texture and black or grayish in color and free of coarse fragments. The subsurface soil (below about 1 to 5 inches) is a clay but commonly grades into a gravelly clay loam or clay loam below about 35 to 40 inches. Spring runoff waters during normal or wet years collect in these clay basins for extended periods of time into the growing season thereby strongly influencing the vegetative composition and production yields. The soils normally remain moist and surface cracking, therefore, is not in evidence until about September or October. In some areas excessive salt concentrations have resulted through capillary action of soil water rising to the surface, then being evaporated leaving the salts behind. These areas can normally be identified by a thin whitish salt crust on the soil surface and/or the growth of salt tolerant plants such as inland saltgrass, kochia, or foxtail barley. Eventually these saline areas may become nonproductive as the salt concentrations continue to increase.

The potential plant community on this site consists of about 85 to 95 percent grasses and grasslike plants, and 5 to 15 percent forbes. The grasses and grasslike plants consit of spikerush, rushes, mat muhly, sedges, Nevada bluegrass and foxtail barley which together makesup 85 to 95 percent of the total plant community. The remainder of this plant community is composed of various forb species and constitute 5 to 15 percent.

The estimated total production per acre of air dry vegetation is 2,000 pounds in favorable years, 1,250 pounds in normal years and 500 pounds in unfavorable years.

Water Runoff Potential. This rating indicates the relative velocity of surface water runoff over a soil type and its associated map unit under natural vegetative conditions. Factors considered in rating runoff were slope, average length of slope and hydrologic soil groups. Velocity of runoff directly affects surface soil erosion by water, and, therefore, becomes an important parameter in predicting surface erosion, gullying, and channel scouring. This also becomes an important parameter for proper design of structures such as culverts, bridges, dams, spillways, and roads. The Water Runoff Potential also gives a good indication of the relative amount of soil water recharge a soil might receive for plant growth and soil development.

The five classes of water runoff and their definitions are:

Very Slow. Free water lies on the surface for long periods or enters immediately into the soil. Velocity is such that erosion by runoff would be minimal.

Slow. Free water covers the soil for significant periods or enters the soil rapidly; a large part of the water passes throught the profile or evaporates into the air. The velocity is such that erosion by runoff would normally be only of slight concern.

Moderate. Surface water flows away at such a rate that a moderate proportion of the water enters the soil profile and free water lies on the surface for only short periods. With moderate runoff, the loss of water over the surface does not reduce seriously the supply available for plant growth. The velocity of the runoff is such that erosion by runoff could present a moderate to serious concern.

Rapid. A large proportion of the percipitation moves rapidly over the surface of the soil and a small part moves through the soil profile. Surface water runs off nearly as fast as it is added. The rapid velocity of the runoff would pose a serious concern to soil erosion by runoff.

Very Rapid. Most of the water moves very rapidly over the surface of the soil and only a very small part moves through the soil profile. The very rapid velocity of the runoff could result in very severe erosional problems.

Natural Watershed Sensitivity. This rating was developed as a method to help set watershed threshold levels for cumulative watershed impact analysis. It rates the potential of the map unit to contribute to water runoff and determines how rapidly it will respond with

runoff from a given storm event or spring melt, and its sensitivity to erosion and slope stability. To determine natural watershed sensitivity rating by watershed, a proportionate rating is used based on area percentage of each soil map unit within the watershed. An overall watershed adjective rating of low, moderate, high or very high is only relative to the soils and watersheds in this survey area and is used as an indicator to help set the final cumulative watershed threshhold level for a particular watershed.

The four natural watershed sensitivity ratings indicate the level of sensitivity by mapping unit and ultimately by whole watersheds when the above analysis is determined. The sensitivity is low if a large amount of disturbance can be tolerated before off-site degradation occurs, Moderate if a moderate amount of disturbance can be tolerated, and High or Very High if corresponding lower amounts of watershed disturbance can be tolerated before off-site watershed degradation is expected to occur.

Hydrologic Soil Groups. are used to estimate relative amounts of runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

Available Water Holding Capacity (AWC) Rating. This available water holding capacity rating refers to the quantity of water that the whole soil is capable of storing for use by plants. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, soil mineralogy, kind and volume of rock fragments, bulk density, and soil structure. Available water holding capacity is an important factor in determining the chance of conifer seedling survival and in the choice of plants to be seeded in range or wildlife vegetation manipulation projects or watershed stabilization or imporvement work. Available water holding capacity is not an estimate of the quantity of water actually available to plants at any given time. The capacity for water storage is given as an adjective rating and includes the whole soil depth to 60 inches or to a root restricting contact if shallower. Total soil depth will always include a range in depth as shown under **effective rooting depth in inches and type of underlying material**. This range in depth will often result in a range in AWC adjective ratings such as very low to low, or low to moderate, and so on. The adjective ratings represent the plant available water in inches of water for the whole soil depth and are as follows: Very Low, 0.6 to 1.5 inches; Low, 1.5 to 3.5 inches; Moderate, 3.5 to 6.5 inches; and High, 6.5 plus inches.

Inches of AWC in Top 20 inches of Soil or to a root limiting depth, if shallower. This available water holding capacity rating shows only the total plant available water in inches in the top 20 inches of soil or to a root limiting depth, if shallower. This represents a major factor in determining the **chance of seedling survival rating** of the map unit descriptions, characteristics and interpretations for management.

Susceptibility to Burning Damage. Soil damage can sometimes occur from burning. The risk of damage increases with the intensity of heat. The damage is mainly related to the loss of organic matter and actual soil loss by erosion. Some soils and soil map units have characteristics which enable them to withstand this loss better than other soils and map units. These characteristics are used to rate the soils for their susceptibility to broadcast-burn damage. The soil factors used were soil erosion hazard maximum, allowable soil loss, organic matter content, nutrient distribution in the soil profile, surface texture and percentage of rock fragments. Topographic features used were slope and aspect.

There are three levels of risk used. The susceptibility to

burning damage is Low if only minimal soil damage is expected through a properly planned and implemented prescribed broadcast burn, Moderate if moderate soil damage is expected to occur unless some intensive measures are planned for and implemented, and High if excessive soil damage is expected unless intensive and more expensive measures are incorporated in a prescribed broadcast burn.

Slope Stability Hazard Rating. Slope stability, as used here, is an estimate of the stability behavior of landscapes. All categories from slow creep to rapid mass movement are included. The ratings of high, moderate and low are used to indicate levels of risk. Soil and map unit factors used in this rating process were steepness of slope, fine-textured subsoils with soil strength (R-value ratings in the 0-30 range), soil underlain by nearly impervious material, and units with evidence of past slope stability failure.

Allowable Soil Loss in Tons/Acre/Year. This is also referred to as the T factor in the Universal Soil Loss Equation (USLE). The T factor is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year. Values of 1, 2, 3 or 5 are used and are based on total soil depth over renewable or non-renewable substrata material. These numbers represent the permissible tons of soil loss per acre per year where food, feed, and fiber plants are to be grown. Only inconclusive data is available to test the validity of these values for forested soils and their corresponding intensities of management. It is felt at this time, however, that these values should also be representative for forest soils in this survey area.

Chance of Seedling Survival. The chance of Seedling Survival rating is a relative rating of the potential for survival of bare root conifer seedlings in clearcut areas the first season following planting (2). Adequate soil moisture appears to be the most limiting factor effecting the biological health and survival of first year planted conifer seedlings in this survey area. This rating, therefore, confined itself to those factors directly related to conifer seedling moisture supply and demand.

Moisture supply is expressed in terms of AWC in the top 20 inches of the soil which is that portion of the soil profile potentially utilized by the seedling root system during its first growing season. The top 2 inches of the seedling root zone was not included in the moisture supply due to very high solar radiation intensities which result in the rapid drying of the soil.

Moisture demand by the tree is expressed as the seasonal evapo-transpiration use expected under the climatic conditions prevaling on the site. Climatic conditions in turn are influenced by geographic location and topographic features of the site. These variables are considered in the computation of water use in inches.

The difference between moisture supply and moisture demand is the water balance. This water balance is an expression of the relative plant moisture stress experienced by the seedlings assuming there is no vegetative competition. The seedling survival rating is high if the calculated water balance is greater than 1.5 inches, Moderate if the water balance is between 0.8 and 1.5 inches, Low if between 0.3 and 0.8 inches, and Very Low if the calculated water balance is less than 0.3 inches. High is defined as having a good survival potential and will require none to minor mitigating measures. Moderate is defined as having a fair survival potential and may require some mitigating measures on high elevation soils or on sites with high evaportranspiration potentials. Low is defined as having a poor survival potential without mitigating measures. It will require considerable effort to change plant moisture stress and/or edaphic conditions to insure adequate survival. These soils have one or more severely limiting factors: Low AWC, high rock fragment content, limiting soil depth, southeast to west exposures or wind swept high elevation soils. Very Low is defined as having a very poor survival potential without mitigating measures. Numerous planting failures are likely. It will require many and expensive measures to modify the plant stress and edapic conditions to insure adequate survival. These soils have a number of severely limiting factors which may include: shallow soils, very low AWC, very high rock fragment content, southeast to west exposures, or severe windswept high elevation soils.

Rating for Timber Site Preparation, Plantability, and Climatic Concerns. This rating was developed as a means of alerting foresters to some of the important soil physical factors and climatic considerations as related to soil type and soil map units capable of commercial timber production. Its intent is to help foresters in their decisions concerning types of equipment or methods for site preparation and planting.

There are three ratings: Good - means there are no serious soil or climatic concerns relating to the above decisions. Fair - means there are some serious soils and/or climatic concerns. Poor - means there are some very serious soil and/or climatic concerns related to the above decisions. The fair and poor ratings are qualified by one or more soil or climatic concern numerical modifiers. The good rating may have #11 as a climatic concern numerical modifier.

Following is a brief description of the numerical modifiers that follow the adjective ratings in the mapping unit descriptions:

[1] Surface stones and boulders (greater than 10" diamenter) and rock outcrop 8-15% of area.

[2] Surface stones and boulders (greater than 10" diameter) and rock outcrop >15% of area.

[3] 30-60% coarse fragments (greater than 3/4" diameter) in top 20 inches of soil.

[4] 60+% coarse fragments (greater than 3/4" diameter) in top 20 inches of soil.

[5] 4-20" pumice overburden (includes pumice sands and gravels, cinders, ash).

[6] 20+ inches of pumice overburden (includes pumice sands and gravels).

[7] 20-40" to a root-restricting layer.

[8] 40-60% slope gradient (35-60% in some map units).

[9] 60+% slope gradient.

[10] Hot, dry summers and marginal to moderate precipitation (16-25" precipitation zone).

[11] Hot, dry summers and marginal precipitation (16-20" precipitation zone) and normally on southeast to west aspects.

[12] Reduced growing season and generally exposed, windy conditions (normally found at elevations of 7,000-8,000 feet).

[13] Severely reduced growing season in cold, very windy conditions (normally above 8,000 feet elevation on the eastern edge of the survey area). These conditions normally restrict tree growth to less than 20 cubic feet per acre per year.

Estimated Engineering Properties. The estimated engineering properties rated in this soil survey are R-value and the Unified and AASHTO ratings.

R-Value. The R-value (resistance value) engineering test (5) was designed as a method of evaluating treated and untreated materials for use as base, subbase, and subgrade road material. The higher the R-value, the more structurally sound the material is and the more applications it has for road material. Each soil family was rated as having either a 0-30, 30-60, or 60+ R-value by its particle size classification.

An R-value rating of 0-30 indicates low soil strength. Probable soil types in the Unified Soil Classification System would include clayey sands, clayey silts, sandy clay, silty clay and heavy clay. Its probable use in structural section would include imported borrow, selected material or basement soil.

An R-value rating of 30-60 indicates soils with moderate soil strength. Probable soil types in the Unified Soil Classification System would include silty sands, clayey sands, sandy silt, silt and clayey silt. Its probable use in structural section would include aggregate base, imported borrow, selected material and basement material.

An R-value rating of 60+ indicates soils with high soil strength. Probable soil types in the Unified Soil Classification System would include sand, clayey gravel, silty gravel, sandy gravel, gravel and crushed rock. its probable use in structural section would include aggregate base, aggregate subbase and selected material.

Unified and AASHTO classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials (1) and the Unified Soil Classification System (3).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection. The A-1 and A-2 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6 and A-2-7.

101 AIKMAN FAMILY, 0 to 2 percent slopes

Map Unit Components	**Aikman family (75 percent)**
Position, Slope, and Elevation	On alluvial basins of basalt plateaus, (subject to spring flooding); 0 to 2 percent slopes; 4300 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Silver sagebrush, low sagebrush, sedges, forbes, grasses; 14 to 20 inches ppt.
Surface Layer	0 to 4 inches; dark gray and dark grayish brown silty clay, granular and platy structure; very hard, pH 6.6 to 7.0.
Substratum	4 to 60 inches; dark grayish brown and grayish brown silty clay, prismatic and blocky structure to massive, very hard to extremely hard, pH 7.0 to 7.4.
Rooting Depth (in.) to Underlying Material	40 plus; clayey alluvium
Erosion Factor (K)	.37
Max. Erosion Hazard	Moderate
Soil Permeability	Very slow
Drainage Class	Moderately well drained
Soil Manageability Class	2ew
Group	II
Forest Site Class	7 (non-commercial)
Range Site	24, 26
Water Runoff Potential	Very Slow
Watershed Sensitivity	6 (Moderate)
Hydrologic Soil Group	D
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.6 inches
Susceptibility to Burning Damage	Low
Slope Stability Hazard	Low
Allowable Soil Loss	5 tons/acre/year
Chance of Seedling Survival	Not Rated
Rating for Timber Site	Not Rated
R-Value	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-60; Silty clay Unified: CH AASHTO: A-7
Included Areas:	Included with this soil in mapping and making up about 25 percent of the acreage are the Barnard, Cardon, Packwood, Bieber, Dishner, Keating and Jacknife families.

102 AIKMAN-CARDON FAMILIES COMPLEX, 0 to 2 percent slopes

Map Unit Components	Aikman family (50 percent)	Cardon family (35 percent)
Position, Slope, and Elevation	On alluvial basins and flood plains (subject to spring flooding), 0 to 2 percent slopes; 4600 to 5500 feet.	On alluvial basins and flood plains (subject to spring flooding), 0 to 2 percent slopes; 4600 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Silver sagebrush, sedges, forges, grasses; 14 TO 18 inches ppt.	Sedges, forbes, grasses, 14 to 18 inches ppt.
Surface Layer	0 to 4 inches; dark gray and dark grayish brown silty clay, granular and platy structure; very hard, pH 6.6 to 7.0.	0 to 4 inches; very dark gray clay, black, moist, platy and blocky structure, hard, pH 6.8.
Substratum	4 to 60 inches; dark grayish brown and grayish brown silty clay, prismatic and blocky structure to massive, very hard to extremely hard, pH 7.0 to 7.4.	4 to 36 inches; dark gray clay, very dark gray, moist, prismatic and angular blocky structure, extremely hard, ph 6.8: over 36 to 60 inches; mottled grayish brown, light brownish gray to olive yellow clay and clay loam, blocky structure, hard to very hard, pH 7.0 to 7.2.
Rooting Depth (in.) to Underlying Material	40 plus; clayey alluvium	40 plus; clayey alluvium
Erosion Factor (K)	.37	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Very slow	Very slow
Drainage Class	Moderately well drained	Somewhat poorly drained
Soil Manageability Class Group	2ew II	3ew
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	24, 26	26, 25
Water Runoff Potential	Very Slow	Very Slow
Watershed Sensitivity	6 (moderate)	6
Hydrologic Soil Group	D	D
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.6 inches	Moderate to High 2.6 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	5 tons/acre/year	5 tons/acre/year
Rating for Timber Site	Not Rated	Not Rated
R-Value	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-60; Silty clay Unified: CH AASHTO: A-7	0-36; Clay Unified: CH AASHTO: A-7 36-46; Clay and clay loam Unified: CH, CL, MH AASHTO: A-6, A-7 46-60; Clay Unified: CH AASHTO: A-7

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage are the Barnard, Bieber, Jacknife, and Deven families and unnamed aquolls and aquents.

103 AIKMAN-BARNARD FAMILIES ASSOCIATION, 0 to 2 percent slopes

Map Unit Components	Aikman family (50 percent)	Barnard family (30 percent)
Position, Slope, and Elevation	On alluvial basins on basalt plateaus (subject to spring flooding), 0 to 2 percent slopes; 4400 to 6000 feet.	On outer edges of alluvial basins on basalt plateaus; 1 to 2 percent slopes; 4400 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Silver sagebrush, sedges, forbes, grasses; 12 to 16 inches ppt.	Big sagebrush, low sagebrush, forbes, cheatgrass, other grasses; 12 to 16 inches ppt.
Surface Layer	0 to 4 inches; dark gray and dark grayish brown silty clay, granular and platy structure; very hard, pH 6.6 to 7.0.	0 to 8 inches; grayish brown to dark grayish brown cobbly loam to gravelly clay loam, platy and blocky structure, slightly hard, pH 6.5 to 7.0.
Substratum	4 to 60 inches; dark grayish brown and grayish brown silty clay, prismatic and blocky structure to massive, very hard to extremely hard, pH 7.0 to 7.4.	32 plus inches; weakly to strongly cemented silica durapan.
Rooting Depth (in.) to Underlying Material	20 to 40 plus; clayey alluvium, basalt	20 to 40; silica duripan over basalt
Erosion Factor (K)	.37	.37
Max. Erosion Hazard	Moderate	Low
Soil Permeability	Very slow	Slow
Drainage Class	Moderately well drained	Well drained
Soil Manageability Class	2ew	1
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	24, 26	18, 17
Water Runoff Potential	Very Slow	Slow
Watershed Sensitivity	6 (Moderate)	6
Hydrologic Soil Group	D	C
Available Water Capacity (AWC)	Low to High	Low to Moderate
Upper 20 inches	2.6 inches	2.6 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	2-5 tons/acre/year	2 tons/acre/year
Rating for Timber Site	Not Rated	Not Rated
R-Value	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-60; Silty clay Unified: CH AASHTO: A-7	0-3; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 3-8; Gravelly clay loam Unified: CL AASHTO: A-6, A-7 8-32; Gravelly silty clay Unified: CH AASHTO: A-7 32+; Silica duripan
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Bieber, Packwood, Puls, Deven and Cardon families, unnamed Xerofluvents and aquents.	

Alcot family, pumice overburden phase (65 percent)

Map Unit Components	
Position, Slope, and Elevation	On undulating basalt plateaus covered with a moderately deep deposit of recent pyroclastic pumice; 1 to 10 percent slopes; 4400 to 4800 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, bitterbrush, rabbitbrush, big sagebrush, Ross's sedge, grasses; 20 to 25 inch ppt.
Surface Layer	1 to 0 inches; ponderosa pine needles and twigs, over 20 inches of pumice overburden consisting of grayish brown gravelly coarse loamy sand grading to a very pale brown extremely gravelly coarse sand. (Pumice thickness ranges from 20 to 40 inches) OVER 20 to 33 inches; light yellowish brown very gravelly sandy loam, subangular blocky structure, soft, pH 6.8.
Substratum	33 to 60 plus inches; brownish yellow and light yellowish brown very gravelly sandy loam and very gravelly loamy sand, massive, soft, pH 6.4.
Rooting Depth (in.) to Underlying Material	40 plus; cinders, basalt
Erosion Factor (K)	.15
Max. Erosion Hazard	Low
Soil Permeability	Rapid in the pumice overburden to moderately rapid below.
Drainage Class	Somewhat excessively drained
Soil Manageability	
Class	3P
Group	III
Forest Site Class	5 (3-4)
Range Site	Not placed in a range site.
Water Runoff Potential	Very slow
Watershed Sensitivity	9 (Low)
Hydrologic Soil Group	A
Available Water Capacity (AWC)	Moderate to high
Upper 20 inches	2.5 inches
Susceptibility to Burning Damage	High
Slope Stability Hazard	Low
Allowable Soil Loss	3 tons/acre/year
Rating for Timber Site	Fair (6)
R-Value	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Gravelly loamy coarse sand Unified: SW-SM, SM AASHTO: A-1-b 6-20; Extremely gravelly coarse sand Unified: GP, GW-GM AASHTO: A-1-a, A-1-b 20-53; Very gravelly sandy loam Unified: GM-GC AASHTO: A-2-4 53-60; Very gravelly loamy sand Unified: GM AASHTO: A-1-b, A-2-4
Included Areas:	Included with this soil in mapping and making up about 30 percent of the acreage are the Menzel family, unnamed cindery over loamy, mixed, and cindery over medial-skeletal, mesic soils. Alcot soils with deeper and shallower depths of pumice overburden, and rock outcrop.

105 ALCOT FAMILY, 40 to 60 inch pumice, 5 to 35 percent slopes

Map Unit Components	**Alcot family, pumice phase (75 percent)**
Position, Slope, and Elevation	On volcanic mountain sideslopes and toeslopes which have been covered with a deep deposit of recent pyroclastic pumice; 5 to 35 percent slopes; 4600 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Sparsely stocked Jeffrey pine, ponderosa pine, white fir, greenleaf manzanita, bitterbrush, rabbitbrush, squaw carpet, Columbia needlegrass, Ross's sedge, other grasses: 16 to 25 inches ppt.
Surface Layer	1 to 0 inches; ponderosa pine needles mixed with pumice gravels, over 0 to 4 inches; dark grayish brown very gravelly loamy sand (pumice), single grained, loose, pH 6.4.
Substratum	4 to 60 inches; light gray to white extremely gravelly coarse sand (pumice), single grained, loose, pH 6.6.
Rooting Depth (in.) to Underlying Material	40 plus; pumice, cinders, basalt
Erosion Factor (K)	.15
Max. Erosion Hazard	Low to moderate
Soil Permeability	Rapid
Drainage Class	Somewhat excessively drained
Soil Manageability Class Group	 3eP III
Forest Site Class	6-7 (4 to non-commercial)
Range Site	Not placed in a range site.
Water Runoff Potential	Very Slow
Watershed Sensitivity	9 (Low)
Hydrologic Soil Group	A
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.5 inches
Susceptibility to Burning Damage	High
Slope Stability Hazard	Low
Allowable Soil Loss	3 tons/acre/year
Rating for Timber Site	Fair (6, 10)
R-Value	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Very gravelly loamy sand Unified: GM, SM AASHTO: A-1-b, A-2-4 4-60; Extremely gravelly sand Unified: GP, GW-GM AASHTO: A-1-a, A-1-b
Included Areas:	Included with this soil in mapping and making up about 25 percent of the acreage are Neer and Skalan families and unnamed cindery over medial, and cindery over medial-skeletal, mesic soils, Lithic Xerorthents, mesic, and rock outcrop.

106 ALCOT-NEER FAMILIES ASSOCIATION, 10 to 20 inch pumice overburden, 5 to 30 percent slopes

Map Unit Components	**Alcot family, pumice overburden phase (50 percent)**	**Neer family (25 percent)**
Position, Slope, and Elevation	On smooth sideslopes and concave areas of undulating volcanic mountain uplands; 5 to 20 percent slopes; 4400 to 5300 feet.	On upper sideslopes, ridges and knolls of volcanic mountain uplands; 10 to 30 percent slopes; 4400 to 5300 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, bitterbrush, big sagebrush, greenleaf manzanita, rabbitbrush, Ross's sedge, grasses; 16 to 25 inches ppt.	Ponderosa pine, Jeffrey pine, bitterbrush, big sagebrush, greenleaf manzanita, rabbitbrush, Ross's sedge, grasses; 16 to 25 inches ppt.
Surface Layer	1 to 0 inches; ponderosa pine needles and twigs, over 20 inches of pumice overburden consisting of grayish brown gravelly coarse loamy sand grading to very pale brown extremely gravelly coarse sand. (Pumice thickness ranges from 10 to 20 inches.) OVER 20 to 33 inches; light yellowish brown very gravelly sandy loam, subangular blocky structure, soft, pH 6.8.	1 to 0 inches of ponderosa pine needles and twigs, over 18 inches of pumice overburden consisting of 5 inches of grayish brown gravelly coarse loamy sand over 13 inches of very pale brown extremely gravelly coarse sand. (Pumice thickness ranges from 10 to 20 inches.) OVER 18 to 22 inches; yellowish brown very gravelly sandy loam, granular structure, slightly hard, pH 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; cinders, basalt	40 plus; basalt, andesite
Erosion Factor (K)	.15	.15
Max. Erosion Hazard	Low to moderate	Low to moderate
Soil Permeability	Rapid in the pumice overburden to moderately rapid below.	Rapid in the pumice overburden to moderately rapid below.
Drainage Class	Somewhat excessively drained	Well Drained
Soil Manageability Class	2ep	2ep
Group	II	
Forest Site Class	6 (4-5)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very slow	Very Slow
Watershed Sensitivity	9 (Low)	9
Hydrologic Soil Group	A	A
Available Water Capacity (AWC) Upper 20 inches	Moderate to high 2.5 inches	Moderate to High 2.5 inches
Susceptibility to Burning Damage	High	High
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Rating for Timber Site	Fair (5,10)	Fair (5,10)
R-Value	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Gravelly loamy coarse sand Unified: SW-SM, SM AASHTO: A-1-b 6-20; Extremely gravelly coarse sand Unified: GP, GW-GM AASHTO: A-1-a, A-1-b 20-53; Very gravelly sandy loam Unified: GM-GC AASHTO: A-2-4 53-60; Very gravelly loamy sand Unified: GM AASHTO: A-1-b, A-2-4	0-5; Gravelly loamy coarse sand Unified: SW-SM, SM AASHTO: A-1-b 5-18; Extremely gravelly coarse sand Unified: GP, GW-GM AASHTO: A-1-a, A-1-b 18-28; Very gravelly coarse sand and very cobbly sandy loam Unified: GM-GC AASHTO: A-2-4 28-60; Extremely cobbly coarse sandy loam Unified: GM, GW-GM AASHTO: A-1-b
Included Areas:	Included with these soils in mapping and making up about 25 percent of the acreage is the Menzel family, Lithic Xerorthents, mesic, rock outcrop, and Alcot soils with a deeper pumice overburden.	

107 ALCOT-SADIE FAMILIES COMPLEX, 1 to 20 percent slopes

Map Unit Components	Alcot family (45 percent)	Sadie family (35 percent)
Position, Slope, and Elevation	On undulating basalt plateaus and sideslopes of volcanic cinder cones; 1 to 20 percent slopes; 4400 to 5500 feet.	On undulating basalt plateaus and sideslopes of volcanic cinder cones; 1 to 20 percent slopes; 4400 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Mixed conifer forest of ponderosa pine, white fir, sugar pine, incense-cedar, plus greenleaf manzanita, snowberry, ceonothus, Ross's sedge, grasses; 20 to 30 inches ppt.	Mixed conifer forest of ponderosa pine, white fir, sugar pine, incense-cedar, plus greenleaf manzanita, snowberry, ceonothus Ross's sedge, grasses; 20 to 30 inches ppt.
Surface Layer	1 to 0 inches of white fir and ponderosa pine needles and twigs, over 0 to 9 inches; brown and yellowish brown gravelly to very gravelly light sandy loam, granular structure, soft, pH 6.6.	2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 5 inches; yellowish brown gravelly sandy loam, granular structure, soft, pH 7.0.
Substratum	9 to 60 inches; light yellowish brown very gravelly light sandy loam, weak subangular blocky and massive structure, soft, pH 6.4.	19 to 50 inches; brownish yellow gravelly coarse sandy loam, massive, pH 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; volcanic ash, cinders, basalt	40 plus; volcanic ash, cinders, basalt
Erosion Factor (K)	.20	.20
Max. Erosion Hazard	Low to Moderate	Low to moderate
Soil Permeability	Moderately rapid	Moderately Rapid
Drainage Class	Somewhat excessively drained.	Well drained.
Soil Manageability Class	2e	2e
Group	II	
Forest Site Class	3 (1-3)	3 (1-3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very Slow	Very slow
Watershed Sensitivity	9 (Low)	9
Hydrologic Soil Group	A	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.6 inches	Moderate to High 2.7 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Rating for Timber Site	Good	Good
R-Value	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Gravelly sandy loam Unified: SM, SM-SC AASHTO: A-2-4, A-4 4-60; Very gravelly sandy loam Unified: GM, GM-GC AASHTO: A-2-4	0-5; Gravelly sandy loam Unified: SM, SM-SC AASHTO:A-2-4 5-50; Gravelly coarse sandy loam Unified: SM AASHTO: A-1-b 50+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Zynbar, Germany and Elmore families, Lithic Xerumbrepts, mesic, rock outcrop, lava flow rock and unnamed soils similar to the Germany family but medial-sketetal.	

108 ALCOT-MENZEL FAMILIES COMPLEX, 10 to 20 inch pumice overburden, 1 to 10 percent slopes

Map Unit Components	**Alcot family, pumice overburden phase (45 percent)**	**Menzel family, (40 percent)**
Position, Slope, and Elevation	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 4600 feet.	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 4600 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, bitterbrush, big sagebrush, rabbitbrush, Pholox spp., buckwheat, Ross's sedge, bottlebrush, needlegrass, cheatgrass; 16 to 20 inches ppt.	Ponderosa pine, bitterbrush, big sagebrush, rabbitbrush, Pholox spp., buckwheat, Ross's sedge bottlebrush, needlegrass, cheatgrass; 16 to 20 inches ppt.
Surface Layer	1 to 0 inches; ponderosa pine needles and twigs, over 20 inches of pumice overburden consisting of grayish brown gravelly coarse loamy sand grading to very pale brown extremely gravelly coarse sand (pumice thickness ranges from 10 to 20 inches) OVER 20 to 33 inches; light yellowish brown very gravelly sandy loam, subangular blocky structure, soft, pH 6.8	1/2 to 0 inches of ponderosa pine needles and pumice gravel pavement, over 14 inches of pumice overburden consisting of grayish brown gravelly coarse sand grading to very pale brown extremely gravelly coarse sand (pumice thickness ranges from 10 to 20 inches) OVER 14 to 18 inches; yellowish brown gravelly sandy loam, granular and blocky structure, soft, pH 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; volcanic ash, cinders, basalt	40 plus; volcanic ash, cinders, basalt
Erosion Factor (K)	.15	.15
Max. Erosion Hazard	Low	Low
Soil Permeability	Rapid in the pumice overburden over moderately rapid below	Rapid in the pumice overburden over moderately rapid below
Drainage Class	Somewhat excessively drained SOIL MANAGEABILITY: CLASS: 2p GROUP: II	Well drained. SOIL MANAGEABILITY: CLASS: 2p
Forest Site Class	5 (3-4)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very Slow	Very Slow
Watershed Sensitivity	9 (Low)	9
Hydrologic Soil Group	A	A
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.5 inches	Moderate to High 2.5 inches
Susceptibility to Burning Damage	Moderate to High	Moderate to High
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Rating for Timber Site	Fair (5,10)	Fair (5,10)
R-Value	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Gravelly loamy coarse sand Unified: SW-SM, SM AASHTO: A-1-b 6-20; Extremely gravelly coarse sand Unified: GP, GW-GM AASHTO: A-1-a, A-1-b 20-53; Very gravelly sandy loam Unified: GM-GC AASHTO: A-2-4 53-60; Very gravelly loamy sand Unified: GM AASHTO: A-1-b, A-2-4	0-4; Gravelly coarse sand Unified: SP, SW-SM AASHTO: A-1-b 4-14; Extremely gravelly coarse sand Unified: GP, GW-GM AASHTO: A-1-a, A-1-b 14-44; Gravelly sandy loam Unified: SM, SM-SC AASHTO: A-2-4 44-60; Very gravelly sandy loam Unified: SM, SM-SC, GM-GC AASHTO: A-2-4
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Holland and Skalan families and rock outcrop.	

109 ALICEL FAMILY, 5 to 25 percent slopes

Map Unit Components	**Alicel family (80 percent)**
Position, Slope, and Elevation	On rolling foothills and alluvial fans; 5 to 25 percent slopes; 4200 to 5000 feet.
Typical Vegetation and Precipitation (ppt)	Few western juniper, big sagebrush, rabbitbrush, bitterbrush, Chrycopsis spp., cheatgrass, crested wheatgrass, Idaho fescue, bottlebrush, thurbers needlegrass, sandberg bluegrass; 10 to 14 inches ppt.
Surface Layer	0 to 38 inches; brown gravelly loam and loam, granular to massive structure, slightly hard, pH 6.4 to 7.0.
Substratum	38 to 45 inches; light yellowish brown gravelly fine sandy loam, massive, hard, pH 7.0.
Rooting Depth (in.) to Underlying Material	30 plus; basalt, andesite
Erosion Factor (K)	.32
Max. Erosion Hazard	Low to moderate
Soil Permeability	Moderate
Drainage Class	Well drained
Soil Manageability Class Group	 2e II
Forest Site Class	7 (non-commercial)
Range Site	12
Water Runoff Potential	Slow
Watershed Sensitivity	8 (Low)
Hydrologic Soil Group	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 3.0 inches
Susceptibility to Burning Damage	Low
Slope Stability Hazard	Low
Allowable Soil Loss	3 tons/acre/year
Rating for Timber Site	No Rated
R-Value	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-38; Gravelly loam and loam Unified: ML-CL AASHTO: A-4 38-45; Gravelly fine sandy loam Unified: SM-SC, ML-CL AASHTO: A-2-4, A-4 45+; Unweathered bedrock
Included Areas:	Included with this soil in mapping and making up about 20 percent of the acreage are the Cowiche, Wrentham, Supan, Alcot and Stukel families, Lithic Xerorthents, mesic, and Rock outcrop.

110 ANATONE-BEARSKIN FAMILIES-ROCK OUTCROP ASSOCIATION, 40 to 70 percent slopes

Map Unit Components	Anatone family (35 percent)	Bearskin family (30 percent)	Rock outcrop (15 percent)
Position, Slope, and Elevation	Mainly on southerly aspects of upper sideslopes, ridges and knolls of mountain uplands; 40 to 70 percent slopes; 5500 to 7000 feet.	Mainly on southerly aspects of sideslopes of mountain uplands; 40 to 60 percent slopes; 5500 to 7000 feet.	On ridges, knolls and scarp breaks of mountain uplands; 40 to 70 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, rabbit- brush, mountain mahogany, Phlox spp.,Idaho fescue, cheatgrass; 20 to 25 inches ppt.	Western juniper, few ponderosa pine and white fir, low sagebrush, big sagebrush rabbitbrush, mulesear, paintbrush, Idaho fescue, wheatgrass, cheatgrass; 20 to 25 inches ppt.	Mainly barren with few western juniper, and shrubs in fractures; 20 to 25 inches ppt.
Surface Layer	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.8 to 7.0.	0 to 8 inches; brown cobbly loam, platy and granular structure, soft to slightly hard, pH 6.8.	NOT APPLICABLE: Basalt, andesite or conglomerated tuff bedrock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	8 to 20; andesite, basalt, tuff	10 to 20; basalt, andesite, tuff	
Erosion Factor (K)	.37	.37	
Max. Erosion Hazard	High to very high	High to very high	
Soil Permeability	Moderate	Moderately slow	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	3Ed III	3Ed	
Forest Site Class	7 (non-commercial)	7 (non-commercial)	
Range Site	9, 1	9	
Water Runoff Potential	Very Rapid	Rapid	Very Rapid
Watershed Sensitivity	3 (very high)	3	0
Hydrologic Soil Group	D	D	
Available Water Capacity (AWC) Upper 20 inches	Very low to low 1.0 to 2.5 inches	Low 1.5 to 2.9 inches	
Susceptibility to Burning Damage	Moderate	Moderate	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	Not Rated	
Rating for Timber Site	Not Rated	Not Rated	
R-Value	30-60	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-8; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 8-17; Very cobbly loam Unified: GM-GC, GC, ML-CL, CL AASHTO: A-2-4, A-2-6, A-4, A-6 17+ Unweathered bedrock	0-8; Cobbly loam Unified: ML-CL:, CL AASHTO: A-4, A-6 8-18; Cobbly silty clay loam Unified: CL, MH AASHTO: A-6 18+; Weathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 20 percent of the acreage are Smarts, DeMasters, Ginser, Manila, Merlin, Ruckles, Lamondi, Bertag, Wapal, Mascamp families, Lithic Xerorthents, frigid, and rubbleland.		

111 ANATONE-BEARSKIN-SMARTS FAMILIES ASSOCIATION, 2 to 20 percent slopes

Map Unit Components	Anatone family (35 percent)	Bearskin family (25 percent)	Smarts family (20 percent)
Position, Slope, and Elevation	Mainly on southerly aspects of upper sideslopes, ridges and knolls of mountain uplands; 2 to 20 percent slopes; 5500 to 7000 feet.	Mainly on southerly aspects of sideslopes of Mountain uplands; 2 to 20 percent slopes; 5500 to 7000 feet.	Mainly on southerly aspects and in draws and concave lower sideslopes of mountain uplands; 2 to 20 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, rabbitbrush, mountain mahogany, Phlox spp., Idaho fescue, cheatgrass; 20 to 25 inches ppt.	Western juniper, few ponderosa pine and white fir, low sagebrush, big sagebrush, rabbitbrush mulesear, vetch, paintbrush, Idaho fescue, wheatgrass, cheatgrass; 20 to 25 inches ppt.	
Surface Layer	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.8 to 7.0.	0 to 8 inches; brown cobbly loam, platy and granular structure, soft to slightly hard, pH 6.8.	1/2 to 0 inches; ponderosa pine and white fir needles and twigs, over 0 to 20 inches; reddish brown stony loam and very cobbly loam, granular and blocky structure, slightly hard to hard, pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	8 to 20; andesite, basalt, tuff	10 to 20; basalt, tuff	20 to 40; basalt, tuff
Erosion Factor (K)	.37	.37	.32
Max. Erosion Hazard	Moderate	Moderate	Low to moderate
Soil Permeability	Moderate	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class	2ed	2ed	2ep
Group	II		
Forest Site Class	7 (non-commercial)	7 (non-commercial)	5-6 (3-5)
Range Site	9,1	9	Not placed in a range site.
Water Runoff Potential	Moderate	Moderate	Slow
Watershed Sensitivity	5 (Moderate)	6	7
Hydrologic Soil Group	D	D	B
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low	Low	Low to Moderate
	1.0 to 2.5 inches	1.5 to 2.9 inches	2.1 inches
Susceptibility to Burning Damage	Low	Low	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Rating for Timber Site	Not Rated	Not Rated	Poor (2,3,7)
R-Value	30-60	30-60	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-8; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6
8-17; Very cobbly loam
Unified: GM-GC, GC, ML-CL, CL
AASHTO: A-2-4, A-2-6, A-4, A-6
17+; Unweathered bedrock

0-8; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6
8-18; Cobbly silty clay loam
Unified: CL, MH
AASHTO: A-6
18+; Weathered bedrock

0-14; Stony loam
Unified: ML-CL, ML
AASHTO: A-4, A-6
14-28; Very cobbly loam, very gravelly loam
Unified: GM-GC, GC, ML-CL, CL
AASHTO: A-2-4, A-2-6, A-4, A-6
28-35; Extremely gravelly clay loam
Unified: GC
AASHTO: A-2-6
35+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the DeMasters, Lamondi, Manila, Merlin, Bertag, Wapal, Mascamp families and Lithic Xerorthents, frigid, and Smarts family, deep.

112 ANATONE-BEARSKIN-SMARTS FAMILIES ASSOCIATION, 20 to 40 percent slopes

Map Unit Components	Anatone family (35 percent)	Bearskin family (30 percent)	Smarts family (15 percent)
Position, Slope, and Elevation	Mainly on southerly aspects of upper sideslopes, ridges and knolls of mountain uplands 20 to 40 percent slopes; 5500 to 7000 feet.	Mainly on southerly aspects of sideslopes of mountain uplands; 20 to 40 percent slopes; 5500 to 7000 feet.	Mainly on southerly aspects and in draws and concave lower sideslopes of mountain uplands; 20 to 40 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, rabbitbrush, mountain mahogany, Phlox spp., Idaho fescue, cheatgrass; 20 to 25 inches ppt.	Western juniper, few ponderosa pine and white fir, low sagebrush, big sagebrush, rabbitbrush, mulesear, vetch, paintbrush, Idaho fescue, wheatgrass, cheatgrass; 20 to 25 inches ppt.	
Surface Layer	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.8 to 7.0.	0 to 8 inches; brown cobbly loam, platy and granular structure, soft to slightly hard, pH 6.8.	1/2 to 0 inches; ponderosa pine and white fir needles and twigs, over 0 to 20 inches; reddish brown stony loam and very cobbly loam, granular and blocky structure, slightly hard and hard, pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	8 to 20; andesite, basalt, tuff	10 to 20; basalt, tuff	20 to 40; basalt, tuff
Erosion Factor (K)	.37	.37	.32
Max. Erosion Hazard	Moderate to high	Moderate to high	Moderate
Soil Permeability	Moderate	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	3Ed III	3Ed	2Ep
Forest Site Class	7 (non-commercial)	7 (non-commercial)	5-6 (3-5)
Range Site	9,1	9	Not placed in a range site.
Water Runoff Potential	Rapid	Rapid	Slow
Watershed Sensitivity	4 (Moderate)	5	7
Hydrologic Soil Group	D	D	B
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.0 to 2.5 inches	Low 1.5 to 2.9 inches	Low to Moderate 2.1 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Low
Rating for Timber Site	Not Rated	Not Rated	Poor (2,3,7)
R-Value	30-60	30-60	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-8; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

8-17; Very cobbly loam
Unified: GM-GC, GC, ML-CL, CL
AASHTO: A-2-4, A-2-6, A-4, A-6

17+; Unweathered bedrock

0-8; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

8-18; Cobbly silty clay loam
Unified: CL, MH
AASHTO: A-6

18+; Weathered bedrock

0-14; Stony loam
Unified: ML-CL, ML
AASHTO: A-4, A-6

14-28; Very cobbly loam, very gravelly loam
Unified: GM-GC, GC, ML-CL, CL
AASHTO: A-2-4, A-2-6, A-4, A-6

28-35; Extremely gravelly clay loam
Unified: GC
AASHTO: A-2-6

35+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the DeMasters, Lamondi, Manila, Merlin, Ruckles, Bertag, Wapal, Mascamp families, Lithic Xerorthents, frigid, and Smarts family, deep.

113 ANATONE-MERLIN FAMILIES - ROCK OUTCROP ASSOCIATION, 40 to 90 percent slopes

Map Unit Components	Anatone family (35 percent)	Merlin family (30 percent)	Rock outcrop (20 percent)
Position, Slope, and Elevation	On ridges, knolls and sideslopes of mountain uplands; 40 to 90 percent slopes; 5500 to 7200 feet.	On sideslopes and slight concave areas of mountain uplands; 40 to 70 percent slopes; 5500 to 7200 feet.	On ridges, knolls and deeply incised drainages of mountain uplands; 40 to 90 percent slopes; 5500 to 7200 feet.
Typical Vegetation and Precipitation (ppt)	Few western juniper, few white fir, low sagebrush, mountain mahogany, Phlox spp., Idaho fescue, cheatgrass, other grasses; 20 to 30 inches ppt.	Few western juniper, few white fir and ponderosa pine, low sagebrush, big sagebrush, mountain mahogany, Idaho fescue, Poa spp., other grasses; 20 to 30 inches ppt.	
Surface Layer	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.8 to 7.0.	0 to 2 inches; grayish brown very cobbly clay loam, granular structure, slightly hard, pH 6.4.	NOT APPLICABLE: Basalt, andesite or conglomerated tuff bedrock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	8 to 20; andesite, tuff	10 to 20; tuff	
Erosion Factor (K)	.37	.32	
Max. Erosion Hazard	High to very high	High to very high	
Soil Permeability	Moderate	Slow	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	4Gd IV	4Sd	
Forest Site Class	7 (non-commercial)	7 (non-commercial)	
Range Site	9,1	9	
Water Runoff Potential	Very Rapid	Very Rapid	Very Rapid
Watershed Sensitivity	2 (Very High)	1	0
Hydrologic Soil Group	D	D	
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.0 to 2.5 inches	Very Low to Low 1.1 to 2.3 inches	
Susceptibility to Burning Damage	Moderate	Moderate	
Slope Stability Hazard	Low to Moderate	High	
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	
Rating for Timber Site	Not Rated	Not Rated	
R-Value	30-60	0-30	
Soil horizons in inches, USDA, Unified, AASHTO	0-8; Cobbly Loam Unified: ML-CL, CL AASHTO: A-4, A-6 8-17; Very cobbly loam Unified: GM-GC, GC, ML-CL, CL AASHTO: A-2-4, A-2-6, A-4, A-6 17+; Unweathered bedrock	0-2; Very cobbly clay loam Unified: GC, CL, CH AASHTO: A-6, A-7 2-12; Gravelly clay Unified: CH AASHTO: A-7 12+; Unweathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 15 percent of the acreage are the Mascamp, Ruckles, Bertag, Cavanaugh and Smarts families, Lithic Xerorthents, frigid, and rubbleland.		

114 ANATONE-PATIO FAMILIES-RUBBLELAND ASSOCIATION, 60 to 90 percent slopes

Map Unit Components	Anatone family (40 percent)	Patio family, (25 percent)	Rubbleland, (20 percent)
Position, Slope, and Elevation	Mainly on southerly aspects of upper sideslopes, ridges, and knolls of mountain uplands; 60 to 90 percent slopes; 5500 to 6600 feet.	Mainly on northerly aspects of mountain uplands; 60 to 80 percent slopes; 5500 to 6600 feet.	On deeply incised drainages and sideslopes of mountain uplands; 70 to 90 percent slopes; 5500 to 6600 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, mountain mahogany, big sagebrush, rabbitbrush, western yarrow, Idaho fescue, other grasses; 20 to 25 inches ppt.	White fir forest, or mixed conifer forest of white fir and ponderosa pine, plus squaw carpet, serviceberry, forbes, Ross's sedge, few grasses; 20 to 25 inches ppt.	
Surface Layer	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.8 to 7.0.	0 to 19 inches; dark grayish brown to brown very gravelly loam, granular and blocky structure, soft, pH 6.8.	NOT APPLICABLE: Colluvial deposition of angular cobbles, stones and boulders of basalt or andesite rock material.
Rooting Depth (in.) to Underlying Material	8 to 20; andesite	20 to 40; andesite	
Erosion Factor (K)	.37	.28	
Max. Erosion Hazard	Very high	Very high	
Soil Permeability	Moderate	Moderate	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	 4Gd IV	 4Gp	
Forest Site Class	7 (non-commercial)	5-6 (4-5)	
Range Site	9,1	Not placed in a range site.	
Water Runoff Potential	Very Rapid	Rapid	Very Rapid
Watershed Sensitivity	2 (High)	4	2
Hydrologic Soil Group	D	B	
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.0 to 2.5 inches	Low to Moderate 2.3 inches	
Susceptibility to Burning Damage	Moderate	High	
Slope Stability Hazard	Moderate	Moderate	
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year	
Rating for Timber Site	Not Rated	Poor (7,9)	
R-Value	30-60	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-8; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 8-17; Very cobbly loam Unified: GM-GC, GC, ML-CL, CL AASHTO: A-2-4, A-2-6, A-4, A-6 17+; Unweathered bedrock	0-28; Very gravelly loam Unified: GM, GM-GC AASHTO: A-2-4 28+; Unweathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 15 percent of the acreage are the Mascamp, Wapal, Smarts and Cavanaugh families, Lithic Xerorthents, frigid, and Rock outcrop.		

115 ANATONE-SMARTS FAMILIES ASSOCIATION, 5 to 20 percent slopes

Map Unit Components	Anatone family (45 percent)	Smarts family (30 percent)
Position, Slope, and Elevation	On upper sideslopes, ridges and knolls of mountain uplands; 5 to 20 percent slopes; 5500 to 7500 feet.	On sideslopes and toeslopes of mountain uplands; 5 to 20 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few scattered ponderosa pine and white fir, mountain mahogany, big sagebrush, low sagebrush, mulesear, Carex spp., grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, western juniper, plus mountain mahogany, big sagebrush, snowberry, greenleaf manzanita, Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and subangular blocky structure, slightly hard, pH 7.0 to 6.8.	1/2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 20 inches; reddish brown stony loam and very cobbly loam, granular and blocky structure, slightly hard to hard, pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt, andesite, conglomerated tuff	20 to 40; andesite, soft to hard basalt
Erosion Factor (K)	.37	.32
Max. Erosion Hazard	Moderate	Low to moderate
Soil Permeability	Moderate	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2edx	2epx
Group	II	
Forest Site Class	7 (non-commercial)	5-6 (3-5)
Range Site	9	Not placed in a range site.
Water Runoff Potential	Moderate	Slow
Watershed Sensitivity	5 (Moderate)	7
Hydrologic Soil Group	D	B
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low	Low to Moderate
	1.2 to 2.5 inches	2.1 inches
Susceptibility to Burning Damage	Low	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year
Rating for Timber Site	Not Rated	Poor (2,3,7)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-8; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 8-17; Very cobbly loam Unified: GM-GC, GC, ML-CL, CL AASHTO: A-2-4, A-2-6, A-4, A-6 17+; Unweathered bedrock	0-14; Stony loam Unified: ML-CL, ML AASHTO: A-4, A-6 14-28; Very cobbly loam, very gravelly loam Unified: GM-GC, GC, ML-CL, CL AASHTO: A-2-4, A-2-6, A-4, A-6 28-35; Extremely gravelly clay loam Unified: GC AASHTO: A-2-6 35+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 25 percent of the acreage are the Bearskin, Mascamp, Lamondi, Smarts, deep, and DeMasters families, rock outcrop, and Lithic Xerorthents, frigid.	

116 ANATONE-SMARTS FAMILIES ASSOCIATION, 20 to 40 percent slopes

Map Unit Components	Anatone family (45 percent)	Smarts family (30 percent)
Position, Slope, and Elevation	On sideslopes, ridges and knolls of mountain uplands; 20 to 40 percent slopes; 5500 to 7500 feet.	Generally on northerly aspects of sideslopes of mountain uplands; 20 to 40 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few scattered ponderosa pine and white fir, mountain mahogany, big sagebrush, low sagebrush, mulesear, carex spp., grasses; 20 to 30 inches ppt.	White fir forest or mixed conifer forest of white fir, ponderosa pine, incense-cedar, western juniper, plus mountain mahogany, big sagebrush, snowberry, greenleaf manzanita, Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and subangular blocky structure, slightly hard, pH 7.0 to 6.8.	1/2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 20 inches; reddish brown stony loam and very cobbly loam, granular and blocky structure, slightly hard and hard, pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt, andesite, conglomerated tuff	20 to 40; andesite and soft to hard basalt
Erosion Factor (K)	.37	.32
Max. Erosion Hazard	Moderate to high	Moderate
Soil Permeability	Moderate	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	3Edx III	2epx
Forest Site Class	7 (non-commercial)	5-6 (3-5)
Range Site	9	Not placed in a range site
Water Runoff Potential	Rapid	Slow
Watershed Sensitivity	4 (Moderate)	7
Hydrologic Soil Group	D	B
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.2 to 2.5 inches	Low to Moderate 2.1 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Low
Rating for Timber Site	Not Rated	Poor (2, 3, 7)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-8; Cobbly loam Unified: ML-CL, CL AASHTO: A-2-4, A-2-6 8-17; Very cobbly loam Unified: GM-GC, GC, ML-CL, CL AASHTO: A-2-4, A-2-6, A-4, A-6 17+; Unweathered bedrock	0-14; Stony loam Unified: ML-CL, ML AASHTO: A-4, A-6 14-28; Very cobbly loam, very gravelly loam Unified: GM-GC, GC, ML-CL, CL AASHTO: A-2-4, A-2-6, A-4, A-6 28-35; Extremely gravelly clay loam Unified: GC AASHTO: A-2-6 35+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 25 percent of the acreage are the Mascamp, Bearskin, Lamondi, Smarts, deep, and DeMasters families, Lithic Xerorthents, frigid and rock outcrop.	

117 ANATONE-SMARTS FAMILIES-ROCK OUTCROP ASSOCIATION, 40 to 70 percent slopes

Map Unit Components	**Anatone family (45 percent)**	**Smarts family (25 percent)**	**Rock outcrop (15 percent)**
Position, Slope, and Elevation	On upper sideslopes, ridges and knolls of mountain uplands; 40 to 70 percent slopes; 5500 to 7500 feet.	Generally on northerly aspects of sideslopes of mountain uplands; 40 to 60 percent slopes; 5500 to 7500 feet.	Steep scarps and ridge tops of mountain uplands; 50 to 70 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few scattered ponderosa pine and white fir, mountain mahogany, low sagebrush, big sagebrush, mulesear, Carex spp., grasses,; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, western juniper, plus mountain mahogany, snowberry, greenleaf manzanita, Ross's sedge, few grasses; 20 to 30 inches ppt.	
Surface Layer	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and subangular blocky structure, slightly hard, pH 7.0 to 6.8.	1/2 to 0 inches; ponderosa pine and white fir needles and twigs, over 0 to 20 inches; reddish brown stony loam and very cobbly loam, granular and blocky structure, slightly hard and hard, pH 6.6 to 6.8.	NOT APPLICABLE: Basalt, andesite or congolmerated tuff bedrock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt, andesite, conglomerated tuff	20 to 40; andesite, soft to hard basalt	
Erosion Factor (K)	.37	.32	
Max. Erosion Hazard	High to very high	High	
Soil Permeability	Moderate	Moderately slow	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	3Edx III	3Epx	
Forest Site Class	7 (non-commercial)	5-6 (3-5)	
Range Site	9	Not placed in a range site.	
Water Runoff Potential	Very Rapid	Moderate	Very Rapid
Watershed Sensitivity	3 (High)	6	0
Hydrologic Soil Group	D	B	
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.2 to 2.5 inches	Low to Moderate 2.1 inches	
Susceptibility to Burning Damage	Moderate	Moderate to High	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year	
Chance of Seedling Survival	Not Rated	Low	
Rating for Timber Site	Not Rated	Poor (2,3,7,8)	
R-Value	30-60	30-60	

Soil horizons in inches, USDA, Unified, AASHTO

0-8; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

8-17: Very cobbly loam
Unified: GM-GC, GC, ML-CL, CL
AASHTO: A-2-4, A-2-6, A-4, A-6

17+; Unweathered bedrock

0-14; Stony loam
Unified: ML-CL, ML
AASHTO: A-4, A-6

14-28; Very cobbly loam, very gravelly loam
Unified: GM-GC, GC, ML-CL, CL
AASHTO: A-2-4, A-2-6, A-4, A-6

28-35; Extremely gravelly clay loam
Unified: GC
AASHTO: A-2-6

35+; Weathered bedrock

Included Areas:

Included with this unit in mapping and making up about 15 percent of the acreage are the Bearskin, Mascamp, Lamondi, Smarts, deep, and DeMasters families, Lithic Xerorthents, frigid, and rubbleland.

118 BAKEOVEN FAMILY-LAVA FLOW-LITHIC XERORTHENTS, MESIC ASSOCIATION, 1 to 15 percent slopes

Map Unit Components	**Bakeoven family (40 percent)**	**Lava flow (25 percent)**	**Lithic Xerorthents, mesic (20 percent)**
Position, Slope, and Elevation	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 4800 feet.	Hummocky disaggreated lava flow rock and collapsed lava tubes with slope lengths of 10 to 40 feet; 5 to 15 percent slopes; 4200 to 4800 feet.	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 4800 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, big sagebrush, low sagebrush, desert mahogany, rabbitbrush, chrysopsis spp., sandberg bluegrass, bottlebrush, Idaho fescue, cheatgrass; 10 to 14 inches ppt.	Barren; 10 to 14 inches ppt.	
Surface Layer	0 to 11 inches; dark grayish brown and grayish brown very cobbly fine sandy loam, subangular blocky structure; slightly hard, pH 6.6.	NOT APPLICABLE: Fractured vesicular, basalt flow rock with minor accumulations of aeolian soil deposition in some fractures.	0 to 5 inches; brown and yellowish brown very cobbly loam and gravelly loam; platy and granular structure; slightly hard; pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	10 to 20; fractured basalt		4 to 10; fractured basalt
Erosion Factor (K)	.24		Variable
Max. Erosion Hazard	Moderate		Moderate
Soil Permeability	Moderately rapid		Moderate
Drainage Class	Well drained		Somewhat excessively drained
Soil Manageability Class Group	2edx III	3eDx	
Forest Site Class	7 (non-commercial)		7 (non-commercial)
Range Site	7		1
Water Runoff Potential	Slow	Rapid	Moderate
Watershed Sensitivity	7 (Moderate)	4	5
Hydrologic Soil Group	D		D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.0 to 1.9 inches		Very Low 0.6 to 1.5 inches
Susceptibility to Burning Damage	Low		Low
Slope Stability Hazard	Low		Low
Allowable Soil Loss	1 tons/acre/year		1 tons/acre/year
Chance of Seedling Survival	Not Rated		Not Rated
Rating for Timber Site	Not Rated		Not Rated
R-Value	30-60		Not Rated
Soil horizons in inches, USDA, Unified, AASHTO	0-11; Very cobbly fine sandy loam Unified: SM, SM-SC AASHTO: A-4 11+; Unweathered bedrock		0-5; Variable Unified: Not Rated AASHTO: Not Rated 5+; Unweathered bedrock
Included Areas:	Included with this unit in mapping and making up about 15 percent of the acreage are the Castlevale, Pass Canyon, Dishner, Searles, Sheld, Wenatchee, Gwin and Stukel families and Lava flow rock with steeper slopes.		

120 BAKEOVEN FAMILY-ROCK OUTCROP ASSOCIATION, 20 to 60 percent slopes

Map Unit Components	**Bakeoven family (45 percent)**	**Rock outcrop (35 percent)**
Position, Slope, and Elevation	On sideslopes and toeslopes of mountain uplands and basalt plateau breaks; 20 to 50 percent slopes; 4200 to 5000 feet.	On upper slopes, ridges and knolls of mountain uplands and basalt plateau breaks; 40 to 60 percent slopes; 4200 to 5000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, big sagebrush, bitterbrush, low sagebrush, rabbitbrush, Ribes spp., bottlebrush, Idaho fescue, wheatgrass, other grasses; 10 to 14 inches ppt.	Barren; 10 to 14 inches ppt.
Surface Layer	0 to 11 inches; dark grayish brown to grayish brown very cobbly fine sandy loam, subangular blocky structure; slightly hard, pH 6.6.	NOT APPLICABLE: Basalt andesite or conglomerated tuff bedrock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	8 to 20; basalt colluvium	
Erosion Factor (K)	.24	
Max. Erosion Hazard	Moderate to high	
Soil Permeability	Moderately rapid	
Drainage Class	Well drained	
Soil Manageability Class Group	 3EPx III	
Forest Site Class	7 (non-commercial)	
Range Site	7, 1	
Water Runoff Potential	Moderate	Very Rapid
Watershed Sensitivity	6 (High)	2
Hydrologic Soil Group	D	
Available Water Capacity (AWC) Upper 20 inches	 0.8 to 1.9 inches	
Susceptibility to Burning Damage	Low	
Slope Stability Hazard	Low	
Allowable Soil Loss	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	
Rating for Timber Site	Not Rated	
R-Value	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-11; Very cobbly fine sandy loam Unified: SM, SM-SC AASHTO: A-4 11+; Unweathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 20 percent of the acreage are the Searles, Wenatchee, Stukel, Ginser and Castlevale families and Lithic Xerorthents, mesic, and rubbleland.	

121 BAKEOVEN FAMILY-ROCK OUTCROP-WENATCHEE FAMILY ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	**Bakeoven family (40 percent)**	**Rock outcrop (25 percent)**	**Wenatchee family (20 percent)**
Position, Slope, and Elevation	On sideslopes of basalt plateau breaks 1 to 20 percent slopes; 4200 to 5000 feet.	On ridges and knolls of basalt plateau breaks; 10 to 20 percent slopes; 4200 to 5000 feet.	On lower sideslopes and toeslopes of basalt plateau sideslopes; 1 to 15 percent slopes; 4200 to 5000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, rabbitbrush, wheatgrass, sandberg bluegrass, Idaho fescue cheatgrass; 10 to 16 inches ppt.	Barren; 10 to 16 inches ppt.	
Surface Layer	A thin pumice overburden of up to 5 inches thick may be present, OVER 0 to 11 inches; dark grayish brown and grayish brown very cobbly fine sandy loam, subangular blocky structure; slightly hard, pH 6.6.	NOT APPLICABLE: Basalt bedrock with minor accumulations of aeolian soil deposition in some fractures.	9 inches of pumice overburden consisting of brown gravelly coarse sandy loam over very pale brown extremely gravelly coarse loamy sand (pumice thickness in this map unit ranges from 0 to 5 inches) OVER 9 to 15 inches; pale brown fine sandy loam, subangular blocky structure, soft, pH 6.8.
Rooting Depth (in.) to Underlying Material	8 to 20; basalt		20 to 40; basalt
Erosion Factor (K)	.24		.20
Max. Erosion Hazard	Moderate		Low to Moderate
Soil Permeability	Moderately rapid		Moderate
Drainage Class	Well drained		Well drained
Soil Manageability Class	3ePx	2e	
Group	III		
Forest Site Class	7 (non-commercial)		7 (non-commercial)
Range Site	7, 1		16
Water Runoff Potential	Slow	Rapid	Slow
Watershed Sensitivity	7 (Moderate)	2	8
Hydrologic Soil Group	D		B
Available Water Capacity (AWC)	Very Low to Low		Low to Moderate
Upper 20 inches	0.8 to 1.9 inches		2.6 inches
Susceptibility to Burning Damage	Low		Moderate
Slope Stability Hazard	Low		Low
Allowable Soil Loss	1 tons/acre/year		2 tons/acre/year
Chance of Seedling Survival	Not Rated		Not Rated
Rating for Timber Site	Not rated		Not Rated
R-Value	30-60		30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-11; Very cobbly fine sandy loam
Unified: SM, SM-SC
AASHTO: A-4

11+; Unweathered bedrock

0-5; Gravelly coarse sandy loam
Unified: SM
AASHTO: A-1-b

5-9; Extremely gravelly loamy coarse sand
Unified: SM, GM
AASHTO: A-1-a, A-1-b

9-15; Fine sandy loam
Unified: SM-SC, ML-CL
AASHTO: A-4

15-27; Loam
Unified: CL
AASHTO: A-4, A-6

27+; Unweathered bedrock

Included Areas:

Included with this unit in mapping and making up about 15 percent of the acreage are the Stukel, Lawyer, Searles, Gwin and Elmore families and unnamed soils similar to the Alicel family but not Pachic, and rock outcrop with steeper slopes.

122 BAKEOVEN-STUKEL FAMILIES-LAVA FLOW ASSOCIATION, 1 to 15 percent slopes

Map Unit Components	**Bakeoven family (35 percent)**	**Stukel family (30 percent)**	**Lava flow (20 percent)**
Position, Slope, and Elevation	On undulating upper slopes and knolls of basalt plateaus; 1 to 15 percent slopes; 4300 to 5000 feet.	On isolated small depressions between lava flow rock on basalt plateaus; 1 to 10 percent slopes; 4300 to 5000 feet.	Hummocky disaggreagated lava flow rock and collapsed lava tubes on basalt plateaus; 5 to 15 percent slopes; 4300 to 5000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, big sagebrush, bitterbrush, desert mahogany, bluebunch wheatgrass, bluegrass, cheatgrass, bottlebrush, 10 to 14 inches ppt.	Western juniper, big sagebrush, bitterbrush, desert mahogany, bluebunch wheatgrass, bluegrass, cheatgrass, bottlebrush, 10 to 14 inches ppt.	
Surface Layer	0 to 11 inches; dark grayish brown and grayish brown very cobbly fine sandy loam, subangular blocky structure; slightly hard, pH 6.6.	0 to 11 inches; grayish brown to brown very cobbly loam to loam granular and blocky structure, soft to slightly hard, pH 6.2 to 7.2.	NOT APPLICABLE: Fractured vesicular basalt flow rock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	8 to 15; Basalt	10 to 20; Basalt	
Erosion Factor (K)	.24	.37	
Max. Erosion Hazard	Moderate	Moderate	
Soil Permeability	Moderately rapid	Moderate	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	2ed II	2ed	
Forest Site Class	7 (non-commercial)	7 (non-commercial)	
Range Site	7, 1	7, 4	
Water Runoff Potential	Slow	Slow	Rapid
Watershed Sensitivity	7 (Moderate)	6	6
Hydrologic Soil Group	D	D	
Available Water Capacity (AWC) Upper 20 inches	Very Low 0.8 to 1.5 inches	Very Low to Low 1.4 to 2.8 inches	
Susceptibility to Burning Damage	Moderate	Moderate	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	Not Rated	
Rating for Timber Site	Not Rated	Not Rated	
R-Value	30-60	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-11; Very cobbly fine sandy loam Unified: SM, SM-SC AASHTO: A-4 11+; Unweatherd bedrock	0-3; Very cobbly loam Unified: SM, SM-SC, ML, ML-CL AASHTO: A-2-4, A-4 3-11; Loam Unified: ML, ML-CL AASHTO: A-4 11+; Unweathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 15 percent of the acreage are the Searles, Pass Canyon, Cowiche, and Alicel families, Lithic Xerorthents, mesic and lava flow rock with steeper slopes.		

123 BEHANIN-CHEADLE FAMILIES ASSOCIATION, 10 to 35 percent slopes

Map Unit Components	Behanin family (60 percent)	Cheadle family (25 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 10 to 35 percent slopes; 7600 to 9500 feet.	On upper sideslopes, ridges, and knolls of mountain uplands; 15 to 35 percent slopes; 7600 to 9500 feet.
Typical Vegetation and Precipitation (ppt)	White bark pine, lodgepole pine, western white pine, quaking aspen, big sagebrush, mulesear, lupine, prostrate manzanita, current spp., Idaho fescue, bottlebrush; 25 to 35 inches ppt.	Few white bark pine, big sagebrush, low sagebrush, mulesear, current spp., Idaho fescue, bottlebrush; 25 to 35 inches ppt.
Surface Layer	1 to 0 inches; lodgepole pine and western white pine needles and twigs, over 0 to 32 inches; dark grayish brown to brown very gravelly loam to very cobbly loam, granular to subangular blocky structure, slightly hard, pH 6.0 to 6.4.	0 to 17 inches; dark grayish brown to brown very cobbly loam to very cobbly clay loam; granular and subangular blocky structure, slightly hard to hard, pH 6.6.
Substratum	32 plus inches; weathering in place semi-soft yellowish brown tuff conglomerate which rubs to a sandy loam texture.	
Rooting Depth (in.) to Underlying Material	20 to 40; andesite, tuff	10 to 20; andesite, tuff
Erosion Factor (K)	.28	.37
Max. Erosion Hazard	Moderate	Moderate to high
Soil Permeability	Moderate	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class	2e	2ed
Group	II	
Forest Site Class	6-7 (5 to non-commercial)	7 (non-commercial)
Range Site	Not placed in a range site.	9
Water Runoff Potential	Slow	Rapid
Watershed Sensitivity	6 (Moderate)	4
Hydrologic Soil Group	B	D
Available Water Capacity (AWC)	Low to Moderate	Very Low to Low
Upper 20 inches	2.6 inches	1.2 to 2.4 inches
Susceptibility to Burning Damage	Moderate	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Moderate	Not Rated
Rating for Timber Site	(7,12,13)	Not Rated
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-32; Very gravelly loam, very cobbly loam Unified: SM-SC, SC AASHTO: A-2-4, A-2-6 32+; Weathered bedrock	0-12; Very cobbly loam Unified: SM-SC, SC AASHTO: A-2-4, A-2-6, A-4, A-6 12-17; Very cobbly clay loam Unified: SC AASHTO: A-6, A-2-6 17+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Duncom, Supervisor and Gallatin families, Lithic Cryochrepts and rock outcrop.	

124 BEHANIN-CHEADLE FAMILIES ASSOCIATION, 35 to 60 percent slopes

Map Unit Components	Behanin family (50 percent)	Cheadle family (30 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 35 to 55 percent slopes; 7600 to 9700 feet.	On upper sideslopes, ridges, and knolls of mountain uplands; 35 to 60 percent slopes; 7600 to 9700 feet.
Typical Vegetation and Precipitation (ppt)	White bark pine, lodgepole pine, western white pine, quaking aspen, big sagebrush, mulesear, lupine, prostrate manzanita, current spp., Idaho fescue, bottlebrush; 25 to 35 inches ppt.	Few white bark pine, big sagebrush, low sagebrush, mulesear, current spp., Idaho fescue, bottlebrush; 25 to 35 inches ppt.
Surface Layer	1 to 0 inches; lodgepole and western white pine needles and twigs, over 0 to 32 inches; dark grayish brown to brown very gravelly loam to very cobbly loam, granular to subangular blocky structure, slightly hard, pH 6.0 to 6.4.	0 to 17 inches; dark grayish brown to brown very cobbly loam to very cobbly clay loam; granular and subangular blocky structure, slightly hard to hard; pH 6.6.
Substratum	32 plus inches; weathering in place semi-soft yellowish brown tuff conglomerate which rubs to a sandy loam texture.	
Rooting Depth (in.) to Underlying Material	20 to 40; andesite, tuff	10 to 20; andesite
Erosion Factor (K)	.28	.37
Max. Erosion Hazard	High	High to very high
Soil Permeability	Moderate	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	3E III	3Ed
Forest Site Class	6-7 (5 to non-commercial)	7 (non-commercial)
Range Site	Not placed in a range site.	9
Water Runoff Potential	Moderate	Very Rapid
Watershed Sensitivity	5 (High)	3
Hydrologic Soil Group	B	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.6 inches	Very Low to Low 1.2 to 2.4 inches
Susceptibility to Burning Damage	Moderate to High	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Moderate	Not Rated
Rating for Timber Site	Poor (7,8,12,13)	Not Rated
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-32; Very gravelly loam, very cobbly loam Unified: SM-SC, SC AASHTO: A-2-4, A-2-6 32+; Weathered bedrock	0-12; Very cobbly loam Unified: SM-SC, SC AASHTO: A-2-4, A-2-6, A-4, A-6 12-17; Very cobbly clay loam Unified: SC AASHTO: A-6, A-2-6 17+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Duncom, Supervisor and Gallatin families, Lithic Cryochrepts, rock outcrop, and rubbleland.	

125 BEHANIN, deep-GALLATIN FAMILIES COMPLEX, 10 to 35 percent slopes

Map Unit Components	Behanin family, deep (65 percent)	Gallatin family (20 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 10 to 35 percent slopes; 7000 to 7500 feet.	On sideslopes and drainageways of mountain uplands; 10 to 35 percent slopes; 7000 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir; lodgepole pine, western white pine, snowberry, forbes, few grasses; 25 to 30 inches ppt.	Quaking aspen, few white fir, snowberry, lupine, mulesear, bottlebrush, other grasses; 25 to 30 inches ppt.
Surface Layer	1-1/2 to 0 inches of white fir needles and twigs, over 0 to 60 inches; very dark grayish brown to brown very gravelly loam, very stony loam and extremely gravelly loam, granular to subangular blocky structure, slightly hard, pH 6.0 to 6.4.	0 to 29 inches; dark grayish brown loam to very cobbly loam, granular to subangular blocky structure, slightly hard, pH 6.2 to 6.4.
Rooting Depth (in.) to Underlying Material	40 plus; andesite	20 to 40; andesite, tuff
Erosion Factor (K)	.28	.32
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderate	Moderate
Drainage Class	Well Drained	Well Drained
Soil Manageability Class Group	 2e II	 2e
Forest Site Class	5-6 (4-5)	7 (non-commercial)
Range Site	Not placed in a range site.	14, 19
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	7 (Moderate)	6
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.4 inches	Low to Moderate 3.2 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate	Not Rated
Rating for Timber Site	Fair (12)	Not Rated
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-34; Very gravelly loam, very stony loam Unified: SM, SM-SC, ML-CL AASHTO: A-2-4, A-2-6, A-4 34-60; Extremely gravelly loam Unified: SM-SC, SC AASHTO: A-2-4, A-2-6, A-4, A-6	0-21; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 21-29; Very cobbly loam Unified: SM-SC, SC, ML-CL, CL AASHTO: A-4, A-6 29+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Woodhurst, Supervisor, Cheadle and Duncom families.	

126 BEHANIN, deep-SUPERVISOR FAMILIES COMPLEX, 15 to 40 percent slopes

Map Unit Components	Behanin family, deep (50 percent)	Supervisor family (35 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 15 to 40 percent slopes; 7000 to 8000 feet.	On sideslopes of mountain uplands; 15 to 40 percent slopes; 7000 to 8000 feet.
Typical Vegetation and Precipitation (ppt)	Lodgepole pine, white fir, few washoe pine, quaking aspen and western white pine, prostrate manzanita, ceonothus, few grasses; 25 to 30 inches ppt.	Lodgepole pine, white fir, few washoe pine, quaking aspen and western white pine, prostrate manzanita, ceonothus, few grasses; 25 to 30 inches ppt.
Surface Layer	1-1/2 to 0 inches of white fir needles and twigs, over 0 to 60 inches; very dark grayish brown to brown very gravelly loam, very stony loam and extremely gravelly loam, granular to subangular blocky structure, slightly hard, pH 6.0 to 6.4.	1 to 0 inches; lodgepole pine needles, over 0 to 12 inches; dark grayish brown to brown gravelly fine sandy loam, granular and blocky structure, slightly hard, pH 5.8 to 6.2.
Rooting Depth (in.) to Underlying Material	40 plus; andesite, basalt	20 to 40; andesite, tuff
Erosion Factor (K)	.28	.20
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderate	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class	2e	2ep
Group	II	
Forest Site Class	5-6 (4-5)	6 (4-5)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	7 (Moderate)	7
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.4 inches	Low to Moderate 2.2 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate	Low to Moderate
Rating for Timber Site	Fair (12)	Fair (7,12)
R-Value	30-60	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-34; Very gravelly loam, very stony loam Unified: SM, SM-SC, ML-CL AASHTO: A-2-4, A-2-6, A-4 34-60; Extremely gravelly loam Unified: SM-SC, SC AASHTO: A-2-4, A-2-6, A-4, A-6	0-12; Gravelly fine sandy loam Unified: SM, SM-SC AASHTO: A-2-4, A-4 12-26; Very gravelly sandy loam Unified: GM, GM-GC, SM, SM-SC AASHTO: A-1-b, A-2-4 26+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Gallatin, Cheadle, Gralic, and Loberg families and rock outcrop.

127 BERTAG, deep-CAVANAUGH-MASCAMP FAMILIES ASSOCIATION, 35 to 60 percent slopes

Map Unit Components	Bertag family, deep (40 percent)	Cavanaugh family (25 percent)	Mascamp family (20 percent)
Position, Slope, and Elevation	On steep sideslopes of basalt plateau breaks, incised drainages and mountain uplands; 35 to 60 percent slopes; 5500 to 7000 feet.	On steep sideslopes and incised drainages of basalt plateau breaks and mountain uplands; 35 to 60 percent slopes; 5500 to 7000 feet.	On ridges, knolls and upper sideslopes of basalt plateau breaks and mountain uplands; 40 to 60 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of ponderosa pine and white fir plus snowberry squaw carpet, Ribes spp., Ross's sedge, few grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of ponderosa pine, white fir, western juniper plus mountain mahogany, big sagebrush, mulesear, snowberry, Ross's sedge, grasses; 20 to 30 inches ppt.	
Surface Layer	1-1/2 to 0 inches of white fir and ponderosa pine needles and twigs, over 0 to 13 inches; dark brown loam, granular and blocky structure, slightly hard, pH 6.4.	1 to 0 inches of white fir and ponderosa pine needles, over 0 to 13 inches; dark brown and brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.4.	0 to 6 inches; dark grayish brown very cobbly loam, granular structure, slightly hard, pH 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; tuff	30 plus; tuff, basalt	10 to 20; basalt, andesite, tuff
Erosion Factor (K)	.43	.37	.37
Max. Erosion Hazard	High	High	High to very high
Soil Permeability	Slow	Slow	Moderate
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	3S III	3S	3Ed
Forest Site Class	4 (2-3)	4-5 (3-4)	7 (non-commercial)
Range Site	Not placed in a range site.	Not placed in a range site.	9
Water Runoff Potential	Rapid	Rapid	Rapid
Watershed Sensitivity	4 (High)	4	4
Hydrologic Soil Group	C	C	D
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.9 inches	Low to Moderate 2.5 inches	Very Low to Low 1.2 to 2.5 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	High	High	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Moderate	Low to Moderate	Not Rated
Rating for Timber Site	Fair (8)	Fair (3,8)	Not Rated
R-Value	0-30	0-30	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-13; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

13-20; Cobbly clay
Unified: CL, CH
AASHTO: A-6, A-7

20-60; Gravelly clay
Unified: CH
AASHTO: A-7

0-7; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

7-13; Very cobbly loam
Unified: SM-SC, SC
AASHTO: A-4, A-6

13-18; Very cobbly clay loam
Unified: CL
AASHTO: A-6

18-60; Very gravelly clay, extremely gravelly clay loam.
Unified: GC
AASHTO: A-2-7, A-7

0-12; Very cobbly loam, very gravelly loam
Unified: SM-SC, SC
AASHTO: A-4

12-19; Very gravelly clay loam
Unified: SC
AASHTO: A-2-6, A-6

19+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the DeMasters, Smarts, Anatone, Merlin and Manila families and rock outcrop.

128 BERTAG-SMARTS FAMILIES ASSOCIATION, 10 to 40 percent slopes

Map Unit Components	Bertag family (40 percent)	Smarts family, (35 percent)
Position, Slope, and Elevation	On toeslopes and lower sideslopes of mountain uplands; 10 to 35 percent slopes; 5500 to 6500 feet.	On sideslopes, ridges and knolls of mountain uplands; 10 to 40 percent slopes; 5500 to 6500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir and ponderosa pine, plus snowbrush serviceberry, lupine, Ross's sedge, few grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus few juniper, serviceberry, snowberry, mountain mahogany, Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	1 to 0 inches of white fir and ponderosa pine needles, over 0 to 4 inches; dark grayish brown loam, platy and granular structure, slightly hard, pH 6.2.	1/2 to 0 inches; ponderosa pine and white fir needles and twigs, over 0 to 20 inches; reddish brown stony loam and very cobbly loam, granular and blocky structure, slightly hard and hard, pH 6.6 to 6.8.
Substratum	29 plus inches semi-hard tuff and tuff conglomerate.	
Rooting Depth (in.) to Underlying Material	20 to 40; tuff	20 to 40; basalt, tuff
Erosion Factor (K)	.43	.32
Max. Erosion Hazard	Moderate	Low to moderate
Soil Permeability	Slow	Moderately Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	 2e II	 2ep
Forest Site Class	5 (3-4)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Moderate	Slow
Watershed Sensitivity	5 (Moderate)	7
Hydrologic Soil Group	C	B
Available Water Capacity (AWC) Upper 20 inches	 2.9 inches	 2.1 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low to Moderate	Low
Allowable Soil Loss	2 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate to high	Low
Rating for Timber Site	Fair (7)	Fair (1,3,7)
R-Value	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 4-29; Clay loam, clay Unified: CL, CH AASHTO: A-6, A-7 29+; Weathered bedrock	0-14; Stony loam Unified: ML-CL, CL AASHTO: A-4, A-6 14-28; Very cobbly loam, very gravelly loam Unified: GM-GC, GC, ML-CL, CL AASHTO: A-2-4, A-2-6, A-4, A-6 28-35; Extremely gravelly clay loam Unified: GC AASHTO: A-2-6 35+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 25 percent of the acreage are the Merlin, Anatone, DeMasters, Bearskin, Mascamp, and Lamondi families, Bertag, deep, and Smarts, deep, families and unnamed soils similar to the Bertag family but shallower and over soft to hard tuff.	

129 BERTAG-SMARTS, deep-CAVANAUGH FAMILIES COMPLEX, 35 to 60 percent slopes

Map Unit Components	**Bertag family, deep (40 percent)**	**Smarts family, deep (25 percent)**	**Cavanaugh family (20 percent)**
Position, Slope, and Elevation	On steep sideslopes of mountain uplands; 35 to 50 percent slopes; 5500 to 7000 feet.	On steep sideslopes and ridges of mountain uplands; 35 to 60 percent slopes; 5500 to 7000 feet.	On steep sideslopes of mountain uplands; 35 to 60 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, plus snowberry, serviceberry, current spp., Ross's sedge, few grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, plus few western juniper, serviceberry, snowberry, mulesear, lupine, Ross's sedge, few grasses 20 to 30 inches ppt.	
Surface Layer	1-1/2 to 0 inches of white fir and ponderosa pine needles and twigs, over 0 to 13 inches; dark brown loam, granular and blocky structure, slightly hard, pH 6.4.	2 to 0 inches of white fir needles and twigs, over 0 to 18 inches; brown stony loam, granular structure, soft, pH 6.2.	1 to 0 inches of white fir and ponderosa pine needles, over 0 to 13 inches; dark brown and brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.4.
Substratum		32 to 50 inches; pale brown extremely gravelly loam, massive, soft, pH 6.0.	
Rooting Depth (in.) to Underlying Material	40 plus; tuff	40 plus; basalt, tuff	30 plus; tuff
Erosion Factor (K)	.43	.32	.37
Max. Erosion Hazard	High	High	High
Soil Permeability	Slow	Moderately slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	 3S III	 3EP	 3S
Forest Site Class	4 (2-3)	4 (2-3)	4-5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Rapid	Moderate	Rapid
Watershed Sensitivity	4 (High)	6	4
Hydrologic Soil Group	C	B	C
Available Water Capacity (AWC) Upper 20 inches	 2.9 inches	 2.6 inches	 2.5 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	High	Low	High
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate to High	Moderate	Low to Moderate
Rating for Timber Site	Fair (8)	Fair (1,8)	Fair (3,8)
R-Value	0-30	30-60	0-30

Soil horizons in inches, USDA, Unified, AASHTO

0-13; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

13-20; Cobbly clay loam
Unified: CL, CH
AASHTO: A-6, A-7

20-60; Gravelly clay
Unified: CH
AASHTO: A-7

0-18; Stony loam
Unified: ML-CL, CL
AASHTO: A-4

18-50; Extremely gravelly clay loam, extremely gravelly loam
Unified: SC
AASHTO: A-2-6, A-6

50+; Weathered bedrock

0-7; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

7-13; Very cobbly loam
Unified: SM-SC, SC
AASHTO: A-4, A-6

13-18; Very cobbly clay loam
Unified: CL
AASHTO: A-6

18-60; Very gravelly clay, extremely gravelly clay loam
Unified: GC
AASHTO: A-2-7, A-7

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Lamondi, DeMasters, Manila, Bearskin and Merlin families, rock outcrop and rubbleland.

130 BIEBER-BARNARD FAMILIES COMPLEX, 1 to 20 percent slopes

Map Unit Components	Bieber family (45 percent)	Barnard familiy (35 percent)
Position, Slope, and Elevation	Undulating to nearly level basalt plateaus; 1 to 20 percent slopes; 4300 to 6000 feet.	Undulating to nearly level basalt plateaus; 1 to 20 percent slopes; 4300 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Low sagebrush, black sagebrush, few western juniper, Phlox spp., cheatgrass, other grasses; 14 to 16 inches ppt.	Big sagebrush , silver sagebrush, mountain mahogany, Carex spp., other grasses; 14 to 16 inches ppt.
Surface Layer	0 to 4 inches; brown very cobbly loam, blocky and granular structure, hard, pH 6.8.	0 to 8 inches; grayish brown to dark grayish brown cobbly loam to gravelly clay loam, platy and blocky structure, slightly hard, pH 6.5 to 7.0.
Substratum	18 plus inches; strongly cemented silical duripan.	32 plus inches; weakly to strongly cemented silica duripan.
Rooting Depth (in.) to Underlying Material	10 to 20; silica duripan, basalt	20 to 40; silica duripan, basalt
Erosion Factor (K)	.37	.37
Max. Erosion Hazard	Moderate	Low to moderate
Soil Permeability	Very slow	Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2ed	2e
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	8	13, 18
Water Runoff Potential	Moderate	Slow
Watershed Sensitivity	5 (Moderate)	6
Hydrologic Soil Group	D	C
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.2 to 2.5 inches	Low to Moderate 2.6 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Very cobbly loam Unified: SC, CL AASHTO: A-6 4-18; Clay Unified: CH AASHTO: A-7 18+; Silica duripan	0-3; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 3-8; Gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 8-32; Clay, gravelly silty clay Unified: CH AASHTO: A-7 32+; Silica duripan
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Keating, Aikman, Deven, Indian Creek, Packwood and Ditchcamp families, Xerofluvents, rubbleland and areas of greater slopes.	

131 BIEBER-BARNARD-SIMPSON FAMILIES COMPLEX, 1 to 10 percent slopes

Map Unit Components	Bieber family (50 percent)	Barnard family (25 percent)	Simpson family (15 percent)
Position, Slope, and Elevation	On low lying areas of undulating basalt plateaus; 1 to 5 percent slopes; 4500 4800 feet.	On mounds and upper areas of undualting basalt plateaus; 2 to 10 percent slopes; 4500 to 4800 feet.	On ridges and upper areas of undulating basalt plateaus; 2 to 10 percent slopes; 4500 to 4800 feet.
Typical Vegetation and Precipitation (ppt)	Few western juniper, low sagebrush, black sagebrush, Idaho fescue, cheatgrass; 12 to 14 inches ppt.	Few western juniper, big sagebrush, low sagebrush, rabbitbrush, Idaho fescue, Poa spp., wheatgrass; 12 to 14 inches ppt.	
Surface Layer	0 to 4 inches; brown very cobbly loam, blocky and granular structure, hard, pH 6.8.	0 to 8 inches; grayish brown to dark grayish brown cobbly loam to gravelly clay loam, platy and blocky structure, slightly hard, pH 6.5 to 7.0.	0 to 3 inches; brown loam, granular structure, slightly hard, pH 7.2.
Substratum	18 plus inches; strongly cemented silica duripan.	32 plus inches; weakly to strongly cemented silica duripan.	28 to 30 inches; yellowish brown semi-consolidated ashy tuff which rubs to a clay loam, massive, very hard, pH 7.6.
Rooting Depth (in.) to Underlying Material	8 to 20; silica duripan over basalt	20 to 40; silica duripan over basalt	20 to 40; basalt
Erosion Factor (K)	.37	.37	.43
Max. Erosion Hazard	Moderate	Low to moderate	Low to moderate
Soil Permeability	Very slow	Slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class	2ed	2e	2e
Group	II		
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	7, 1	17	12, 17
Water Runoff Potential	Slow	Slow	Slow
Watershed Sensitivity	5 (Moderate)	6	6
Hydrologic Soil Group	D	C	C
Available Water Capacity (AWC)	Very Low to Low	Low to Moderate	Low to Moderate
Upper 20 inches	1.0 to 2.6 inches	2.6 inches	2.7 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	0-30	0-30

Soil horizons in inches, USDA, Unified, AASHTO

0-4; Very cobbly loam
Unified: SC, CL
AASHTO: A-6
4-18; Clay
Unified: CH
AASHTO: A-7
18+; Silica duripan

0-3; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6
3-8; Gravelly clay loam
Unified: CL, MH
AASHTO: A-6, A-7
8-32; Clay, gravelly silty clay
Unified: CH
AASHTO: A-7
32+; Silica duripan

0-3; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6
3-8; Silty clay loam
Unified: CL, MH, CH
AASHTO: A-6, A-7
8-28; Silty clay
Unified: CH
AASHTO: A-7
28-30; Clay loam
Unified: CL, MH, CH
AASHTO: A-6, A-7
30+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage are the Aikman, Puls, Dishner, Deven, and Cowiche families.

132 BIEBER-DEVEN-ROVAL FAMILIES COMPLEX, 1 to 10 percent slopes

Map Unit Components	Bieber family (35 percent)	Deven family (30 percent)	Roval family (20 percent)
Position, Slope, and Elevation	On nearly level to undulating slightly concave areas of basalt plateaus; 1 to 5 percent slopes; 4600 to 5800 feet.	On nearly level to undulating slightly convex areas of basalt plateaus; 1 to 10 percent slopes; 4600 to 5800 feet.	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4600 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, black sagebrush, Phlox spp., Idaho fescue, Poa spp., cheatgrass, other grasses; 14 to 16 inches ppt.	Western juniper, low sagebrush, Carex spp., Phlox spp., Idaho fescue, Poa spp., cheatgrass, other grasses; 14 to 16 inches ppt.	
Surface Layer	0 to 4 inches; brown very cobbly loam, blocky and granular structure, hard, pH 6.8.	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.	0 to 2 inches; brown very cobbly loam, platy and granular structure, slightly hard, pH 6.6.
Substratum	18 plus inches; strongly cemented silica duripan.		13 to 14 inches; strongly cemented silica duripan.
Rooting Depth (in.) to Underlying Material	8 to 15; silica duripan over basalt or tuff.	8 to 15 hard fractured basalt, or soft to hard tuff.	10 to 20; silica duripan over basalt or tuff.
Erosion Factor (K)	.37	.37	.37
Max. Erosion Hazard	Moderate	Moderate	Moderate
Soil Permeability	Very slow	Slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class	2edx	2edx	2ed
Group	II		
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	8, 1	8, 1	8
Water Runoff Potential	Moderate	Moderate	Moderate
Watershed Sensitivity	5 (Moderate)	5	6
Hydrologic Soil Group	D	D	D
Available Water Capacity (AWC)	Very Low to Low	Very Low to Low	Low
Upper 20 inches	1.0 to 1.9 inches	1.0 to 2.1 inches	1.5 to 3.0 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Very cobbly loam Unified: SC, CL AASHTO: A-4, A-6 4-18; Clay Unified: CH AASHTO: A-7 18+; Silica duripan	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweatehered bedrock	0-2; Very cobbly loam Unified: SM-SC, SC AASHTO: A-2-4, A-4 2-10; Clay loam Unified: CL, MH AASHTO: A-6 10-13; Clay Unified: CH AASHTO: A-7 13-14; Silica duripan 14+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage are the Gwin, Pass Canyon, Lawyer, Barnard, Stukel and Keating families, Lithic Xerorthents, mesic, and Rock outcrop.

133 BIEBER-ROVAL FAMILIES COMPLEX, 1 to 15 percent slopes

Map Unit Components	Bieber family (50 percent)	Roval family (35 percent)
Position, Slope, and Elevation	On gently undulating basalt plateaus and sideslopes of hills; 1 to 15 percent slopes; 4600 to 5500 feet.	On gently undulating basalt plateaus and sideslopes of hills; 1 to 15 percent slopes 4600 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, big sagebrush, bitterbrush, western yarrow, Phlox spp., Idaho fescue, bluebunch wheatgrass, sandberg bluegrass, other grasses; 14 to 16 inches; ppt.	Western juniper, low sagebrush, big sagebrush, Phlox spp., sandburg bluegrass, cheatgrass, other grasses; 14 to 16 inches ppt.
Surface Layer	0 to 4 inches; brown very cobbly loam, blocky and granular structure, hard, pH 6.8.	0 to 2 inches; brown very cobbly loam, platy and granular structure, slightly hard, pH 6.6.
Substratum	18 plus inches; strongly cemented silica duripan.	13 to 14 inches; strongly cemented silica duripan.
Rooting Depth (in.) to Underlying Material	12 to 20; silica duripan over basalt.	12 to 20; silica duripan over basalt.
Erosion Factor (K)	.37	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Very slow	Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2ed	2ed
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	8	8
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	5 (Moderate)	6
Hydrologic Soil Group	D	D
Available Water Capacity (AWC) Upper 20 inches	Low 1.5 to 2.5 inches	Low 1.8 to 3.0 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Very cobbly loam Unified: SC, CL AASHTO: A-6 4-18; Clay Unified: CH AASHTO: A-7 18+; Silica duripan	0-2; Very cobbly loam Unified: SM-SC, SC AASHTO: A-2-4, A-4 2-10; Clay loam Unified: CL, MH AASHTO: A-6 10-13; Clay Unified: CH AASHTO: A-7 13-14; Silica duripan 14+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Packwood, Puls, Keating, Deven, Barnard and Ditchcamp families.	

134 BIEBER-ROVAL-BARNARD FAMILIES COMPLEX, 1 to 10 percent slopes

Map Unit Components	Bieber family (45 percent)	Roval family (25 percent)	Barnard family (15 percent)
Position, Slope, and Elevation	On undulating basalt plateaus; 1 to 10 percent slopes; 4500 to 5200 feet.	On slightly convex areas of undulating basalt plateaus; 2 to 10 percent slopes; 4500 to 5200 feet.	On low lying areas of unit on undulating basalt plateaus; 1 to 5 percent slopes; 4500 to 5200 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, rabbit- brush, Phlox spp., western yarrow, Idaho fescue, wheatgrass, bottlebrush, cheatgrass; 14 to 16 inches ppt.	Western juniper, low sagebrush, big sagebrush, bitterbrush, wheatgrass, Idaho fescue, bottlebrush, cheatgrass; 14 to 16 inches ppt.	
Surface Layer	0 to 4 inches; brown very cobbly loam, blocky and granular structure, hard, pH 6.8.	0 to 2 inches; brown very cobbly loam, platy and granular structure, slightly hard, pH 6.6.	0 to 8 inches; grayish brown to dark grayish brown cobbly loam to gravelly clay loam, platy and blocky structure, slightly hard, pH 6.5 to 7.0.
Substratum	18 plus inches; strongly cemented silica duripan.	13 plus inches; strongly cemented silica duripan.	32 plus inches; weakly to strongly cemented silica duripan.
Rooting Depth (in.) to Underlying Material	10 to 20; silica duripan over basalt	10 to 20; silica duripan over basalt	20 to 40; silica duripan over basalt
Erosion Factor (K)	.37	.37	.37
Max. Erosion Hazard	Moderate	Moderate	Low to moderate
Soil Permeability	Very slow	Slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2ed II	2ed	2e
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	8	8	18, 24
Water Runoff Potential	Moderate	Moderate	Slow
Watershed Sensitivity	5 (Moderate)	6	6
Hydrologic Soil Group	D	D	C
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.3 to 2.6 inches	Low 1.5 to 3.0 inches	Low to Moderate 2.6 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Very cobbly loam Unified: SC, CL AASHTO: A-6 4-18; Clay Unified: CH AASHTO: A-7 18+; Silica duripan	0-2; Very cobbly loam Unified: SM-SC, SC AASHTO: A-2-4, A-4 2-10; Clay loam Unified: CL, MH AASHTO: A-6 10-13: Clay Unified: CH AASHTO: A-7 13-14; Silica duripan 14+; Unweathered bedrock	0-3; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 3-8; Gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 8-32; Clay, gravelly silty clay Unified: CH AASHTO: A-7 32+; Silica duripan

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Ditchcamp, Deven, Pass Canyon, Puls, and Aikman families and Lithic Xerorthents, mesic.

135 BIEBER-ROVAL-PULS FAMILIES COMPLEX, 1 to 15 percent slopes

Map Unit Components	Bieber family (35 percent)	Roval family (30 percent)	Puls family (20 percent)
Position, Slope, and Elevation	On undulating basalt plateaus; 1 to 15 percent slopes; 4500 to 5800 feet.	On upper slopes and knolls of undulating basalt plateaus; 2 to 15 percent slopes; 4500 to 5800 feet.	On slight depressions of baslat plateaus; 1 to 10 percent slopes; 4500 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Low sagebrush, few western juniper, Phlox spp., Idaho fescue, cheatgrass; 14 to 16 inches ppt.	Western juniper, low sagebrush, big sagebrush sandberg bluegrass, Idaho fescue, bottlebrush; 14 to 16 inches ppt.	
Surface Layer	0 to 4 inches; brown very cobbly loam, blocky and granular structure, hard, pH 6.8.	0 to 2 inches; brown very cobbly loam, platy and granular structure, slightly hard, pH 6.6.	0 to 5 inches; pinkish gray very stony clay loam, granular structure, slightly hard, pH 6.3.
Substratum	18 plus inches; strongly cemented silica duripan.	13 plus inches; strongly cemented silica duripan.	19 to 28 inches; indurated silica duripan.
Rooting Depth (in.) to Underlying Material	10 to 20; silica duripan over basalt	10 to 20; silica duripan over basalt	5 to 10; dense very hard clay over silica duripan at 10 to 20 inches
Erosion Factor (K)	.37	.37	.37
Max. Erosion Hazard	Moderate	Moderate	Moderate
Soil Permeability	Very slow	Slow	Very slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class	2ed	2ed	3eDx
Group	II		
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	8	8	1
Water Runoff Potential	Moderate	Moderate	Moderate
Watershed Sensitivity	5 (Moderate)	6	5
Hydrologic Soil Group	D	D	D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low	Low	Very Low to Low
	1.3 to 2.6 inches	1.5 to 3.0 inches	1.1 to 2.7 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Very cobbly loam Unified: SC, CL AASHTO: A-6 4-18; Clay Unified: CH AASHTO: A-7 18+; Silica duripan	0-2; Very cobbly loam Unified: SM-SC, SC AASHTO: A-2-4, A-4 2-10; Clay loam Unified: CL, MH AASHTO: A-6 10-13; Clay Unified: CH AASHTO: A-7 13-14; Silica duripan 14+; Unweathered bedrock	0-5; Very stony clay loam Unified: ML, CL AASHTO: A-6, A-7 5-19; Clay loam, clay Unified: CL, CH AASHTO: A-7 19-28; Silica duripan 28+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Deven, Pass Canyon, Simpson, Barnard, Aikman and Fordice families and Lithic Xerorthents, mesic.		

Map Unit Components	**Cardon family (75 percent)**
Position, Slope, and Elevation	On nearly level slightly concave alluvial basins and drainages, (subject to spring flooding); 0 to 2 percent slopes; 4700 to 5200 feet.
Typical Vegetation and Precipitation (ppt)	Silver sagebrush, sedges, forbes, timothy, Kentucky bluegrass, other grasses; 14 to 18 inches ppt.
Surface Layer	0 to 4 inches; very dark gray clay, black, moist, platy and blocky structure, hard, pH 6.8.
Substratum	4 to 36 inches; dark gray clay very dark gray, moist, prismatic and angular blocky structure, extremely hard, pH 6.8: over 36 to 60 inches; mottled grayish brown, light brownish gray to olive yellow clay and clay loam, blocky structure, hard to very hard, pH 7.0 to 7.2.
Rooting Depth (in.) to Underlying Material	40 plus; clayey alluvium
Erosion Factor (K)	.37
Max. Erosion Hazard	Moderate
Soil Permeability	Very slow
Drainage Class	Somewhat poorly drained
Soil Manageability Class Group	 3eW III
Forest Site Class	7 (non-commercial)
Range Site	26, 25
Water Runoff Potential	Very Slow
Watershed Sensitivity	6 (Moderate)
Hydrologic Soil Group	D
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.6 inches
Susceptibility to Burning Damage	Low
Slope Stability Hazard	Low
Allowable Soil Loss	5 tons/acre/year
Chance of Seedling Survival	Not Rated
Rating for Timber Site	Not Rated
R-Value	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-36; Clay Unified: CH AASHTO: A-7 36-46; Clay, Clay loam Unified: CH, CL, MH AASHTO: A-6, A-7 46-60; Clay Unified: CH AASHTO: A-7
Included Areas:	Included with this soil in mapping and making up about 25 percent of the acreage are the Aikman, Barnard and Bieber families and unnamed Xerofluvents and Aquolls.

137 CARDON-JACKET-DEVEN FAMILIES ASSOCIATION, 5 to 25 percent slopes

Map Unit Components	Cardon family (35 percent)	Jacket family (25 percent)	Deven family (25 percent)
Position, Slope, and Elevation	On lower sideslopes and alluvial drainages of mountain uplands; 5 to 15 percent slopes; 5600 to 6200 feet.	On sideslopes and ridges of mountain uplands; 5 to 25 percent slopes; 5600 to 6200 feet.	On sideslopes and knolls and eroded drainages of mountain uplands; 5 to 25 percent slopes; 5600 to 6200 feet.
Typical Vegetation and Precipitation (ppt)	Sedges, forbes, moss, timothy, Poa spp., other grasses; 18 to 20 inches ppt.	Ponderosa pine, few white fir, western juniper, mountain mahogany, big sagebrush, Ross's sedge, few grasses; 18 to 20 inches ppt.	
Surface Layer	0 to 4 inches; very dark gray clay, black, moist, platy and blocky structure, hard, pH 6.8.	1 to 0 inches, ponderosa pine needles and twigs, over 0 to 2 inches; very dark grayish brown cobbly clay loam, granular structure, slightly hard, pH 6.2.	0 to 2 inches; brown cobbly loam, platy and granular structure, slightly hard, pH 7.0.
Substratum	4 to 36 inches; dark gray clay, very dark gray, moist, prismatic and angular blocky structure, extremely hard, pH 6.8; over 36 to 60 inches; mottled grayish brown, light brownish gray to olive yellow clay and clay loam, blocky structure, hard to very hard, pH 7.0 to 7.2.	34 plus inches; weathered in place platy to massive semi-soft volcanic tuff.	13 to 25 plus inches; weathered in place platy to massive soft to hard volcanic tuff.
Rooting Depth (in.) to Underlying Material	40 plus; tuff, clayey alluvium	20 to 40; tuff	10 to 20; tuff
Erosion Factor (K)	.37	.32	.37
Max. Erosion Hazard	Moderate	Moderate	Moderate
Soil Permeability	Very slow	Slow	Slow
Drainage Class	Somewhat poorly drained	Well drained	Well drained
Soil Manageability Class Group	3eW II	2e	2ed
Forest Site Class	7 (non-commercial)	5-6 (3-5)	7 (non-commercial)
Range Site	25	Not placed in a range site.	23, 8
Water Runoff Potential	Moderate	Moderate	Rapid
Watershed Sensitivity	4 (High)	5	4
Hydrologic Soil Group	D	C	D
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.6 inches	Low to Moderate 2.6 inches	Very Low to Low 1.4 to 2.9 inches
Susceptibility to Burning Damage	Low	Moderate	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	5 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Low	Not Rated
Rating for Timber Site	Not Rated	Fair (7,10)	Not Rated
R-Value	0-30	0-30	0-30

Soil horizons in inches, USDA, Unified, AASHTO

0-36; Clay
Unified: CH
AASHTO: A-7

36-46; Clay, clay loam
Unified: CH, CL, MH
AASHTO: A-6, A-7

46-60; Clay
Unified: CH
AASHTO: A-7

0-2; Cobbly clay loam
Unified: CL, MH
AASHTO: A-6

2-34; Clay
Unified: CH
AASHTO: A-7

34+; Weathered bedrock

0-2; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

2-13; Clay loam, clay
Unified: CL, CH
AASHTO: A-7

13+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Hiibner, Lawyer and Keating families and Lithic Xerorthents, mesic.

Map Unit Components	**Saprists (70 percent)**
Position, Slope, and Elevation	On slightly concave alluvial basins and drainages (subject to spring flooding); 0 to 2 percent slopes; 5000 to 5100 feet.
Typical Vegetation and Precipitation (ppt)	Club moss, milk thistle, foxtail barley, sedges, forbes and other grasses; 14 to 16 inches ppt.
Surface Layer	0 to 24 inches of black to dark reddish brown highly decomposed organic matter; soft platy structure; (pH 6.2-6.6) over 24 to 60 inches of black with 50 to 60 percent mottled colors of very dark gray and light brownish gray highly decomposed organic matter; soft platy structure; (pH 6.4-6.8).
Rooting Depth (in.) to Underlying Material	40 plus; decomposed organic matter
Erosion Factor (K)	Not Rated.
Max. Erosion Hazard	Low
Soil Permeability	Slow
Drainage Class	Very poorly drained
Soil Manageability Class Group	 3W III
Forest Site Class	7 (non-commercial)
Range Site	25
Water Runoff Potential	Very Slow
Watershed Sensitivity	9 (Low)
Hydrologic Soil Group	D
Available Water Capacity (AWC) Upper 20 inches	High 4.0 inches
Susceptibility to Burning Damage	High
Slope Stability Hazard	Low
Allowable Soil Loss	Not Rated tons/acre/year
Chance of Seedling Survival	Not Rated
Rating for Timber Site	Not Rated
R-Value	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-60; Organic material Unified: Pt AASHTO: A-8
Included Areas:	Included with this soil in mapping and making up about 30 percent of the acreage are the Supan and Jacknife families and unnamed fluvaquents and Aquolls.

139 CASTLEVALE-BAKEOVEN FAMILIES COMPLEX, 2 to 8 inch pumice overburden, 1 to 10 percent slopes

Map Unit Components	Castlevale family (45 percent)	Bakeoven family (35 percent)
Position, Slope, and Elevation	On undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 4600 feet.	On undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 4600 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, big sagebrush, low sagebrush, rabbitbrush, mustard, buckwheat, wheatgrass, cheatgrass; 10 to 14 inches ppt.	Western juniper, few ponderosa pine, big sagebrush, bitterbrush, wheatgrass, cheatgrass, other grasses 10 to 14 inches ppt.
Surface Layer	8 inches of pumice overburden consisting of grayish brown very gravelly coarse sandy loam grading to pale brown extremely gravelly coarse sandy loam. (Pumice thickness ranges from 2 to 8 inches.) OVER 8 to 13 inches; yellowish brown gravelly sandy loam, subangular blocky structure, soft, pH 6.8.	A thin pumice overburden up to 8 inches thick may be present, OVER 0 to 11 inches; dark grayish brown and grayish brown very cobbly fine sandy loam, subangular blocky structure; slightly hard, pH 6.6.
Rooting Depth (in.) to Underlying Material	8 to 20; basalt	10 to 20; basalt
Erosion Factor (K)	.24	.24
Max. Erosion Hazard	Low to moderate	Low to moderate
Soil Permeability	Moderate	Moderately rapid
Drainage Class	Well drained	Well drained
Soil Manageability Class	2ed	2ed
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commerical)
Range Site	4, 1	7
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	7 (Moderate)	7
Hydrologic Soil Group	D	D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.0 to 2.4 inches	Very Low to Low 1.0 to 1.9 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-8; Very gravelly coarse sandy loam extremely gravelly coarse sandy loam. Unified: SW-SM, SM AASHTO: A-1-b, A-1-a 8-13; Gravelly sandy loam Unified: SM-SC, SM AASHTO: A-2-4 13-18; Gravelly loam Unified: SM-SC, SC AASHTO: A-4, A-6 18+; Unweathered bedrock	0-11; Very cobbly fine sandy loam Unified: SM, SM-SC AASHTO: A-4 11+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Wenatchee and Searles families, Lithic Xerorthents, mesic, and Rock outcrop.	

140 CASTLEVALE-WENATCHEE-SEARLES FAMILIES COMPLEX, 2 to 12 inch pumice overburden, 1 to 10 percent slopes

Map Unit Components	Castlevale family (35 percent)	Wenatchee family (30 percent)	Searles family (20 percent)
Position, Slope, and Elevation	On convex areas of undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 4600 feet.	On gentle concave areas on basalt plateaus; 1 to 5 percent slopes; 4200 to 4600 feet.	On gentle concave areas on basalt plateaus; 1 to 10 percent slopes, 4200 to 4600 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, big sagebrush, low sagebrush, rabbitbrush, mustard, buckwheat, bottlebrush, cheatgrass; 12 to 14 inches ppt.	Western juniper, big sagebrush, rabbitbrush, bitterbrush, Ribes spp., bottlebrush, needlegrass, sandberg bluegrass; 12 to 14 inches ppt.	
Surface Layer	8 inches of pumice overburden consisting of grayish brown very gravelly coarse sandy loam grading to pale brown extremely gravelly coarse sandy loam. (Pumice thickness ranges from 2 to 12 inches.) OVER 8 to 13 inches; yellowish brown gravelly sandy loam, subangular blocky structure, soft, pH 6.8.	9 inches of pumice overburden consisting of brown gravelly coarse sandy loam over very pale brown extremely gravelly coarse loamy sand (pumice thickness ranges from 2 to 12 inches) OVER 9 to 15 inches; pale brown fine sandy loam, subangular blocky structure, soft, pH 6.8.	A thin pumice overburden of up to 12 inches thick may be present, OVER 0 to 7 inches; brown gravelly sandy loam, gravels are pumice, granular structure, soft, pH 7.0.
Rooting Depth (in.) to Underlying Material	8 to 20; basalt	20 to 40; basalt	20 to 40; basalt
Erosion Factor (K)	.24	.20	.24
Max. Erosion Hazard	Low to moderate	Low	Low
Soil Permeability	Moderate	Moderate	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2edx II	1	1
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	7, 1	16	16
Water Runoff Potential	Slow	Very Slow	Very Slow
Watershed Sensitivity	7 (Low)	8	9
Hydrologic Soil Group	D	B	B
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.0 to 2.4 inches	Low to Moderate 2.6 inches	Low to Moderate 2.3 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	30-60	30-60	30-60

140 CASTLEVALE-WENATCHEE-SEARLES FAMILIES COMPLEX (continued)

Soil horizons in inches, USDA, Unified, AASHTO

0-8; Very gravelly coarse sandy loam, extremely gravelly coarse sandy loam
Unified: SW-SM, SM
AASHTO: A-1-b, A-1-a

8-13; Gravelly sandy loam
Unified: SM-SC, SM
AASHTO: A-2-4

13-18; Gravelly loam
Unified: SM-SC, SC
AASHTO: A-4, A-6

18+; Unweathered bedrock

0-5; Gravelly coarse sandy loam
Unified: SM
AASHTO: A-1-b

5-9; Extremely gravelly loamy coarse sand
Unified: SM, GM
AASHTO: A-1-a, A-1-b

9-15; Fine sandy loam
Unified: SM-SC, ML-CL
AASHTO: A-4

15-27; Loam
Unified: CL
AASHTO: A-4, A-6

27+; Unweathered bedrock

0-7; Gravelly sandy loam
Unified: SM, SM-SC
AASHTO: A-4

7-14; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

14-34; Extremely cobbly loam
Unified: SC
AASHTO: A-6

34+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Skalan, Stukel, Holland, Bakeoven families and Lithic Xerorthents, mesic, and Rock outcrop.

141 CAVANAUGH-PATIO deep FAMILIES ASSOCIATION, 35 to 65 percent slopes

Map Unit Components	Cavanaugh family (50 percent)	Patio family, deep (30 percent)
Position, Slope, and Elevation	On steep hummocky relief sideslopes of mountain uplands; 35 to 65 percent slopes; 5800 to 7200 feet.	On steep smooth sideslopes of mountain uplands; 35 to 65 percent slopes; 5800 to 7200.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense- cedar, plus snowberry, ceonothus, mulesear, few grasses, Ross's sedge; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, plus snowberry, forbes, Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	1 to 0 inches of white fir and ponderosa pine needles, over 0 to 13 inches; dark brown and brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.4.	1 to 0 inches of white fir needles, over 0 to 18 inches; yellowish brown very gravelly loam, granular structure, slightly hard, pH 6.2 to 6.8.
Rooting Depth (in.) to Underlying Material	30 plus; tuff	40 plus; andesite
Erosion Factor (K)	.37	.28
Max. Erosion Hazard	High	High
Soil Permeability	Slow	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class	3S	3Ep
Group	III	
Forest Site Class	4-5 (3-4)	4 (3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Rapid	Moderate
Watershed Sensitivity	4 (High)	6
Hydrologic Soil Group	C	B
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.5 inches	Moderate 2.3 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	High	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Low to Moderate
Rating for Timber Site	Fair (3,8)	Fair (8)
R-Value	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-7; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 7-13; Very cobbly loam Unified: SM-SC, SC AASHTO: A-4, A-6 13-18; Very cobbly clay loam Unified: CL AASHTO: A-6 18-60; Very gravelly clay, extremely gravelly clay loam Unified: GC AASHTO: A-2-7, A-7	0-60; Very gravelly loam, extremely gravelly loam,extremely cobbly loam Unified: SM, SM-SC AASHTO: A-2-4, A-2-6

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the Anatone, Wapal, DeMasters, Manila and Bertag families and Rock outcrop.

142 CHEADLE-GALLATIN FAMILIES-ROCK OUTCROP ASSOCIATION, 10 to 60 percent slopes

Map Unit Components	Cheadle family (40 percent)	Gallatin family (30 percent)	Rock outcrop (15 percent)
Position, Slope, and Elevation	On upper sideslopes and convex areas of mountain uplands; 10 to 60 percent slopes; 7500 to 9000 feet.	On lower sideslopes and toeslopes of mountain uplands; 10 to 50 percent slopes; 7500 to 9000 feet.	On ridges and scarp faces of mountain uplands; 30 to 60 percent slopes; 7500 to 9000 feet.
Typical Vegetation and Precipitation (ppt)	Big sagebrush, low sagebrush, Phlox spp., buckwheat, mulesear, Idaho fescue, other grasses; 25 to 35 inches ppt.	Few white bark pine, few lodgepole pine, quaking aspen, big sagebrush, lupine, mulesear, skunk cabbage, Idaho fescue, other grasses; 25 to 35 inches ppt.	
Surface Layer	0 to 17 inches; dark grayish brown to brown very cobbly loam to very cobbly clay loam, granular and subangular blocky structure, slightly hard to hard, pH 6.6.	0 to 29 inches; dark grayish brown loam to very cobbly loam, granular to subangular blocky structure, slightly hard, pH 6.2 to 6.4.	NOT APPLICABLE: Basalt, andesite or conglomerated tuff bedrock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	10 to 20; andesite, tuff	20 to 40; andesite, basalt	
Erosion Factor (K)	.37	.32	
Max. Erosion Hazard	Moderate to high	Moderate to high	
Soil Permeability	Moderate	Moderate	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	 3Ed III	 2e	
Forest Site Class	7 (non-commercial)	7 (non-commercial)	
Range Site	9	14, 19	
Water Runoff Potential	Rapid	Moderate	Very Rapid
Watershed Sensitivity	4 (High)	6	0
Hydrologic Soil Group	D	B	
Available Water Capacity (AWC) Upper 20 inches	 1.2 to 2.4 inches	 3.2 inches	
Susceptibility to Burning Damage	Moderate	Moderate	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year	
Chance of Seedling Survival	Not Rated	Not Rated	
Rating for Timber Site	Not Rated	Not Rated	
R-Value	30-60	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-12; Very cobbly loam Unified; SM-SC, SC AASHTO: A-2-4, A-2-6, A-4, A-6 12-17; Very cobbly clay loam Unified: SC AASHTO: A-6, A-2-6 17+; Unweathered bedrock	0-21; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 21-29; Very cobbly loam Unified: SM-SC, SC, ML-CL, CL AASHTO: A-4, A-6 29+; Unweathered bedrock	

Included Areas: Included with this unit in mapping and making up about 15 percent of the acreage are the Duncom and Supervisor families, Lithic Cryochrepts, Tuff outcrop, Cryoborolls, wet and Rubble land.

144 COWICHE FAMILY, 1 to 10 percent slopes

Map Unit Components	**Cowiche family (70 percent)**
Position, Slope, and Elevation	Mainly on toeslopes of mountain uplands and alluvial fans; 1 to 10 percent slopes; 4300 to 4800 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, big sagebrush, rabbitbrush, Idaho fescue, wheatgrass, cheatgrass; 12 to 14 inches ppt.
Surface Layer	0 to 6 inches; brown to grayish brown loam, platy and granular structure; soft to slightly hard; pH 6.2 to 6.4.
Substratum	25 plus inches; weathered volcanic tuff which can be dug with a spade.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt, tuff
Erosion Factor (K)	.37
Max. Erosion Hazard	Low
Soil Permeability	Moderate
Drainage Class	Well drained
Soil Manageability	
Class	1
Group	I
Forest Site Class	7 (non-commercial)
Range Site	12
Water Runoff Potential	Very Slow
Watershed Sensitivity	8 (Low)
Hydrologic Soil Group	B
Available Water Capacity (AWC)	Low to Moderate
Upper 20 inches	2.5 inches
Susceptibility to Burning Damage	Moderate
Slope Stability Hazard	Low
Allowable Soil Loss	2 tons/acre/year
Chance of Seedling Survival	Not Rated
Rating for Timber Site	Not Rated
R-Value	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Loam Unified; ML-CL, CL AASHTO: A-4, A-6 6-25; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6 25+; Weathered bedrock
Included Areas:	Included with this soil in mapping and making up about 30 percent of the acreage are the Pass Canyon, Searles, Supan, Stukel, Simpson and Wrentham families.

145 COWICHE-CASUSE FAMILIES-ROCK OUTCROP, TUFF ASSOCIATION, 2 to 30 percent slopes

Map Unit Components	Cowiche family (45 percent)	Casuse family (30 percent)	Rock outcrop (15 percent)
Position, Slope, and Elevation	On alluvial fans and lower sideslopes of mountain uplands; 2 to 20 percent slopes; 4500 to 5300 feet.	On sideslopes and toeslopes of mountain uplands; 5 to 30 percent slopes; 4500 to 5300 feet.	On ridges, knolls and deeply incised drainages. 5 to 30 percent slopes; 4500 to 5300 feet.
Typical Vegetation and Precipitation (ppt)	Dense western juniper, bitterbrush, big sagebrush, rabbitbrush, grasses; 14 to 16 inches ppt.	Western juniper, low sagebrush, mountain mahogany, Idaho fescue, cheatgrass, other grasses; 14 to 16 inches ppt.	
Surface Layer	0 to 6 inches; brown to grayish brown loam, platy and granular structure; soft to slightly hard; pH 6.2 to 6.4.	0 to 5 inches; light gray to light brownish gray loam, subangular blocky and granular structure, soft to slightly hard, pH 6.8.	NOT APPLICABLE: Platy and massive paralithic volcanic tuff which rubs to a sandy loam, loam, or clay loam texture.
Substratum	25 plus inches weathered volcanic tuff which can be dug with a spade.	14 plus inches; semi-soft weathered platy volcanic tuff.	
Rooting Depth (in.) to Underlying Material	20 to 40; basalt, tuff	7 to 20; tuff	
Erosion Factor (K)	.37	.49	
Max. Erosion Hazard	Low to moderate	Moderate to high	
Soil Permeability	Moderate	Moderate	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	2e II	2ed	
Forest Site Class	7 (non-commercial)	7 (non-commercial)	
Range Site	13	4, 1	
Water Runoff Potential	Slow	Rapid	Very Rapid
Watershed Sensitivity	7 (High)	4	2
Hydrologic Soil Group	B	D	
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.5 inches	Very Low to Low 1.1 to 3.2 inches	
Susceptibility to Burning Damage	Moderate	Low	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	Not Rated	
Rating for Timber Site	Not Rated	Not Rated	
R-Value	30-60	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 6-25; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6 25+; Weathered bedrock	0-5; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 5-10; Clay loam Unified: CL, MH AASHTO: A-6 10-14; Very gravelly clay loam Unified: SC AASHTO: A-6, A-7 14+; Weathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 10 percent of the acreage are the Pass Canyon, Keating and Hiibner families, Lithic Xerorthents, mesic, Xerofluvents and Aquolls.		

146 COWICHE-SIMPSON FAMILIES COMPLES, 1 to 15 percent slopes

Map Unit Components	Cowiche family (50 percent)	Simpson family (35 percent)
Position, Slope, and Elevation	On sideslopes and alluvial fans of basalt plateaus; 1 to 15 percent slopes; 4300 to 4600 feet.	On lower toeslopes and alluvial basin areas of basalt plateaus; 1 to 15 percent slopes; 4300 to 4600 feet.
Typical Vegetation and Precipitation (ppt)	Big sagebrush, rabbitbrush, bitterbrush, few western juniper, sandberg bluegrass, thurber needlegrass, bottlebrush, cheat- grass; 10 to 14 inches ppt.	Big sagebrush, rabbitbrush, bitterbrush, few western juniper, sandberg bluegrass, thurber needlegrass, bottlebrush, cheat- grass; 10 to 14 inches ppt.
Surface Layer	0 to 6 inches; brown to grayish brown loam, platy and granular structure; soft to slightly hard; pH 6.2 to 6.4.	0 to 3 inches; brown loam, granular structure, slightly hard, pH 7.2.
Substratum	25 plus inches; weathered volcanic tuff which can be dug with a spade.	28 to 30 inches; yellowish brown semi-consolidated ashy tuff which rubs to a clay loam, massive, very hard, pH 7.6.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt, tuff	20 to 40; basalt, tuff
Erosion Factor (K)	.37	.43
Max. Erosion Hazard	Low	Low
Soil Permeability	Moderate	Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	1	1
Group	IA	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	12	12
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	8 (Moderate)	6
Hydrologic Soil Group	B	C
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate	Low to Moderate
	2.5 inches	2.7 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	2 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 6-25; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6 25+; Weathered bedrock	0-3; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 3-8; Silty clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 8-28; Silty clay Unified: CH AASHTO: A-7 28-30; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 30+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage are the Searles, Supan, Pass Canyon and Gwin families and Simpson Soils deeper than 40 inches.

147 DEMASTERS-MERLIN-DEMASTERS deep FAMILIES ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	DeMasters family (35 percent)	Merlin family (30 percent)	DeMasters family, deep (15 percent)
Position, Slope, and Elevation	On sideslopes and ridges of undulating basalt plateaus; 1 to 20 percent slopes; 5400 to 6000 feet.	On knolls, ridges and nearly level shallow rocky areas of basalt plateaus; 1 to 20 percent slopes; 5400 to 6000 feet.	On gentle concave areas and alluvial draws of undulating basalt plateaus; 1 to 15 percent slopes; 5400 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense- cedar, plus western juniper, greenleaf manzanita, snowberry, mountain mahogany, mulesear, Ross's sedge, few grasses, note- in the northeast corner of the survey area stands of Ponderosa Pine/ Jeffrey Pine are found); 20 to 30 inches ppt.	Western juniper, low sagebrush, big sagebrush, mountain mahogany, forbes, Idaho fescue, Poa spp., bottlebrush, cheatgrass; 20 to 30 inches ppt.	
Surface Layer	2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 9 inches; dark brown loam, granular and blocky structure, soft, pH 6.6 to 6.8.	0 to 2 inches; grayish brown very cobbly clay loam, granular structure, slightly hard, pH 6.4.	1-1/2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 14 inches; brown loam, granular and blocky structure, soft, pH 5.6 to 6.4.
Rooting Depth (in.) to Underlying Material	20 to 40; soft to hard basalt	10 to 20; basalt	40 plus; soft to hard basalt
Erosion Factor (K)	.32	.32	.32
Max. Erosion Hazard	Low to moderate	Moderate	Low
Soil Permeability	Moderately slow	Slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2e II	2ed	1
Forest Site Class	5 (3-4)	7 (non-commercial)	4 (2-3)
Range Site	Not placed in a range site.	9	Not placed in a range site
Water Runoff Potential	Slow	Moderate	Very Slow
Watershed Sensitivity	7 (Moderate)	4	8
Hydrologic Soil Group	B	D	B
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 3.4 inches	Very Low to Low 1.1 to 2.3 inches	Moderate to High 3.4 inches
Susceptibility to Burning Damage	Low to Moderate	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	High	Not Rated	High
Rating for Timber Site	Fair (7)	Not Rated	Good
R-Value	30-60	0-30	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-9;	Loam Unified: ML-CL, CL AASHTO: A-4, A-6	0-2;	Very cobbly clay loam Unified: SC, CL AASHTO: A-6	0-14;	Loam Unified: ML-CL, CL AASHTO: A-4, A-6
9-31;	Loam, gravelly loam Unified: CL AASHTO: A-6	2-12;	Gravelly clay Unified: CH AASHTO: A-7	14-37;	Gravelly clay loam Unified: CL AASHTO: A-6
31+;	Weathered bedrock	12+;	Unweathered bedrock	37-60;	Extremely cobbly clay loam Unified: SC, CL AASHTO: A-6, A-7

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Mascamp, Bearskin, Anatone, Smarts, Cavanaugh and Bertag families and Rock outcrop.

148 DEMASTERS-SMARTS FAMILIES, deep COMPLEX, 1 to 20 percent slopes

Map Unit Components	DeMasters family, deep (60 percent)	Smarts family, deep (25 percent)
Position, Slope, and Elevation	On smooth sloping sideslopes of mountain uplands; 1 to 20 percent slopes; 5500 to 7500 feet.	On ridges and convex areas of sideslopes of mountain uplands; 2 to 20 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense- cedar, plus snowberry, serviceberry, Phlox spp., Ross's sedge, few grasses; 20 to 30 inches ppt.	White fir forest or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus few western juniper, few lodgepole pine at higher elevations, snowberry, serviceberry, Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	1-1/2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 14 inches; brown loam, granular and blocky structure, soft, pH 5.6 to 6.4.	2 to 0 inches of decomposed and undecompossed white fir needles and twigs, over 0 to 18 inches; reddish brown stony loam, granular structure, soft, pH 6.2.
Substratum		32 to 50 inches; pale brown extremely gravelly loam, massive, soft, pH 6.0.
Rooting Depth (in.) to Underlying Material	40 plus; basalt	40 plus; basalt
Erosion Factor (K)	.32	.32
Max. Erosion Hazard	Low to moderate	Low to moderate
Soil Permeability	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2e	2ep
Group	II	
Forest Site Class	4 (2-3)	4 (2-3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very Slow	Slow
Watershed Sensitivity	8 (Low)	8
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High	Moderate
	3.4 inches	2.6 inches
Susceptibility to Burning Damage	Low	Low to Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	High	Moderate
Rating for Timber Site	Good	Fair (1,8)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-14; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 14-37; Gravelly clay loam Unified: CL AASHTO: A-6 37-60; Extremely cobbly clay loam Unified: SC, CL AASHTO: A-6, A-7	0-18; Stony loam Unified: ML-CL, CL AASHTO: A-4 18-50; Extremely gravelly clay loam, extremely gravelly loam Unified: SC AASHTO: A-2-6, A-6 50+; Weathered bedrock

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage are the Lamondi, Bertag, Cavanaugh, Mascamp and Anatone families, and moderately deep DeMasters and smarts families and unnamed soils similar to DeMasters family but not Pachic.

149 DEMASTERS-SMARTS FAMILIES, deep COMPLEX, 20 to 40 percent slopes

Map Unit Components	DeMasters family, deep (45 percent)	Smarts family, deep (40 percent)
Position, Slope, and Elevation	On smooth to concave sideslopes of mountain uplands; 20 to 35 percent slopes; 5500 to 7500 feet.	On ridges and convex areas of sideslopes of mountain uplands; 2 to 20 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense- cedar, plus snowberry, serviceberry, Phlox spp., Ross's sedge, few grasses; 20 to 30 inches ppt.	White fir forest or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus few western juniper, few lodgepole pine at higher elevations, snowberry, serviceberry, Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	1-1/2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 14 inches; dark brown loam, granular and blocky structure, soft, pH 5.6 to 6.4.	2 to 0 inches of decomposed and undecompossed white fir needles and twigs, over 0 to 18 inches; reddish brown stony loam, granular structure, soft, pH 6.2.
Substratum		32 to 50 inches; pale brown extremely gravelly loam, massive, soft, pH 6.0.
Rooting Depth (in.) to Underlying Material	40 plus; basalt	40 plus; basalt
Erosion Factor (K)	.32	.32
Max. Erosion Hazard	Moderate	Low to moderate
Soil Permeability	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	 2e II	 2ep
Forest Site Class	4 (2-3)	4 (2-3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	7 (Moderate)	8
Hydrologic Soil Group	B	B
Available Water Capacity (AWC)	Moderate to High	Moderate
Upper 20 inches	3.4 inches	2.6 inches
Susceptibility to Burning Damage	Low to moderate.	Low to Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	High	Moderate
Rating for Timber Site	Good	Fair (1,8)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-14; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 14-37; Gravelly clay loam Unified: CL AASHTO: A-6 37-60; Extremely cobbly clay loam Unified: SC, CL AASHTO: A-6, A-7	0-18; Stony loam Unified: ML-CL, CL AASHTO: A-4 18-50; Extremely gravelly clay loam, extremely gravelly loam Unified: SC AASHTO: A-2-6, A-6 50+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Lamondi, Bertag, Cavanaugh, Mascamp and Anatone families, and moderately deep DeMasters and smarts families and unnamed soils similar to DeMasters family but not Pachic.	

150 DEVEN FAMILY, 1 to 10 percent slopes

Map Unit Components	**Deven family (80 percent)**
Position, Slope, and Elevation	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4600 to 5100 feet.
Typical Vegetation and Precipitation (ppt)	Normally dense western juniper plus big sagebrush, sandberg bluegrass, bottlebrush, Idaho fescue, cheatgrass; 14 to 16 inches ppt.
Surface Layer	0 to 5 inches; grayish brown and brown clay loam and clay, granular and blocky structure, hard to very hard, pH 6.4.
Rooting Depth (in.) to Underlying Material	14 to 20; basalt
Erosion Factor (K)	.43
Max. Erosion Hazard	Moderate
Soil Permeability	Slow
Drainage Class	Well drained
Soil Manageability	
Class	2ed
Group	II
Forest Site Class	7 (non-commercial)
Range Site	23
Water Runoff Potential	Moderate
Watershed Sensitivity	5 (Moderate)
Hydrologic Soil Group	D
Available Water Capacity (AWC)	Low
Upper 20 inches	1.6 to 2.4 inches
Susceptibility to Burning Damage	Low to Moderate
Slope Stability Hazard	Low
Allowable Soil Loss	1 tons/acre/year
Chance of Seedling Survival	Not Rated
Rating for Timber Site	Not Rated
R-Value	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Clay loam Unified: CL, MH AASHTO: A-6, A-7 2-17; Clay, cobbly clay Unified: CH AASHTO: A-7 17+; Unweathered bedrock
Included Areas:	Included with this soil in mapping and making up about 20 percent of the acreage are the Barnard, Bieber, Keating, Packwood, Roval and Pass Canyon families.

151 DEVEN-BIEBER-BARNARD FAMILIES COMPLEX, 0 to 5 percent slopes

Map Unit Components	Deven family (45 percent)	Bieber family (25 percent)	Barnard family (20 percent)
Position, Slope, and Elevation	On upper areas of gently undulating basalt plateaus; 1 to 5 percent slopes; 4500 to 5500 feet.	On upper areas of gently undulating basalt plateaus; 1 to 5 percent slopes; 4500 to 5500 feet.	On low lying basin areas and drainageways of gently undulating basalt plateaus (subject to spring flooding); 0 to 2 percent slopes; 4500 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, big sagebrush, Phlox spp., Idaho fescue, sandberg bluegrass, bottlebrush,cheatgrass; 14 to 16 inches ppt.	Western juniper, low sagebrush, big sagebrush, Phlox spp., Idaho fescue, sandberg bluegrass, bottlebrush, cheatgrass; 14 to 16 inches ppt.	
Surface Layer	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3	0 to 4 inches; brown very cobbly loam, blocky and granular structure, hard, pH 6.8.	0 to 8 inches; grayish brown to dark grayish brown cobbly loam to gravelly clay loam, platy and blocky structure, slightly hard, pH 6.5 to 7.0.
Substratum		18 plus inches; strongly cemented silica duripan.	32 plus inches; weakly to strongly cemented silica duripan.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt	10 to 20; silica duripan over basalt	20 to 40; silica duripan over basalt
Erosion Factor (K)	.37	.37	.37
Max. Erosion Hazard	Moderate	Moderate	Moderate
Soil Permeability	Slow	Very Slow	Slow
Drainage Class	Well Drained	Well Drained	Well drained
Soil Manageability Class	2edx	2ed	2e
Group	II		
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	8	8	18, 24
Water Runoff Potential	Moderate	Moderate	Very Slow
Watershed Sensitivity	5 (Moderate)	5	6
Hydrologic Soil Group	D	D	C
Available Water Capacity (AWC)	Very Low to Low	Very Low to Low	Low to Moderate
Upper 20 inches	1.4 to 2.8 inches	1.2 to 2.5 inches	2.6 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock	0-4; Very cobbly loam Unified: SC, CL AASHTO: A-6 4-18; Clay Unified: CH AASHTO: A-7 18+; Silica duripan	0-3; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 3-8; Gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 8-32; Clay, gravelly silty clay Unified: CH AASHTO: A-7 32+; Silica duripan

Included Areas:

Included with these soils in mapping and making up about 10 percent of the acreage are the Keating, Aikman, Packwood, Ruckles, and Puls families, Lithic Xerorthents, mesic, and Rock outcrop.

152 DEVEN-BIEBER-LAWYER FAMILIES ASSOCIATION, 1 to 10 percent slopes

Map Unit Components	Deven family (40 percent)	Bieber family (30 percent)	Lawyer family (20 percent)
Position, Slope, and Elevation	On gently undulating basalt plateaus; 1 to 5 percent slopes; 4600 to 5500 feet.	On gently undulating basalt plateaus; 1 to 5 percent slopes; 4600 to 5500 feet.	On slightly raised 2 to 15 acre islands surrounded by shallow rocky soil; 2 to 10 percent slopes; 4600 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Few western juniper, low sagebrush, Phlox spp., sandberg bluegrass, Idaho fescue, cheatgrass; 16 to 18 inches ppt.	Few western juniper, low sagebrush, Phlox spp., sandberg bluegrass, Idaho fescue, cheatgrass; 16 to 18 inches ppt.	
Surface Layer	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.	0 to 4 inches; brown very cobbly loam, blocky and granular structure, hard, pH 6.8.	2 to 0 inches of ponderosa pine needles and twigs, over 0 to 8 inches; dark brown stony loam, granular structure, soft, pH 6.2.
Substratum		18 plus inches; strongly cemented silica duripan.	
Rooting Depth (in.) to Underlying Material	8 to 16; basalt	8 to 20; silica duripan over basalt	20 to 40; basalt
Erosion Factor (K)	.37	.37	.32
Max. Erosion Hazard	Moderate	Moderate	Low
Soil Permeability	Slow	Very slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2ed II	2ed	1
Forest Site Class	7 (non-commercial)	7 (non-commercial)	6 (4-5)
Range Site	8, 1	8, 1	Not placed in a range site.
Water Runoff Potential	Moderate	Moderate	Very Slow
Watershed Sensitivity	5 (Moderate)	5	8
Hydrologic Soil Group	D	D	B
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.1 to 2.1 inches	Very Low to Low 1.0 to 2.5 inches	Low to Moderate 2.6 inches
Susceptibility to Burning Damage	Low	Low	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Low to Moderate
Rating for Timber Site	Not Rated	Not Rated	Fair (1,3,7,10)
R-Value	0-30	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock	0-4; Very cobbly loam Unified: SC, CL AASHTO: A-6 4-18; Clay Unified: CH AASHTO: A-7 18+; Silica duripan	0-8; Stony loam Unified: SM, SM-SC, ML, ML-CL AASHTO: A-4 8-24; Very cobbly clay loam, extremely cobbly clay loam Unified: SC AASHTO: A-6 24+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 10 percent of the acreage are the Pass Canyon, Jacket, Elmore, Fordice, Keating families and Lithic Xerorthents, mesic.		

153 DEVEN-BIEBER-PASS CANYON FAMILIES ASSOCIATION, 1 to 15 percent slopes

Map Unit Components	**Deven family (45 percent)**	**Bieber family (30 percent)**	**Pass Canyon family (15 percent)**
Position, Slope, and Elevation	On sideslopes, ridges and knolls of undulating basalt plateaus; 1 to 15 percent slopes; 4600 to 6000 feet.	On lower sideslopes and basins of undulating basalt plateaus; 1 to 10 percent slopes; 4600 to 6000 feet.	On knolls, ridges and upper sideslopes of undulating basalt plateaus; 2 to 15 percent slopes; 4600 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, big sagebrush, Eriog. spp., Idaho fescue, sandberg bluegrass, bottlebrush, 14 to 16 inches ppt.	Low sagebrush, Phlox spp., sandberg bluegrass, carex spp., Idaho fescue, bottlebrush, cheatgrass; 14 to 16 inches ppt.	
Surface Layer	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.	0 to 4 inches; brown very cobbly loam, blocky and granular structure, hard, pH 6.8.	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam, granular and platy structure, slightly hard, pH 6.8 to 6.6.
Substratum		18 plus inches; strongly cemented silica duripan.	
Rooting Depth (in.) to Underlying Material	10 to 20; basalt, soft to hard tuff	8 to 15; silica duripan over basalt, tuff	10 to 20; basalt, soft to hard tuff
Erosion Factor (K)	.37	.37	.32
Max. Erosion Hazard	Moderate	Moderate	Moderate
Soil Permeability	Slow	Very slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class	2ed	2ed	2ed
Group	II		
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	8	8, 1	8
Water Runoff Potential	Moderate	Moderate	Moderate
Watershed Sensitivity	5 (Moderate)	5	6
Hydrologic Soil Group	D	D	D
Available Water Capacity (AWC)	Very Low to Low	Very Low to Low	Very Low to Low
Upper 20 inches	1.4 to 2.8 inches	1.0 to 1.9 inches	1.3 to 2.6 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock	0-4; Very cobbly loam Unified: SC, CL AASHTO: A-6 4-18; Clay Unified: CH AASHTO: A-7 18+; Silica duripan	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-4; Loam Unified: CL, ML-CL AASHTO: A-4, A-6 4-12; Clay loam, cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 10 percent of the acreage are the Roval, Keating, Aikman, Gwin, Lawyer and Elmore Families and Lithic Xerorthents, mesic.		

154 DEVEN-PASS CANYON FAMILIES COMPLEX, 1 to 10 percent slopes

Map Unit Components	Deven family (45 percent)	Pass Canyon family (35 percent)
Position, Slope, and Elevation	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4400 to 5500 feet.	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4400 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few ponderosa pine, low sagebrush, big sagebrush, mulesear, bitterbrush, rabbitbrush, sandberg bluegrass, Idaho fescue, bottlebrush; 14 to 18 inches ppt.	Western juniper, few ponderosa pine, low sagebrush, big sagebrush, bitterbrush, rabbitbrush, sandberg bluegrass, Idaho fescue, cheatgrass, 14 to 18 inches ppt.
Surface Layer	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam, and loam, granular and platy structure, slightly hard, pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	12 to 20; basalt, soft to hard tuff	10 to 20; basalt, soft to hard tuff
Erosion Factor (K)	.37	.32
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Slow	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2ed	2ed
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	8	8, 4
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	5 (Moderate)	6
Hydrologic Soil Group	D	D
Available Water Capacity (AWC)	Low	Very Low to Low
Upper 20 inches	1.7 to 2.8 inches	1.3 to 2.6 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-4; Loam Unified: CL, ML-CL AASHTO: A-4, A-6 4-12; Clay loam, cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Bieber, Barnard, Hiibner, Los Gatos, Keating, Aikman, Lawyer and Gwin families and Lithic Xerorthents, mesic.	

155 DEVEN-PASS CANYON-KEATING FAMILIES COMPLEX, 1 to 15 percent slopes

Map Unit Components	Deven family (40 percent)	Pass Canyon family (25 percent)	Keating family (20 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 1 to 15 percent slopes; 4400 to 5800 feet.	On sideslopes, ridges and knolls of mountain uplands; 1 to 15 percent slopes; 4400 to 5800 feet	On lower sideslopes and concave areas of mountain uplands; 1 to 15 percent slopes; 4400 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Few western juniper, low sagebrush, big sagebrush, rabbitbrush, bitterbrush, Indian Paint brush, mulesear, Idaho fescue, bottlebrush, cheatgrass; 14 to 18 inches ppt.	Few western juniper, low sagebrush, buckwheat, cheatgrass, Idaho fescue; 14 to 18 inches ppt.	
Surface Layer	0 to 2 inches; brown cobbly loam, platy and granular structure, slightly hard, pH 7.0.	0 to 3 inches; grayish brown cobbly loam, granular structure, slightly hard, pH 6.4.	0 to 2 inches dark grayish brown cobbly clay loam, granular structure, hard, pH 6.8.
Substratum	13 to 25 plus inches; weathered in place platy to massive soft to hard volcanic tuff.	14 plus inches; weathered in place platy to massive semi-soft to hard volcanic tuff.	
Rooting Depth (in.) to Underlying Material	10 to 20; soft to hard tuff, basalt	8 to 14; soft to hard tuff, basalt	20 to 40; tuff, basalt
Erosion Factor (K)	.37	.37	.32
Max. Erosion Hazard	Moderate	Moderate	Low to moderate
Soil Permeability	Slow	Moderately slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2ed II	2ed	2e
Forest Site Class	7 (non-commercial	7 (non-commercial)	7 (non-commercial)
Range Site	8, 23	8, 1	18
Water Runoff Potential	Moderate	Moderate	Slow
Watershed Sensitivity	5 (Moderate)	5	6
Hydrologic Soil Group	D	D	C
Available Water Capacity (AWC) Upper 20 inches	Low 1.5 to 2.9 inches	Very Low to Low 1.2 to 2.1 inches	Low to Moderate 2.7 inches
Susceptibility to Burning Damage	Low	Low	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-13; Clay loam, clay Unified: CL, CH AASHTO: A-7 13+; Weathered bedrock	0-3; cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 3-14; CLay loam Unified: CL, MH AASHTO: A-6, A-7 14+; Weathered bedrock	0-6; Cobbly clay loam, clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 6-32; Clay Unified: CH AASHTO: A-7 32+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Roval, Bieber, Hiibner, Gwin, Elmore, Lawyer, Fordice and Jacket families and Lithic Xerorthents, mesic.		

156 DEVEN-PASS CANYON-KEATING FAMILIES COMPLEX, 15 to 35 percent slopes

Map Unit Components	**Deven family (40 percent)**	**Pass Canyon family (25 percent)**	**Keating family (20 percent)**
Position, Slope, and Elevation	On sideslopes of mountain uplands; 15 to 35 percent slopes; 4400 to 5800 feet.	On sideslopes, ridges and knolls of mountain uplands; 15 to 35 percent slopes; 4400 to 5800 feet.	On lower sideslopes and concave areas of mountain uplands; 15 to 35 percent slopes; 4400 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Few western juniper, low sagebrush, big sagebrush, rabbitbrush, bitterbrush, Indian paint brush, mulesear, Idaho fescue, bottlebrush, cheatgrass; 14 to 18 inches ppt.	Few western juniper, low sagebrush, buckwheat, cheatgrass, Idaho fescue; 14 to 18 inches ppt.	
Surface Layer	0 to 2 inches; brown cobbly loam, platy and granular structure, slightly hard, pH 7.0.	0 to 3 inches; grayish brown cobbly loam, granular structure, slightly hard, pH 6.4.	0 to 2 inches; dark grayish brown cobbly clay loam, granular structure, hard, pH 6.8.
Substratum	13 to 25 plus inches; weathered in place platy to massive soft to hard volcanic tuff.	14 plus inches; weathered in place platy to massive semi-soft to hard volcanic tuff.	
Rooting Depth (in.) to Underlying Material	10 to 20; soft to hard tuff, basalt	8 to 14; soft to hard tuff, basalt	20 to 40; tuff, basalt
Erosion Factor (K)	.37	.37	.32
Max. Erosion Hazard	Moderate to high	Moderate to high	Moderate
Soil Permeability	Slow	Moderately slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	 3Ed III	 3Ed	 2s
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial
Range Site	8, 23	8, 1	18
Water Runoff Potential	Rapid	Rapid	Moderate
Watershed Sensitivity	3 (High)	4	5
Hydrologic Soil Group	D	D	C
Available Water Capacity (AWC) Upper 20 inches	Low 1.5 to 2.9 inches	Very Low to Low 1.2 to 2.1 inches	Low to Moderate 2.7 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low to Moderate	Low	Low to Moderate
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Cobbly Loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-13; Clay loam, clay Unified: CL, CH AASHTO: A-7 13+; Weathered bedrock	0-3; cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 3-14; Clay loam Unified: CL, MH AASHTO: A-6, A-7 14+; Weathered bedrock	0-6; Cobbly clay loam, clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 6-32; Clay Unified: CH AASHTO: A-7 32+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Roval, Bieber, Hiibner, Gwin, Elmore, Lawyer, Fordice and Jacket families and Lithic Xerorthents, mesic.		

157 DEVEN-PASS CANYON-KEATING FAMILIES COMPLEX, 35 to 60 percent slopes

Map Unit Components	**Deven family (35 percent)**	**Pass Canyon family (25 percent)**	**Keating family (20 percent)**
Position, Slope, and Elevation	On sideslopes of mountain uplands; 35 to 60 percent slopes; 4400 to 5800 feet.	On sideslopes, ridges and knolls of mountain uplands; 35 to 60 percent slopes; 4400 to 5800 feet.	On lower sideslopes and concave areas of mountain uplands; 35 to 60 percent slopes; 4400 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Few western juniper, low sagebrush, big sagebrush, rabbitbrush, bitterbrush, Indian Paint brush, mulesear, Idaho fescue, bottlebrush, cheatgrass; 14 to 18 inches ppt.	Few western juniper, low sagebrush, buckwheat, cheatgrass, Idaho fescue; 14 to 18 inches ppt.	
Surface Layer	0 to 2 inches; brown cobbly loam, platy and granular structure, slightly hard, pH 7.0.	0 to 3 inches; grayish brown cobbly loam, granular structure, slightly hard, pH 6.4.	0 to 2 inches; dark grayish brown cobbly clay loam, granular structure, hard, pH 6.8.
Substratum	13 to 25 plus inches; weathered in place platy to massive soft to hard volcanic tuff.	14 plus inches; weathered in place platy to massive semi-soft to hard volcanic tuff.	
Rooting Depth (in.) to Underlying Material	10 to 20; soft to hard tuff, basalt	8 to 14; soft to hard tuff, basalt	20 to 40; tuff, basalt
Erosion Factor (K)	.37	.37	.32
Max. Erosion Hazard	High to very high	High to very high	High
Soil Permeability	Slow	Moderately slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	3Sd III	3Ed	3S
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	8, 23	8, 1	18
Water Runoff Potential	Very Rapid	Very Rapid	Rapid
Watershed Sensitivity	2 (High)	2	4
Hydrologic Soil Group	D	D	C
Available Water Capacity (AWC) Upper 20 inches	Low 1.5 to 2.9 inches	Very Low to Low 1.2 to 2.1 inches	Low to Moderate 2.7 inches
Susceptibility to Burning Damage	Moderate	Moderate	High
Slope Stability Hazard	High	Low	High
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Cobbly Loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-13; Clay loam, clay Unified: CL, CH AASHTO: A-7 13+; Weathered bedrock	0-3; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 3-14; Clay loam Unified: CL, MH AASHTO: A-6, A-7 14+; Weathered Bedrock	0-6; Cobbly clay loam, clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 6-32; Clay Unified: CH AASHTO: A-7 32+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Roval, Bieber, Hiibner, Gwin, Elmore, Lawyer, Fordice and Jacket families and Lithic Xerorthents, mesic.		

158 DEVEN-PULS FAMILIES ASSOCIATION, 1 to 15 percent slopes

Map Unit Components	Deven family (50 percent)	Puls family (35 percent)
Position, Slope, and Elevation	On upper sideslopes and knolls of undulating basalt plateaus and mountain uplands; 2 to 15 percent slopes; 4500 to 5700 feet.	On lower sideslopes and slightly concave drainageways of undulating basalt plateaus and mountain uplands; 1 to 10 percent slopes; 4500 to 5700 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, Phlox spp., Idaho fescue, bottlebrush, sandberg bluegrass, cheatgrass; 14 to 16 inches ppt.	Low sagebrush, black sagebrush, sedges, sandberg bluegrass, cheatgrass; 14 to 16 inches ppt.
Surface Layer	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.	0 to 5 inches; pinkish gray very stony clay loam, granular structure, slightly hard, pH 6.3.
Substratum		19 to 28 inches; indurated silica cemented duripan.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt	5 to 10; dense very hard clay over silica duripan below 10 to 20 inches
Erosion Factor (K)	.37	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Slow	Very slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2ed	3eDx
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	8	1
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	5 (Moderate)	5
Hydrologic Soil Group	D	D
Available Water Capacity (AWC)	Very Low to Low	Very Low to Low
Upper 20 inches	1.4 to 2.8 inches	1.1 to 2.7 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock	0-5; Very stony clay loam Unified: ML, CL AASHTO: A-6, A-7 5-19; Clay Unified: CL, CH AASHTO: A-7 19-28; Silica duripan 28+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Bieber, Roval, Barnard, Castlevale families, Lithic Xerorthents, mesic, Rock outcrop and unnamed soils similar to the Bieber family but with an abruptic textural change.	

159 DEVEN FAMILY-ROCK OUTCROP ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	**Deven family (65 percent)**	**Rock outcrop (15 percent)**
Position, Slope, and Elevation	On basalt plateaus; 1 to 20 percent slopes; 4500 to 6000 feet.	On upper slopes and knolls of basalt plateaus; 5 to 20 percent slopes; 4500 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Few western juniper, low sagebrush, cheatgrass, Idaho fescue, oatgrass, Carex spp. other grasses; 14 to 18 inches ppt.	Barren; 14 to 18 inches ppt.
Surface Layer	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.	NOT APPLICABLE: Basalt or andesite bedrock with minor accumulations of Aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	8 to 16 inches; hard fractured basalt	
Erosion Factor (K)	.37	
Max. Erosion Hazard	Moderate	
Soil Permeability	Slow	
Drainage Class	Well Drained	
Soil Manageability Class Group	 2edx II	
Forest Site Class	7 (non-commercial)	
Range Site	8, 1	
Water Runoff Potential	Moderate	Rapid
Watershed Sensitivity	5 (High)	2
Hydrologic Soil Group	D	
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.0 to 2.1 inches	
Susceptibility to Burning Damage	Low	
Slope Stability Hazard	Low	
Allowable Soil Loss	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	
Rating for Timber Site	Not Rated	
R-Value	0-30	
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 20 percent of the acreage are the Pass Canyon, Roval, Bieber, Aikman and Keating families and Lithic Xerorthents, mesic.	

161 DIVERS-LAPINE-KINZEL FAMILIES ASSOCIATION, 2 to 15 inch pumice overburden, 2 to 30 percent slopes

Map Unit Components	**Divers family, pumice overburden phase (40 percent)**	**Lapine family, pumice overburden phase (25 percent)**	**Kinzel family (20 percent)**
Position, Slope, and Elevation	On upper sideslopes, ridges and knolls of volcanic mountain uplands; 10 to 30 percent slopes; 6600 to 7500 feet.	On lower sideslopes and toeslopes of volcanic mountain uplands; 2 to 30 percent slopes; 6600 to 7500 feet.	On undulating hummocky lower areas of the unit; 2 to 25 percent slopes; 6600 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	Red fir forest, or mixed conifer forest of red fir, lodgepole pine, western white pine, mountain hemlock, plus prostrate manzanita, mint.; 40 to 45 inches ppt.	Red fir forest, or mixed conifer forest of red fir, lodgepole pine, western white pine, mountain hemlock, plus prostrate manzanita, mint.; 40 to 45 inches ppt.	
Surface Layer	15 inches of pumice overburden consisting of light brownish gray gravelly sandy loam grading to a white very gravelly sand texture (Thickness ranges from 2 to 15 inches) OVER 15 to 26 inches; brown very gravelly loamy sand to extremely cobbly sandy loam, platy and granular structure, soft, pH 5.2.	1 to 0 inches; red fir needles and twigs, over 23 inches of pumice overburden consisting of grayish brown very gravelly coarse sand to a pale brown extremely gravelly coarse sand; (Thickness in this unit ranges from 2 to 15 inches.) OVER 23 to 26 inches; yellowish brown very gravelly sandy loam, granular structure, loose, pH 6.0.	A thin pumice overburden up to 10 inches thick is present in some pedons, OVER 0 to 10 inches; dark grayish brown gravelly loamy sand to very cobbly sandy loam, single grain and subangular blocky structure, loose and soft, pH 5.5 to 6.0.
Substratum		26 to 60 inches; brownish yellow extremely stony sandy loam, extremely gravelly sandy loam and extremely gravelly loamy coarse sand, massive and single grained, soft to loose pH 6.2 to 6.6.	30 to 41 plus inches; light yellowish gray weakly cemented volcanic ash that rubs to a sandy loam texture, massive, very hard.
Rooting Depth (in.) to Underlying Material	30 plus; basalt andesite	40 plus; cinders, basalt	20 to 40 volcanic ash, basalt, andesite
Erosion Factor (K)	.17	.20	.17
Max. Erosion Hazard	Moderate	Low to moderate	Moderate
Soil Permeability	Rapid in the overburden, and moderately rapid below	Rapid	Moderately rapid
Drainage Class	Somewhat excessively drained	Somewhat excessively drained	Well drained
Soil Manageability Class Group	2ep II	2ep	2ep
Forest Site Class	5 (3-4)	5 (3-4)	6 (4-5)
Range Site	Not placed in a range site.	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very Slow	Very Slow	Slow
Watershed Sensitivity	8 (Low)	8	7
Hydrologic Soil Group	A	A	C
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.6 inches	Moderate to High 2.5 inches	Low to Moderate 2.2 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year	2 tons/acre/year

Chance of Seedling Survival	Moderate to High	Moderate to High	Moderate
Rating for Timber Site	Fair (1, 3, 5)	Fair (5)	Fair (1, 7)
R-Value	60+	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Gravelly sandy loam Unified: SM AASHTO: A-1-b 4-15; Very gravelly sand Unified: SW-SM, SM AASHTO: A-1-a, A-1-b 15-60; Gravelly loamy sand, extremely cobbly sandy loam Unified: SM AASHTO: A-1-b	0-2; Very gravelly coarse sand Unified: SW-SM AASHTO: A-1-a 2-23; extremely gravelly coarse sand Unified: GP AASHTO: A-1-a 23-50; Very gravelly sandy loam, extremely stony sandy loam, extremely gravelly sandy loam Unified: SW-SM, SM AASHTO: A-1-a, A-1-b 50-60; Extremely gravelly loamy coarse sand Unified: GP, GW-GM AASHTO: A-1-a	0-6; Gravelly loamy sand Unified: SM AASHTO: A-1-b 6-30; Very cobbly sandy loam, extremelys tony sandy loam Unified: SM, SM-SC AASHTO: A-2-4 30+; Weathered bedrock

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage are the Wuksi and Ahart families, and Rock outcrop.

162 DIVERS-LAPINE-KINZEL FAMILIES ASSOCIATION, 30 to 55 percent slopes

Map Unit Components	Divers family (40 percent)	Lapine family (25 percent)	Kinzel family (20 percent)
Position, Slope, and Elevation	On sideslopes, ridges and knolls of volcanic mountain uplands; 30 to 55 percent slopes; 6700 to 7600 feet.	On sideslopes of volcanic mountain uplands; 30 to 50 percent slopes; 6700 to 7600 feet.	On lower sideslopes and depressions of volcanic mountain uplands; 30 to 40 percent slopes; 6700 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	Red fir forest, or mixed conifer forest of red fir, ponderosa pine, western white pine, mountain hemlock, plus prostrate manzanita, current spp., snowberry, few grasses; 40 to 45 inches ppt.	Red fir forest, or mixed conifer forest of red fir, lodgepole pine, western white pine, mountain hemlock, plus prostrate manzanita, current spp., rabbitbrush, grasses; 40 to 45 inches ppt.	
Surface Layer	A thin pumice overburden up to 6 inches thick is present in some pedons OVER 0 to 11 inches; brown very gravelly loamy coarse sand and extremely cobbly sandy loam, platy and granular structure, loose to soft, pH 5.2.	A thin pumice overburden up to 6 inches thick may be present in some pedons, OVER 0 to 14 inches; brown to pale brown gravelly to very gravelly sandy loam, granular structure, soft, pH 6.0 to 7.0.	A thin pumice overburden up to 6 inches thick may be present in some pedons, OVER 0 to 10 inches; dark grayish brown gravelly loamy sand to very cobbly sandy loam; single grain and subangular blocky structure, loose and soft, pH 5.5 to 6.0.
Substratum		14 to 60 inches; pale brown to strong brown very gravelly sandy loam and extremely gravelly loamy sand to weathered gravel size cinders, massive, slightly hard, pH 7.0 to 6.0.	30 to 41 plus inches; light yellowish gray weakly cemented volcanic ash that rubs to a sandy loam texture, massive, very hard.
Rooting Depth (in.) to Underlying Material	30 plus; basalt, andesite	40 plus; cinders, basalt	20 to 40; volcanic ash, basalt, andesite
Erosion Factor (K)	.17	.20	.17
Max. Erosion Hazard	Moderate to high	Moderate to high	Moderate to high
Soil Permeability	Moderate rapid	Rapid	Moderately rapid
Drainage Class	Somewhat excessively drained	Somewhat excessively drained	Well drained
Soil Manageability Class	3Ep	3Ep	3Ep
Group	III		
Forest Site Class	5 (3-4)	5 (3-4)	6 (4-5)
Range Site	Not placed in a range site.	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Moderate	Moderate	Moderate
Watershed Sensitivity	7 (Moderate)	7	6
Hydrologic Soil Group	A	A	C
Available Water Capacity (AWC)	Moderate	Moderate to High	Low to Moderate
Upper 20 inches	2.1 inches	3.0 inches	2.2 inches
Susceptibility to Burning Damage	High	High	High
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate	High	Moderate
Rating for Timber Site	Fair (1,3,8)	Fair (8)	Fair (3,7)
R-Value	60+	60+	60+

Soil horizons in inches, USDA, Unified, AASHTO

0-3; Very gravelly loamy coarse sand
Unified: SM
AASHTO: A-1-a, A-1-b

3-60; Extremely cobbly sandy loam
Unified: SM
AASHTO: A-1-b

0-8; Gravelly sandy loam
Unified: SM
AASHTO: A-1-b

8-22; Very gravelly sandy loam
Unified: SW-SM, SM
AASHTO: A-1-a, A-1-b

22-60; Extremely gravelly loamy sand
Unified: GP, GW-GM
AASHTO: A-1-a

0-6; Gravelly loamy sand
Unified: SM
AASHTO: A-1-b

6-30; Very cobbly sandy loam, extremely stony sandy loam
Unified: SM, SM-SC
AASHTO: A-2-4

30+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage is the Ahart family, and Rock outcrop and unnamed medial over cindery, frigid Xerumberpts.

163 DIVERS-LAPINE FAMILIES-ROCK OUTCROP ASSOCIATION, 5 to 15 inch pumice overburden, 30 to 60 percent slopes

Map Unit Components	**Divers family, pumice overburden phase (40 percent)**	**Lapine family, pumice overburden phase (30 percent)**	**Rock outcrop (15 percent)**
Position, Slope, and Elevation	On sideslopes of volcanic mountain uplands; 30 to 60 percent slopes; 6700 to 7600 feet.	On lower sideslopes of volcanic mountain uplands; 30 to 45 percent slopes; 6700 to 7600 feet.	On ridge tops and sideslopes of mountain uplands; 35 to 60 percent slopes; 6700 to 7600 feet.
Typical Vegetation and Precipitation (ppt)	Red fir forest, or mixed conifer forest of red fir, white fir, western white pine, mountain hemlock, plus greenleaf manzanita, snowbrush, mint; 40 to 45 inches ppt.	Red fir forest, or mixed conifer forest of red fir, white fir, western white pine, mountain hemlock plus greenleaf manzanita, snowbrush, mint; 40 to 45 inches ppt.	
Surface Layer	15 inches of pumice overburden consisting of light brownish gray gravelly sandy loam grading to a white very gravelly sand texture (Thickness ranges from 5 to 15 inches) OVER 15 to 26 inches; brown very gravelly loamy sand to extremely cobbly sandy loam, platy and granular structure, soft, pH 5.2.	1 to 0 inches; red fir needles and twigs, over 23 inches of pumice overburden consisting of grayish brown very gravelly coarse sand to a pale brown extremely gravelly coarse sand; (Thickness in this unit ranges from 5 to 15 inches.) OVER 23 to 26 inches; yellowish brown very gravelly sandy loam, granular structure, loose, pH 6.0.	NOT APPLICABLE; Basalt or andesite bedrock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	30 plus; basalt, andesite	30 plus; cinders	
Erosion Factor (K)	.17	.20	
Max. Erosion Hazard	Moderate to high	Moderate to high	
Soil Permeability	Rapid in the overburden and moderately rapid below	Rapid	
Drainage Class	Somewhat excessively drained	Somewhat excessively drained	
Soil Manageability Class Group	3Ep III	3Ep	
Forest Site Class	5 (3-4)	5-6 (3-5)	
Range Site	Not placed in a range site.	Not placed in a range site.	
Water Runoff Potential	Moderate	Slow	Very Rapid
Watershed Sensitivity	7 (Moderate)	7	0
Hydrologic Soil Group	A	A	
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.6 inches	Moderate to high 2.5 inches	
Susceptibility to Burning Damage	High	High	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year	
Chance of Seedling Survival	Moderate to high	Moderate to high	
Rating for Timber Site	Fair (1, 5, 7, 8)	Fair (5, 8)	
R-Value	60+	60+	

Soil horizons in inches, USDA, Unified, AASHTO

0-4; Gravelly sandy loam
Unified: SM
AASHTO: A-1-b

4-15; Very gravelly sand
Unified: SW-SM, SM
AASHTO: A-1-a, A-1-b

15-60; Gravelly loamy sand, extremely cobbly sandy loam
Unified: SM
AASHTO: A-1-b

0-2; Very gravelly coarse sand
Unified: SW-SM
AASHTO: A-1-a

2-23; Extremely gravelly coarse sand
Unified: GP
AASHTO: A-1-a

23-50; Very gravelly sandy loam, extremely stony sandy loam, extremely gravelly sandy loam
Unified: SW-SM, SM
AASHTO: A-1-a, A-1-b

50-60; Extremely gravelly loamy coarse sand
Unified: GP, GW-GM
AASHTO: A-1-a

Included Areas:

Included with this unit in mapping and making up about 15 percent of the acreage are Lithic Cryorthents, Kinzel family, Rubble land and unnamed Xerumbrepts, medial, frigid.

164 ELMORE deep FAMILY, 1 to 15 percent slopes.

Map Unit Components	**Elmore family, deep (75 percent)**
Position, Slope, and Elevation	On undulating basalt plateaus and alluvial fans and lower sideslopes of mountain uplands; 1 to 15 percent slopes; 4300 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, few incense-cedar and white fir, (few black oak in south central portion of survey area), big sagebrush, bitterbrush, greenleaf manzanita, squaw carpet, mulesear, lupine, Ross's sedge, grasses; 16 to 25 inches ppt.
Surface Layer	2 to 0 inches; of decomposed and undecomposed ponderosa pine needles and twigs, over 0 to 13 inches; dark brown and reddish brown loam, granular structure, very friable, pH 6.4 to 6.6.
Rooting Depth (in.) to Underlying Material	40 plus; soft to hard basalt
Erosion Factor (K)	.37
Max. Erosion Hazard	Low
Soil Permeability	Moderately slow
Drainage Class	Well drained
Soil Manageability Class Group	 1 IA
Forest Site Class	5 (2-3)
Range Site	Not placed in a range site.
Water Runoff Potential	Slow
Watershed Sensitivity	8 (Low)
Hydrologic Soil Group	B
Available Water Capacity (AWC) Upper 20 inches	High 3.4 inches
Susceptibility to Burning Damage	Low
Slope Stability Hazard	Low
Allowable Soil Loss	3 tons/acre/year
Chance of Seedling Survival	Moderate to High
Rating for Timber Site	Good (10)
R-Value	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-13; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 13-48; Gravelly loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 48+; Weathered bedrock
Included Areas:	Included with this soil in mapping and making up about 25 percent of the acreage are the Lawyer, Elmore, moderately deep, Jacket, Fordice, Gwin, Germany and Pass Canyon families, rock outcrop, and unnamed soils similar to the Elmore family but not Pachic.

165 ELMORE deep FAMILY, 15 to 40 percent slopes.

Map Unit Components	**Elmore family, deep (70 percent)**
Position, Slope, and Elevation	On smooth middle to lower sideslopes of mountain uplands; 15 to 40 percent slopes; 4600 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, few incense-cedar, white fir and black oak, big sagebrush, bitterbrush, ceonothus, snowberry, greenleaf manzanita, mulesear, lupine, Ross's sedge, grasses; 16 to 25 inches ppt.
Surface Layer	2 to 0 inches; decomposed and undecomposed ponderosa pine needles and twigs, over 0 to 13 inches; dark brown and reddish brown loam, granular structure, very friable, pH 6.4 to 6.6.
Rooting Depth (in.) to Underlying Material	40 plus; basalt andesite
Erosion Factor (K)	.37
Max. Erosion Hazard	Moderate
Soil Permeability	Moderately slow
Drainage Class	Well drained
Soil Manageability Class Group	 2e II
Forest Site Class	5 (2-3)
Range Site	Not placed in a range site.
Water Runoff Potential	Moderate
Watershed Sensitivity	7 (Moderate)
Hydrologic Soil Group	B
Available Water Capacity (AWC) Upper 20 inches	High 3.4 inches
Susceptibility to Burning Damage	Low to Moderate
Slope Stability Hazard	Low
Allowable Soil Loss	3 tons/acre/year
Chance of Seedling Survival	Moderate to High
Rating for Timber Site	Good (10)
R-Value	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-13; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 13-48; Gravelly loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 48+; Weathered bedrock
Included Areas:	Included with this soil in mapping and making up about 30 percent of the acreage are the Lawyer, Elmore, moderately deep, Jacket, Fordice, Gwin and Pass Canyon families, Rock outcrop, and unnamed soils similar to the Elmore family but not Pcahic.

166 ELMORE-DEVEN-ELMORE deep FAMILIES ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	**Elmore family (35 percent)**	**Deven family (30 percent)**	**Elmore family, deep (15 percent)**
Position, Slope, and Elevation	On sideslopes of undulating basalt plateaus; 1 to 20 percent slopes; 4700 to 5400 feet.	On knolls, ridges and nearly level areas of basalt plateaus; 1 to 20 percent slopes; 4700 to 5400 feet.	On gentle concave areas and alluvial draws of undulating basalt plateaus; 1 to 15 percent slopes; 4700 to 5400 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, western juniper, mountain mahogany, big sagebrush, bitterbrush, squaw carpet, western yarrow, Ross's sedge, grasses; 16 to 20 inches ppt.	Western juniper, low sagebrush, big sagebrush, mountain mahogany, Phlox spp., Idaho fescue, bottlebrush, sandberg gluegrass, thrubers needlesgrass; 16 to 20 inches ppt.	
Surface Layer	1 to 0 inches of ponderosa pine needles and twigs, over 0 to 8 inches; brown loam, platy and granular structure, slightly hard, pH 6.0.	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.	2 to 0 inches; decomposed and undecomposed P. pine needles and twigs, over 0 to 13 inches; dark brown and reddish brown loam, granular structure, very friable, pH 6.4 to 6.6.
Rooting Depth (in.) to Underlying Material	20 to 40; soft to hard basalt	10 to 20; soft to hard basalt	40 plus; soft to hard basalt
Erosion Factor (K)	.37	.37	.37
Max. Erosion Hazard	Low to moderate	Moderate	Low
Soil Permeability	Moderately slow	Slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2e II	2ed	1
Forest Site Class	5-6 (3-5)	7 (non-commercial)	5 (2-4)
Range Site	Not placed in a range site.	8	Not placed in a range site.
Water Runoff Potential	Slow	Moderate	Very Slow
Watershed Sensitivity	8 (Moderate)	5	8
Hydrologic Soil Group	B	D	B
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 3.2 inches	Very Low to Low 1.4 to 2.8 inches	High 3.4 inches
Susceptibility to Burning Damage	Low to Moderate	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate	Not Rated	Moderate to High
Rating for Timber Site	Fair (7,10)	Not Rated	Good (10)
R-Value	30-60	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-8; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 8-27; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 27+; Unweathered bedrock	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock	0-13; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 13-48; Gravelly loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 48+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Pass Canyon, Bieber, Roval, Lawyer, Jacket and Keating families.

167 ELMORE-JACKET, deep-LAWYER FAMILIES ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	**Elmore family, deep (45 percent)**	**Jacket family, deep (30 percent)**	**Lawyer family (15 percent)**
Position, Slope, and Elevation	On sideslopes and toeslopes of mountain uplands; 1 to 15 percent slopes; 4400 to 5800 feet.	On sideslopes and in drainages of mountain uplands; 1 to 20 percent slopes; 4400 to 5800 feet.	On upper sideslopes and convex areas of mountain uplands; 5 to 20 percent slopes; 4400 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, incense-cedar, black oak, manzanita, squaw carpet, bitterbrush, Ross's sedge, few grasses; 16 to 25 inches ppt.	Ponderosa pine, incense-cedar, black oak, squaw carpet, manzanita, forbes, Ross's sedge, few grasses; 16 to 25 inches ppt.	
Surface Layer	2 to 0 inches; decomposed and undecomposed ponderosa pine needles and twigs, over 0 to 13 inches; dark brown and reddish brown loam, granular structure, very friable, pH 6.4 to 6.6.	2 to 0 inches of ponderosa pine needles and twigs, over 0 to 9 inches; dark brown and reddish brown loam, granular and blocky structure, slightly hard, pH 6.2 to 6.4.	2 to 0 inches of ponderosa pine needles and twigs, over 0 to 8 inches; dark stony loam, granular structure, soft, pH 6.2.
Rooting Depth (in.) to Underlying Material	40 plus; basalt alluvium	40 plus; tuff alluvium	20 to 40; basalt
Erosion Factor (K)	.37	.37	.32
Max. Erosion Hazard	Low	Low to moderate	Low to moderate
Soil Permeability	Moderately slow	Slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	 1 II	 2e	 2e
Forest Site Class	5 (2-4)	5 (2-4)	6 (4-5)
Range Site	Not placed in a range site.	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Moderate	Slow
Watershed Sensitivity	8 (Moderate)	5	7
Hydrologic Soil Group	B	C	B
Available Water Capacity (AWC) Upper 20 inches	 3.4 inches	 3.0 inches	 2.6 inches
Susceptibility to Burning Damage	Low	Low to Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate to High	Moderate	Low to Moderate
Rating for Timber Site	Good (10)	Good (10)	Fair (1,3,7,10)
R-Value	30-60	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-13; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 13-48; Gravelly loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 48+; Weathered bedrock	0-9; Loam Unified: CL AASHTO: A-4, A-6 9-14; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 14-36; Clay Unified: CH AASHTO: A-7 36-60; Gravelly Clay Loam Unified: CL, MH, CH AASHTO: A-6, A-7	0-8; Stony loam Unified: SM, SM-SC, ML, ML-CL AASHTO: A-4 8-24; Very cobbly clay loam, extremely cobbly clay loam Unified: SC AASHTO: A-6 24+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 10 percent of the acreage are the Pass Canyon, Gwin and Fordice families and Rock outcrop.		

168 ELMORE-JACKET, deep-LAWYER FAMILIES ASSOCIATION, 20 to 40 percent slopes

Map Unit Components	**Elmore family, deep (35 percent)**	**Jacket family, deep (30 percent)**	**Lawyer family (20 percent)**
Position, Slope, and Elevation	On sideslopes of mountain uplands; 20 to 35 percent slopes; 4400 to 5800 feet.	On sideslopes and in drainages of mountain uplands; 20 to 35 percent slopes; 4400 to 5800 feet.	On upper sideslopes and convew areas of mountain uplands; 20 to 40 percent slopes; 4400 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, incense-cedar, black oak, green leaf manzanita, squaw carpet, bitterbrush, Ross's sedge, few grasses; 16 to 25 inches ppt.	Ponderosa pine, incense-cedar, black oak, squaw carpet, green leaf manzanita, forbes, Ross's sedge, few grasses; 16 to 25 inches ppt.	
Surface Layer	2 to 0 inches; decomposed and undecomposed ponderosa pine needles and twigs, over 0 to 13 inches; dark brown and reddish brown loam, granular structure, very friable; pH 6.4 to 6.6.	2 to 0 inches of ponderosa pine needles and twigs, over 0 to 9 inches; dark brown and reddish brown loam, granular and blocky structure, slightly hard, Ph 6.2	2 to 0 inches of ponderosa pine needles and twigs, over 0 to 8 inches; dark brown stony loam, granular structure, soft, pH 6.2.
Rooting Depth (in.) to Underlying Material	40 plus; basalt, alluvium	40 plus; tuff, alluvium	20 to 40; basalt
Erosion Factor (K)	.37	.37	.32
Max. Erosion Hazard	Moderate	Moderate	Moderate
Soil Permeability	Moderately slow	Slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class	2e	2e	2e
Group	II		
Forest Site Class	5 (2-4)	5 (2-4)	6 (4-5)
Range Site	Not placed in a range site.	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Rapid	Moderate
Watershed Sensitivity	7 (Moderate)	5	7
Hydrologic Soil Group	B	C	B
Available Water Capacity (AWC) Upper 20 inches	High	Moderate to High	Low to Moderate
	3.4 inches	3.0 inches	2.6 inches
Susceptibility to Burning Damage	Low to Moderate	Low to Moderate	Moderate
Slope Stability Hazard	Low	Low to Moderate	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate to High	Moderate	Low to Moderate
Rating for Timber Site	Good (10)	Good (10)	Fair (1,3,7,10)
R-Value	30-60	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-13; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 13-48; Gravelly loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 48+; Weathered bedrock	0-9; Loam Unified: CL AASHTO: A-4, A-6 9-14; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 14-36; Clay Unified: CH AASHTO: A-7 36-60; Gravelly clay loam Unified: CL, MH, CH AASHTO: A-6, A-7	0-8; Stony loam Unified: SM, SM-SC, ML, ML-CL AASHTO: A-4 8-24; Very cobbly clay loam, extremely cobbly clay loam Unified: SC AASHTO: A-6 24+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Pass Canyon, Gwin and Fordice families and Rock outcrop.

169 ELMORE, deep-ELMORE FAMILY-LAVA FLOW ASSOCIATION, 5 to 30 percent slopes

Map Unit Components	**Elmore family, deep (30 percent)**	**Elmore family (25 percent)**	**Lava flow (25 percent)**
Position, Slope, and Elevation	On concave areas of strongly undulating topography between lava flow rock on basalt plateaus; 5 to 15 percent slopes; 4600 to 5000 feet.	On sideslopes of strongly undulating topography adjacent to lava flow rock on basalt plateaus; 10 to 25 percent slopes; 4600 to 5000 feet.	Disaggreated mounds of fractured basalt lava flow rock on undulating basalt plateaus; 10 to 30 percent slopes; 4600 to 5000 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, western juniper, big sagebrush, bitterbrush, mulesear, Ross's sedge, grasses; 16 to 20 inches ppt.	Ponderosa pine, Jeffrey pine, western juniper, mountain mahogany, big sagebrush, mulesear, Ross's sedge, grasses; 16 to 20 inches ppt.	
Surface Layer	2 to 0 inches; decomposed and undecomposed ponderosa pine needles and twigs over 0 to 13 inches; dark brown and reddish brown, loam, granular structure, very friable, pH 6.4 to 6.6.	1 to 0 inches of ponderosa pine needles and twigs, over 0 to 8 inches; brown loam, platy and granular structure, slightly hard, pH 6.0.	NOT APPLICABLE: Fractured vesicular basalt flow rock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	40 plus; basalt	20 to 40; basalt	
Erosion Factor (K)	.37	.37	
Max. Erosion Hazard	Low	Moderate	
Soil Permeability	Moderately slow	Moderately slow	
Drainage Class	Well Drained	Well drained	
Soil Manageability Class Group	1 II	2e	
Forest Site Class	5 (3)	5-6 (4-5)	
Range Site	Not placed in a range site.	Not placed in a range site.	
Water Runoff Potential	Slow	Slow	Rapid
Watershed Sensitivity	8 (Moderate)	7	4
Hydrologic Soil Group	B	B	
Available Water Capacity (AWC) Upper 20 inches	High 3.4 inches	Low to Moderate 3.2 inches	
Susceptibility to Burning Damage	Low	Low to Moderate	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	3 tons/acre/year	2 tons/acre/year	
Chance of Seedling Survival	Moderate to High	Moderate	
Rating for Timber Site	Good (10)	Fair (1,7,10)	
R-Value	30-60	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-13; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 13-48; Gravelly loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 48+; Weathered bedrock	0-8; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 8-27; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 27+; Unweathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 20 percent of the acreage are the Fordice, Lawyer, Pass Canyon, Gwin and Germany families and Lithic Xerumbrepts, mesic, and unnamed soils similar to the Elmore family but have a cambic horizon.		

170 GALLATIN-BEHANIN deep-DUNCOM FAMILIES COMPLEX, 5 to 30 percent slopes

Map Unit Components	**Gallatin family (35 percent)**	**Behanin family, deep (25 percent)**	**Duncom family (25 percent)**
Position, Slope, and Elevation	On sideslopes and broad alluvial drainageways of mountain uplands; 5 to 25 percent slopes; 7000 to 8000 feet.	On sideslopes of mountain uplands; 5 to 30 percent slopes; 7000 to 8000 feet.	On upper slopes and knolls of mountain uplands; 5 to 30 percnet slopes; 7000 to 8000 feet.
Typical Vegetation and Precipitation (ppt)	Big sagebrush, lupine, mulesear, few white fir; few ponderosa pine, Idaho fescue Poa spp., other grasses; 25 to 35 inches ppt.	White fir, lodgepole pine, quaking aspen, big sagebrush, mulesear, Ross's sedge, few grasses; 25 to 35 inches ppt.	
Surface Layer	0 to 29 inches; dark grayish brown loam to very cobbly loam granular to subangular blocky structure slightly hard, pH 6.2 to 6.4.	1-1/2 to 0 inches of white fir needles and twigs, over 0 to 60 inches; very dark grayish brown to brown very gravelly loam, very stony loam and extremely gravelly loam, granular to subangular blocky structure, slightly hard, pH 6.0 to 6.4.	0 to 17 inches; brown to dark grayish brown loam, granular to subangular blocky structure, slightly hard, pH 6.4 to 6.6.
Rooting Depth (in.) to Underlying Material	40 plus; andesite, basalt	20 to 40; basalt, tuff	10 to 20; basalt, tuff
Erosion Factor (K)	.32	.28	.37
Max. Erosion Hazard	Moderate	Moderate	Moderate
Soil Permeability	Moderate	Moderate	Moderate
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2e II	2e	2ed
Forest Site Class	7 (non-commercial)	5 (3-4)	7 (non-commercial)
Range Site	14, 19	Not placed in a range site.	9
Water Runoff Potential	Slow	Slow	Rapid
Watershed Sensitivity	6 (Moderate)	7	4
Hydrologic Soil Group	B	B	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 3.2 inches	Moderate 2.4 inches	Low 1.6 to 3.2 inches
Susceptibility to Burning Damage	Low	Low to Moderate	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	3 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Moderate	Not Rated
Rating for Timber Site	Not Rated	Fair (1,12)	Not Rated
R-Value	30-60	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-21; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 21-29; Very cobbly loam Unified: SM-SC, SC, ML-CL, CL AASHTO: A-4, A-6 29+; Unweathered bedrock	0-34; Very gravelly loam, very stony loam Unified: SM, ML, ML-CL AASHTO: A-4 34-60; Extremely gravelly loam Unified: GM, GM-GC AASHTO: A-2-4, A-2-6	0-17; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 17+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Cheadle, Supervisor and Woodhurst families, and Cryoborolls, wet.		

171 GALLATIN-CHEADLE FAMILIES-CRYOBOROLLS, wet ASSOCIATION, 15 to 40 percent slopes

Map Unit Components	Gallatin family (35 percent)	Cheadle family (30 percent)	Cryoborolls, wet (20 percent)
Position, Slope, and Elevation	On sideslopes and toeslopes of mountain uplands; 15 to 35 percent slopes; 7000 to 9000 feet.	On uppersideslopes, ridges and knolls of mountain uplands; 20 to 40 percent slopes; 7000 to 9000 feet.	On broad toeslopes and alluvial fans of mountain uplands; 15 to 30 percent slopes; 7000 to 8500 feet.
Typical Vegetation and Precipitation (ppt)	Few white fir, few white bark pine, big sagebrush, mulesear, Idaho fescue, wheatgrass, Poa spp.; 25 to 35 inches ppt.	Big sagebrush, low sagebrush, buckwheat, Phlox spp., mulesear, Idaho fescue; 25 to 35 inches ppt.	
Surface Layer	0 to 29 inches; dark grayish brown loam to very cobbly loam, granular to subangular blocky structure, slightly hard, pH 6.2 to 6.4.	0 to 17 inches; dark grayish brown to brown very cobbly loam to very cobbly clay loam; granular and subangular blocky structure, slightly hard to hard, pH 6.6.	0 to 23 inches; very dark gray, dark grayish brown and brown gravelly loam and very gravelly loam; granular and blocky structure; yellowish brown mottles below 14 inches; slightly hard; pH 6.0 to 6.6.
Substratum			23 to 35 inches; grayish brown extremely cobbly loam; light olive brown mottles; massive; slightly hard; pH 6.0.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt, andesite	10 to 20; andesite	20 plus; basalt, andesite, alluvium
Erosion Factor (K)	.32	.37	Variable
Max. Erosion Hazard	Moderate	Moderate to high	Moderate
Soil Permeability	Moderate	Moderate	Slow to moderate
Drainage Class	Well drained	Well drained	Poorly drained
Soil Manageability Class Group	2e II	2ed	3eW
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	14, 19	9	25
Water Runoff Potential	Slow	Rapid	Moderate
Watershed Sensitivity	6 (Moderate)	4	6
Hydrologic Soil Group	B	D	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 3.2 inches	Very Low to Low 1.2 to 2.4 inches	Low to High 2.8 inches
Susceptibility to Burning Damage	Moderate	Moderate	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	2-3 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	30-60	30-60	Not Rated
Soil horizons in inches, USDA, Unified, AASHTO	0-21; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 21-29; Very cobbly loam Unified: SM-SC,SC, ML-CL,CL AASHTO: A-4, A-6 29+; Unweathered bedrock	0-12; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4, A-6 12-17; Very cobbly clay loam Unified: SC AASHTO: A-6, A-7 17+; Unweathered bedrock	0-35; Variable Unified: Not Rated AASHTO: Not Rated 35+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Woodhurst, Behanin, Supervisor and Duncom families, rock outcrop, and Lithic Cryochrepts.		

173 GERMANY deep-SADIE FAMILIES COMPLEX, 1 to 5 percent slopes.

Map Unit Components	Germany family, deep (50 percent)	Sadie family, (35 percent)
Position, Slope, and Elevation	On undulating basalt plateaus; 1 to 5 percent slopes; 4350 to 4500 feet.	On undulating basalt plateaus; 1 to 5 percent slopes; 4350 to 4500 feet.
Typical Vegetation and Precipitation (ppt)	Mixed conifer forest of ponderosa pine, Jeffrey pine, white fir, plus green leaf manzanita, ceonothus, rabbitbrush, Ross's sedge, grasses; 22 to 28 inches ppt.	Mixed conifer forest of ponderosa pine, Jeffrey pine, white fir, plus green leaf manzanita, ceonothus, rabbitbrush, Ross's sedge, grasses; 22 to 28 inches ppt.
Surface Layer	1 to 0 inches of ponderosa pine needles and twigs, over 0 to 14 inches; dark yellowish brown and yellowish brown fine sandy loam; platy and subangular blocky structure; soft; pH 6.2.	2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 5 inches; yellowish brown gravelly sandy loam, granular structure, soft, pH 7.0.
Substratum	32 to 47 inches; brownish yellow very cobbly fine sandy loam; massive; slightly hard; pH 6.0.	19 to 50 inches; brownish yellow gravelly coarse sandy loam, massive, slightly hard, pH 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; hard vesicular basalt	40 plus; hard vescular basalt
Erosion Factor (K)	.20	.20
Max. Erosion Hazard	Low	Low
Soil Permeability	Moderately rapid	Moderately rapid
Drainage Class	Well drained	Well drained
Soil Manageability Class	1	1
Group	IA	
Forest Site Class	3 (1-2)	3-4 (2-3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very Slow	Very Slow
Watershed Sensitivity	9 (Low)	9
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.8 inches	Moderate to High 2.7 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate	Moderate
Rating for Timber Site	Good	Good
R-Value	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-47; Fine sandy loam, cobbly fine sandy loam, very cobbly fine sandy loam Unified: SM, SM-SC AASHTO: A-4 47+; Unweathered bedrock	0-5; Gravelly sandy loam Unified: SM, SM-SC AASHTO: A-4 5-50; Gravelly coarse sandy loam Unified: SM AASHTO: A-1-b, A-2-4 50+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage is lava flow rock, Lithic Xerumbrepts and Elmore families, and unnamed soils similar to Germany family but medial skeletal.

174 GERMANY FAMILY-LITHIC XERUMBREPTS-LAVA FLOW ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	**Germany family (35 percent)**	**Lithic Xerumbrepts, mesic (25 percent)**	**Lava flow (20 percent)**
Position, Slope, and Elevation	On isolated concave 0.1 to 2 acre pockets between hummocky broken lava flow rock on basalt plateaus; 1 to 5 percent slopes; 4300 to 5000 feet.	On isolated concave 0.1 to 2 acre islands mainly on top of or immediately adjacent to hummocky broken lava flow rock on basalt plateaus; 1 to 10 percent slopes; 4300 to 5000 feet.	Hummocky, disaggregated lava flow rock and collapsed lava tubes on basalt plateaus with slope lengths of 10 to 40 feet; 5 to 20 percent slopes; 4300 to 5000 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, incense- cedar, white fir, western juniper, rabbitbrush, bitterbrush, greenleaf manzanita, Phlox spp., Carex spp., Ross's sedge bottlebrush, Junegrass, needlegrass, other grasses; 18 to 25 inches ppt.	Few ponderosa pine, Jeffrey pine, incense- cedar; western juniper, bitterbrush, big sagebrush, greenleaf manzanita, squaw carpet, Phlox spp., Carex spp., Ross's sedge, grasses; 18 to 25 inches ppt.	
Surface Layer	0 to 24 inches; yellowish brown loam, granular and massive structure, soft, pH 6.0 to 6.2.	1/2 to 0 inches of ponderosa pine and brush needles, leaves and twigs, over 0 to 12 inches; brown and yellowish brown very cobbly sandy loam and extremely cobbly sandy loam, granular structure, soft, pH 6.0 to 6.2.	NOT APPLICABLE: Fractured vesicular basalt flow rock with minor accumulations of aeolian soil deposition and duff material in some fractures.
Rooting Depth (in.) to Underlying Material	20 to 40; hard fractured vesicular basalt	10 to 20; hard fractured vesicular basalt	
Erosion Factor (K)	.32	Variable	
Max. Erosion Hazard	Low	Low	
Soil Permeability	Moderately rapid	Moderatley rapid	
Drainage Class	Well drained	Well drained	
Soil Manageability Class	3eX	3eX	
Group	III		
Forest Site Class	5-6 (3-5)	6-7 (5 to Non-commercial)	
Range Site	Not placed in a range site.	8, 9	
Water Runoff Potential	Very Slow	Slow	Rapid
Watershed Sensitivity	8 (Low)	8	7
Hydrologic Soil Group	B	D	
Available Water Capacity (AWC)	Low to Moderate	Very Low to Low	
Upper 20 inches	2.8 inches	1.0 to 2.0 inches	
Susceptibility to Burning Damage	Moderate	Moderate	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	
Chance of Seedling Survival	Moderate	Very Low	
Rating for Timber Site	Poor (2, 7, 10)	Poor (1 or 2, 3 or 4, 8, 10)	
R-Value	60+	Not Rated	

Soil horizons in inches, USDA, Unified, AASHTO

0-24; Loam
Unified: SM, SM-SC, ML, ML-CL
AASHTO: A-4
24+; Unweathered bedrock

0-12; Variable
Unified: Not Rated
AASHTO: Not Rated
12+; Unweathered bedrock

Included Areas:

Included with this unit in mapping and making up about 20 percent of the acreage are the Pass Canyon, Sheld, Ahart, Germany deep, Gwin, Bakeoven, Sadie, Neer and Alcot families unnamed soils similar to Germany family but medial-sketetal and Lava flow rock with steeper slopes.

175 GWIN-PASS CANYON FAMILIES-LITHIC XERORTHENTS, MESIC COMPLEX, 1 to 20 percent slopes

Map Unit Components	**Gwin family (40 percent)**	**Pass Canyon family (30 percnet)**	**Lithic Xerorthents, mesic (15 percent)**
Position, Slope, and Elevation	Mainly on southeast to westerly aspects on sideslopes of mountain uplands; 1 to 20 percent slopes; 4500 to 6000 feet.	Mainly on southeast to westerly aspects on sideslopes of mountain uplands; 1 to 20 percent slopes; 4500 to 6000 feet.	Mainly on southeast to westerly aspects on ridges, knolls and highly eroded drainages of mountain uplands; 1 to 20 percent slopes; 4500 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Low sagebrush, western yarrow, Phlox spp., buckwheat, mulesear, cheatgrass, Idaho fescue; 14 to 18 inches ppt.	Western juniper, low sagebrush, big sagebrush, rabbitbrush, western yarrow, Phlox spp., mulesear, cheatgrass, Idaho fescue, sandberg bluegrass; 14 to 18 inches ppt.	
Surface Layer	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure; slightly hard, pH 6.8.	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam, and loam, granular and platy structure, slightly hard, pH 6.6 to 6.8.	0 to 5 inches; brown and yellowish brown very cobbly loam and gravelly loam; platy and granular structure; slightly hard; pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	10 to 20 basalt	10 to 20; basalt	4 to 10; basalt
Erosion Factor (K)	.37	.32	Variable
Max. Erosion Hazard	Moderate	Moderate	Moderate to high
Soil Permeability	Moderately slow	Moderately slow	Moderate
Drainage Class	Well drained	Well drained	Somewhat excessively drained
Soil Manageability Class Group	2edx II	2edx	3edx
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	8	8	1
Water Runoff Potential	Moderate	Moderate	Moderate
Watershed Sensitivity	6 (Moderate)	6	4
Hydrologic Soil Group	D	D	D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.0 to 2.0 inches	Very Low to Low 1.3 to 2.6 inches	Very Low 0.6 to 1.5 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	30-60	30-60	Not Rated

Soil horizons in inches, USDA, Unified, AASHTO

0-11; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

11-18; Extremely cobbly clay loam
Unified: SC, CL
AASHTO: A-6

18+; Unweathered bedrock

0-2; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

2-4; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

4-12; Clay loam, cobbly clay loam
Unified: CL, MH
AASHTO: A-6, A-7

12+; Unweathered bedrock

0-5; Variable
Unified: Not Rated
AASHTO: Not Rated

5+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Ruckles, Ridd, Los Gatos, Deven, Keating, Supan, Fordice families and rock outcrop.

176 GWIN-PASS CANYON FAMILIES-LITHIC XERORTHENTS, MESIC COMPLEX, 20 to 40 percent slopes

Map Unit Components	Gwin family (45 percent)	Pass Canyon family (25 percent)	Lithic Xerorthents, mesic (15 percent)
Position, Slope, and Elevation	Mainly on southeast to westerly aspects on sideslopes of mountain uplands; 20 to 40 percent slopes; 4500 to 6000 feet.	Mainly on southeast to westerly aspects on sideslopes of mountain uplands; 20 to 40 percent slopes; 4500 to 6000 feet.	Mainly on southeast to westerly aspects on ridges, knolls and highly eroded drainages of mountain uplands; 20 to 40 percent slopes; 4500 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Low sagebrush, western yarrow, Phlox spp., buckwheat, mulesear, cheatgrass, Idaho fescue; 14 to 18 inches ppt.	Western juniper, low sagebrush, big sagebrush, rabbitbrush, western yarrow, Phlox spp., mulesear, cheatgrass, Idaho fescue, sandberg bluegrass; 14 to 18 inches ppt.	
Surface Layer	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure, slightly hard, pH 6.8.	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam, and loam, granular and platy structure, slightly hard, pH 6.6 to 6.8.	0 to 5 inches; brown and yellowish brown very cobbly loam and gravelly loam; platy and granular structure; slightly hard; pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt	10 to 20; basalt	4 to 10; basalt
Erosion Factor (K)	.37	.32	Variable
Max. Erosion Hazard	Moderate to high	Moderate to high	High
Soil Permeability	Moderately slow	Moderately slow	Moderate
Drainage Class	Well drained	Well drained	Somewhat excessively drained
Soil Manageability Class	3Edx	3Edx	3EDx
Group	III		
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	8	8	1
Water Runoff Potential	Rapid	Rapid	Rapid
Watershed Sensitivity	5 (Moderate)	5	3
Hydrologic Soil Group	D	D	D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.0 to 2.0 inches	Very Low to Low 1.3 to 2.6 inches	Very Low 0.6 to 1.5 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	30-60	30-60	Not Rated

Soil horizons in inches, USDA, Unified, AASHTO

0-11; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

11-18; Extremely cobbly clay loam
Unified: SC, CL
AASHTO: A-6

18+; Unweathered bedrock

0-2; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

2-4; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

4-12; Clay loam, cobbly clay loam
Unified: CL, MH
AASHTO: A-6, A-7

12+; Unweathered bedrock

0-5; Variable
Unified: Not Rated
AASHTO: Not Rated

5+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Ruckles, Ridd, Los Gatos, Deven, Keating, Supan, Fordice families and rock outcorp.

177 GWIN-PASS CANYON FAMILIES-LITHIC XERORTHENTS, MESIC COMPLEX, 40 to 70 percent slopes

Map Unit Components	Gwin family (50 percent)	Pass Canyon family (20 percent)	Lithic Xerorthents, mesic (20 percent)
Position, Slope, and Elevation	Mainly on southeast to westerly aspects on sideslopes of mountain uplands; 40 to 70 percent slopes; 4500 to 6000 feet.	Mainly on southeast to westerly aspects on sideslopes of mountain uplands; 40 to 60 percent slopes; 4500 to 6000 feet.	Mainly on southeast to westerly aspects on ridges, knolls and highly eroded drainages of mountain uplands; 40 to 70 percent slopes; 4500 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Low sagebrush, western yarrow, Phlox spp., buckwheat, mulesear, cheatgrass, Idaho fescue; 14 to 18 inches ppt.	Western juniper, low sagebrush, big sagebrush, rabbitbrush, western yarrow, Phlox spp., mulesear, cheatgrass, Idaho fescue, sandberg bluegrass; 14 to 18 inches ppt.	
Surface Layer	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure, slightly hard, pH 6.8.	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam, and loam, granular and platy structure, slightly hard, pH 6.6 to 6.8.	0 to 5 inches; brown and yellowish brown very cobbly loam and gravelly loam; platy and granular structure; slightly hard; pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt	10 to 20; basalt	4 to 10; basalt
Erosion Factor (K)	.37	.32	Variable
Max. Erosion Hazard	High to very high	High to very high	Very high
Soil Permeability	Moderatley slow	Moderately slow	Moderate
Drainage Class	Well drained	Well drained	Somewhat excessively drained
Soil Manageability Class	3Edx	3Edx	3EDx
Group	III		
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	8	8	1
Water Runoff Potential	Very Rapid	Very Rapid	Very Rapid
Watershed Sensitivity	3 (High)	3	1
Hydrologic Soil Group	D	D	D
Available Water Capacity (AWC)	Very Low to Low	Very Low to Low	Very Low
Upper 20 inches	1.0 to 2.0 inches	1.3 to 2.6 inches	0.6 to 1.5 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	30-60	30-60	Not Rated

Soil horizons in inches, USDA, Unified, AASHTO

0-11; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

11-18; Extremely cobbly clay loam
Unified: SC, CL
AASHTO: A-6

18+; Unweathered bedrock

0-2; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

2-4; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

4-12; Clay loam, cobbly clay loam
Unified: CL, MH
AASHTO: A-6, A-7

12+; Unweathered bedrock

0-5; Variable
Unified: Not Rated
AASHTO: Not Rated

5+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 10 percent of the acreage are the Ruckles, Ridd, Los Gatos, Deven, Keating, Supan, Fordice families and rock outcorp.

178 GWIN-RUCKLES FAMILIES-ROCK OUTCROP ASSOCIATION, 40 to 70 percent slopes

Map Unit Components	Gwin family (35 percent)	Ruckles family (30 percent)	Rock outcrop (20 percent)
Position, Slope, and Elevation	Mainly on southerly and westerly aspects of mountain uplands; 40 to 70 percent slopes; 4800 to 6400 feet.	Mainly on southerly and westerly aspects of mountain uplands; 40 to 70 percent slopes; 4800 to 6400 feet.	On ridges and knolls of mountain uplands; 45 to 70 percent slopes; 4800 to 6400 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, mountain mahogany, low sagebrush, few big sagebrush, mulesear, Idaho fescue, sandberg bluegrass, cheatgrass; 16 to 20 inches ppt.	Western juniper, mountain mahogany few ponderosa pine and white fir, low sagebrush, big sagebrush, mulesear, Idaho fescue, bottlebrush, sandberg bluegrass, 16 to 20 inches ppt.	
Surface Layer	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure, slightly hard, pH 6.8.	0 to 4 inches; brown very cobbly loam, granular structure, soft, pH 7.0.	NOT APPLICABLE: Basalt, andesite or conglomerated tuff bedrock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	8 to 20; basalt	10 to 20; basalt, tuff	
Erosion Factor (K)	.37	.37	
Max. Erosion Hazard	High to very high	High to very high	
Soil Permeability	Moderately slow	Slow	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	 3Edx III	 3Sd	
Forest Site Class	7 (non-commercial)	7 (non-commercial)	
Range Site	8, 1	8	
Water Runoff Potential	Very Rapid	Very Rapid	Very Rapid
Watershed Sensitivity	3 (Very High)	2	0
Hydrologic Soil Group	D	D	
Available Water Capacity (AWC) Upper 20 inches	 0.8 to 2.0 inches	 1.0 to 2.0 inches	
Susceptibility to Burning Damage	Moderate	Moderate	
Slope Stability Hazard	Low	High	
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	Not Rated	
Rating for Timber Site	Not Rated	Not Rated	
R-Value	30-60	0-30	
Soil horizons in inches, USDA, Unified, AASHTO	0-11; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 11-18; Extremely cobbly clay loam Unified: SC, CL AASHTO: A-6 18+; Unweathered bedrock	0-4; Very cobbly loam Unified: SM, SC AASHTO: A-4, A-6 4-14; Very gravelly clay Unified: GC, CH AASHTO: A-7 14+; Unweathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 15 percent of the acreage are Lithic Xerorthents, mesic, rubbleland, Pass Canyon, Deven, Fordice, and Lawyer families.		

179 HADES-VIPONT-ANATONE FAMILIES ASSOCIATION, 10 to 30 percent slopes

Map Unit Components	Hades family (40 percent)	Vipont family (25 percent)	Anatone family (20 percent)
Position, Slope, and Elevation	On lower sideslopes and alluvial fans of mountain uplands; 10 to 25 percent slopes; 5700 to 6500 feet.	On sideslopes and drainages of mountain uplands; 15 to 30 percent slopes; 5700 to 6500 feet.	On upper sideslopes, ridges and knolls of mountain uplands; 15 to 30 percent slopes; 5700 to 6500 feet.
Typical Vegetation and Precipitation (ppt)	Few white fir, few ponderosa pine, western juniper, mountain mahogany, big sagebrush, ceonothus, greenleaf manzanita, snowberry, bitterbrush, mulesear, wheatgrass, Ross's sedge, Idaho fescue; 20 to 22 inches ppt.	Few white fir, few ponderosa pine, western juniper, mountain mahogany, big sagebrush, ceonothus, greenleaf manzanita, snowberry, bitterbrush, mulesear, wheatgrass, Ross's sedge, Idaho fescue; 20 to 22 inches ppt.	
Surface Layer	0 to 15 inches; dark brown loam, granular and blocky structure, slightly hard, pH 6.6 to 6.8.	0 to 16 inches; brown very gravelly loam, granular and blocky structure slightly hard, pH 6.8.	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.8 to 7.0.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt	20 to 40; basalt	10 to 20; basalt, andesite
Erosion Factor (K)	.32	.28	.37
Max. Erosion Hazard	Moderate	Moderate	Moderate
Soil Permeability	Moderately slow	Moderately slow	Moderate
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	 2e II	 2e	 2ed
Forest Site Class	5 (3-4)	5-6 (4-5)	7 (non-commercial)
Range Site	Not placed in a range site.	Not placed in a range site.	9
Water Runoff Potential	Slow	Slow	Rapid
Watershed Sensitivity	7 (Moderate)	7	4
Hydrologic Soil Group	B	B	D
Available Water Capacity (AWC) Upper 20 inches	 3.2 inches	 2.8 inches	 1.2 to 2.5 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Moderate to High	Moderate	Not Rated
Rating for Timber Site	Fair (7, 10)	Fair (1,7,10)	Not Rated
R-Value	30-60	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-15: Loam Unified: ML-CL, CL AASHTO: A-4, A-6 15-36; Gravelly clay loam, gravelly silty clay loam Unified: CL, MH AASHTO: A-6, A-7 36+; Unweathered bedrock	0-16; Very gravelly loam Unified: SM, SM-SC AASHTO: A-4 16-32; Very gravelly clay loam, very cobbly clay loam, extremely cobbly clay loam Unified: SC, CL AASHTO: A-6, A-7 32+; Weathered bedrock	0-8; Cobbly loam Unified: ML, ML-CL AASHTO: A-4 8-17; Very cobbly loam Unified: SM, SC AASHTO: A-4, A-6 17+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Ginser, Mascamp, Bearskin, Smarts, Ridd, Lamondi families and rock outcrop and unnamed soils similar to the Hades family but with a cambic horizon.		

180 HIIBNER-DEVEN-KEATING FAMILIES COMPLEX, 20 to 60 percent slopes

Map Unit Components	Hiibner family (35 percent)	Deven family (25 percent)	Keating family (20 percent)
Position, Slope, and Elevation	Mainly on southeast to westerly aspects of sideslopes of hills and basalt plateaus; 20 to 60 percent slopes; 4400 to 5800 feet.	Mainly on southeast to westerly aspects of sideslopes and toeslopes of hills and basalt plateaus; 20 to 60 percent slopes; 4400 to 5800 feet.	Mainly on southeast to westerly aspects of sideslopes of hills and basalt plateaus; 20 to 60 percent slopes; 4400 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few scattered ponderosa pine, big sagebrush, low sagebrush, mountain mahogany, rabbitbrush, Ross's sedge, grasses; 14 to 16 inches ppt.	Western juniper, low sagebrush, mountain mahogany, rabbitbrush, phlox spp., grasses; 14 to 16 inches ppt.	
Surface Layer	0 to 12 inches; brown stony loam and very cobbly clay loam, granular and blocky structure, slightly hard, pH 6.6.	0 to 2 inches; brown cobbly loam, platy and granular structure, slightly hard, pH 7.0.	0 to 2 inches; dark grayish brown cobbly clay loam, granular structure, hard, pH 6.8.
Substratum		13 to 25 plus inches; weathered in place platy to massive soft to hard tuff.	
Rooting Depth (in.) to Underlying Material	20 to 40; tuff and basalt	10 to 20; soft to hard tuff and basalt bedrock.	20 to 40; basalt and tuff.
Erosion Factor (K)	.37	.37	.32
Max. Erosion Hazard	Moderate to high	High	Moderate to high
Soil Permeability	Slow	Slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	3Epx III	3Edx	3E
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	18	8, 23	18, 13
Water Runoff Potential	Rapid	Rapid	Rapid
Watershed Sensitivity	4 (High)	3	4
Hydrologic Soil Group	C	D	C
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.3 inches	Low 1.5 to 2.9 inches	Low to Moderate 2.7 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low to High	Low to High	Low to High
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-3; Stony loam Unified: ML, CL AASHTO: A-4, A-6 3-12; Very cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12-25; Very cobbly clay Unified: CH AASHTO: A-7 25+; Weathered bedrock	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-13; Clay loam, clay Unified: CL, CH AASHTO: A-7 13+; Weathered bedrock	0-6; Cobbly clay loam, clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 6-32; Clay Unified: CH AASHTO: A-7 32+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are Rock outcrop, Rubble land, Ridd, Gwin, Ruckles and Fordice families, and soils similar to Hiibner family but are Pachic.

181 HIIBNER-RUCKLES FAMILIES COMPLES, 15 to 35 percent slopes

Map Unit Components	Hiibner family (50 percent)	Ruckles family (35 percent)
Position, Slope, and Elevation	Mainly on southeast to westerly aspects of smooth sideslopes of mountain uplands; 15 to 35 percent slopes; 4600 to 5800 feet.	Mainly on southeast to westerly aspects of ridges and sideslopes of mountain uplands; 15 to 35 percent slopes; 4600 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, Western juniper mountain mahogany, big sagebrush, bitterbrush, Ross's sedge, grasses; 16 to 20 inches ppt.	Western juniper, mountain mahogany, big sagebrush, low sagebrush, rabbitbrush, cheatgrass, bottlebrush, Idaho fescue; 16 to 20 inches ppt.
Surface Layer	0 to 12 inches; brown stony loam and very cobbly clay loam, granular and blocky structure, slightly hard, pH 6.6.	0 to 4 inches; brown very cobbly loam, granular structure, soft, pH 7.0.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt, tuff	10 to 20; basalt, tuff
Erosion Factor (K)	.37	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Slow	Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2epx	2edx
Group	II	
Forest Site Class	6 (4-5)	7 (non-commercial)
Range Site	Not placed in a range site.	8, 23
Water Runoff Potential	Moderate	Rapid
Watershed Sensitivity	6 (Moderate)	4
Hydrologic Soil Group	C	D
Available Water Capacity (AWC)	Low to Moderate	Very Low to Low
Upper 20 inches	2.3 inches	1.0 to 2.0 inches
Susceptibility to Burning Damage	Moderate to High	Moderate
Slope Stability Hazard	Low to Moderate	Low to Moderate
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Low to Very Low	Not Rated
Rating for Timber Site	Poor (1,4,7,11)	Not Rated
R-Value	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-3; Stony loam Unified: ML, CL AASHTO: A-4, A-6 3-12; Very cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12-25; Very cobbly clay Unified: CH AASHTO: A-7 25+; Weathered bedrock	0-4; Very cobbly loam Unified: SM, SC AASHTO:A-4, A-6 4-14; Very gravelly clay Unified: GC, CH AASHTO: A-7 14+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage are the Gwin, Lawyer, Fordice, Pass Canyon, Deven and Jacket families, Lithic Xerorthents, mesic, and Rock outcrop.

182 HOLLAND FAMILY, 4 to 15 inch pumice overburden, 1 to 10 percent slopes

Map Unit Components	**Holland family (65 percent)**
Position, Slope, and Elevation	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 4500 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, western juniper bitterbrush, big sagebrush, rabbitbrush, Ross's sedge, grasses; 16 to 20 inches ppt.
Surface Layer	1 to 0 inches ponderosa pine needles and twigs, over 12 inches of pumice overburden consisting of 0 to 5 inches grayish brown gravelly coarse sand; 5 to 12 inches; very pale brown extremely gravelly coarse sand (thickness ranges from 4 to 15 inches; OVER 12 to 21 inches; brown loam, subangular blocky structure, hard, pH 6.6.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt
Erosion Factor (K)	.20
Max. Erosion Hazard	Low
Soil Permeability	Rapid in pumice overburden and moderately slow below.
Drainage Class	Well drained
Soil Manageability Class Group	 2p II
Forest Site Class	6 (4-5)
Range Site	Not placed in a range site.
Water Runoff Potential	Very Slow
Watershed Sensitivity	9 (Low)
Hydrologic Soil Group	B
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.6 inches
Susceptibility to Burning Damage	Moderate to High
Slope Stability Hazard	Low
Allowable Soil Loss	2 tons/acre/year
Chance of Seedling Survival	Moderate
Rating for Timber Site	Fair (5,7,10)
R-Value	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-5; Gravelly coarse sand Unified: SW-SM, SM AASHTO: A-1-a 5-12; Extremely gravelly coarse sand Unified: GW-GM AASHTO: A-1-a 12-21; Loam Unified: CL AASHTO: A-6 21-37; Clay loam Unified: CL, MH AASHTO: A-6, A-7 37+; Unweathered bedrock
Included Areas:	Included with this soil in mapping and making up about 35 percent of the acreage are the Alcot, menzel and Skalan families, Lithic Xerorthents, mesic, and soils similar to the Holland family but with greater and lesser amounts of pumice overburden.

183 HOLLAND deep-SKALAN FAMILIES COMPLEX, 8 to 20 inch pumice overburden, 1 to 10 percent slopes

Map Unit Components	Holland family, deep (45 percent)	Skalan family (35 percent)
Position, Slope, and Elevation	On undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 4500 feet.	On undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 4500 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, few western juniper, bitterbrush, big sagebrush, rabbitbrush, cheatgrass, bottlebrush, Ross's sedge, Idaho fescue; 16 to 20 inches ppt.	Few ponderosa pine, Jeffrey pine, western juniper, big sagebrush, rabbitbrush, bitterbrush cheatgrass, bottlebrush, Ross's sedge, Idaho fescue; 16 to 20 inches ppt.
Surface Layer	1/2 to 0 inches of ponderosa and Jeffrey pine needles over 11 inches of pumice consisting of 0 to 6 inches; grayish brown gravelly coarse loamy sand; 6 to 11 inches; very pale brown extremely gravelly coarse sand (thickness ranges from 8 to 20 inches) OVER 11 to 17 inches; yellowish brown loam, granular and blocky structure, hard, pH 6.6.	8 inches of pumice overburden consisting of 0 to 4 inches; grayish brown gravelly coarse loamy sand; 4 to 8 inches very pale brown extremely gravelly coarse sand (pumice thickness ranges from 8 to 20 inches) OVER 8 to 20 inches; light yellowish brown extremely cobbly loam, granular and blocky structure, slightly hard, pH 6.4.
Rooting Depth (in.) to Underlying Material	40 plus; basalt	30 plus; basalt
Erosion Factor (K)	.20	.20
Max. Erosion Hazard	Low	Low
Soil Permeability	Rapid in the pumice overburden and moderately slow below	Rapid in the pumice overburden and moderately slow below.
Drainage Class	Well drained	Well drained
Soil Manageability Class	2p	2p
Group	II	
Forest Site Class	5 (3-4)	6 (4-5)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very Slow	Very Slow
Watershed Sensitivity	9 (Low)	9
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.6 inches	Moderate 2.1 inches
Susceptibility to Burning Damage	Moderate to High	Moderate to High
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate	Low
Rating for Timber Site	Fair (5,10)	Fair (3,5,7,10)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Gravelly loamy coarse sand Unified: SM AASHTO: A-1-b 6-11; Extremely gravelly coarse sand Unified: GW-GM AASHTO: A-1-a 11-17; Loam Unified: CL AASHTO: A-6 17-48; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 48+; Unweathered bedrock	0-4; Gravelly loamy coarse sand Unified: SM AASHTO: A-1-b 4-8; Extremely gravelly coarse sand Unified: GW-GM AASHTO: A-1-a 8-20; Extremely cobbly loam Unified: SM, SM-SC, ML, ML-CL AASHTO: A-4, A-6 20-32; Extremely stony clay loam Unified: CL AASHTO: A-6 32+; Unweathered bedrock

Included Areas:

Included with this unit in mapping and making up about 20 percent of acreage are the Alcot, Menzel, and Germany families and Lithic Xerumbrepts, mesic, and rock outcrop.

184 INDIAN CREEK FAMILY, 1 to 5 percent slopes

Map Unit Components	**Indian Creek family (65 percent)**
Position, Slope, and Elevation	On nearly level to gently undulating basalt plateaus; 1 to 5 percent slopes; 4500 to 4800 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, black sagebrush, few big sagebrush, rabbitbrush, Idaho fescue, Poa spp., cheatgrass; 12 to 14 inches ppt.
Surface Layer	0 to 5 inches; brown and light brown, cobbly clay loam and clay loam, granular and platy structure, hard, pH 6.8.
Substratum	11 to 60 inches, weakly cemented silica duripan which becomes strongly cemented with depth and is generally over basalt bedrock.
Rooting Depth (in.) to Underlying Material	8 to 20; silica duripan over basalt
Erosion Factor (K)	.43
Max. Erosion Hazard	Moderate
Soil Permeability	Very slow
Drainage Class	Well drained
Soil Manageability Class Group	2edx II
Forest Site Class	7 (non-commercial)
Range Site	7, 1
Water Runoff Potential	Slow
Watershed Sensitivity	5 (Moderate)
Hydrologic Soil Group	D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.1 to 2.8 inches
Susceptibility to Burning Damage	Low
Slope Stability Hazard	Low
Allowable Soil Loss	1 tons/acre/year
Chance of Seedling Survival	Not Rated
Rating for Timber Site	Not Rated
R-Value	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-5; Cobbly clay loam, clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 5-11; Clay Unified: CH AASHTO: A-7 11-60; Silica duripan
Included Areas:	Included with the soil in mapping and making up abaout 35 percent of the acreage are the Puls, Packwood, Barnard, Bieber, Aikman and Deven families and Lithic Xerorthents, mesic.

185 INDIAN CREEK-PULS-BARNARD FAMILIES COMPLEX, 0 to 2 percent slopes

Map Unit Components	**Indian Creek family (40 percent)**	**Puls family (30 percent)**	**Barnard family (15 percent)**
Position, Slope, and Elevation	On shallow clay basins of basalt plateaus, (subject to spring flooding), 0 to 2 percent slopes, 4300 to 5300 feet.	On shallow clay basins of basalt plateaus, (subject to spring flooding), 0 to 2 percent slopes; 4300 to 5300 feet.	On clay basins of basalt plateaus, (subject to spring flooding), 0 to 2 percent slopes, 4300 to 5300 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, sandberg bluegrass, bottlebrush, other grasses; 12 to 14 inches ppt.	Low sagebrush, black sagebrush, Phlox spp., sandburg, bluegrass, cheatgrass, other grasses; 12 to 14 inches ppt.	
Surface Layer	0 to 5 inches, brown and light brown, cobbly clay loam, and clay loam, granular and platy structure, hard, pH 6.8.	0 to 5 inches; pinkish gray very stony clay loam, granular structure, slightly hard, pH 6.3.	0 to 8 inches; grayish brown to dark grayish brown cobbly loam to gravelly clay loam, platy and blocky structure, slightly hard, pH 6.5 to 7.0.
Substratum	11 to 60 inches, weakly cemented duripan which becomes strongly cemented with depth and is generally over basalt bedrock.	19 to 28 inches; indurated silica cemented duripan.	32 plus inches; weakly to strongly cemented silica duripan.
Rooting Depth (in.) to Underlying Material	10 to 20; silica duripan over basalt	6rttuff0; dense very hard clay, over silica duripan at 10 to 20 inches	20 to 40; silica duripan
Erosion Factor (K)	.43	.37	.37
Max. Erosion Hazard	Moderate	Moderate	Low
Soil Permeability	Very slow	Very slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class	2edx	3eDx	1
Group	II		
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	7	1	17, 24
Water Runoff Potential	Very Slow	Very Slow	Very Slow
Watershed Sensitivity	5 (Moderate)	5	6
Hydrologic Soil Group	D	D	C
Available Water Capacity (AWC)	Very Low to Low	Very Low to Low	Low to Moderate
Upper 20 inches	1.4 to 2.8 inches	1.1 to 2.8 inches	2.6 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	0-30	0-30

Soil horizons in inches, USDA, Unified, AASHTO

0-5; Cobbly clay loam, clay loam
Unified: CL, MH, CH
AASHTO: A-6, A-7
5-11; Clay
Unified: CH
AASHTO: A-7
11-60; Silica duripan

0-5; Very stony clay loam
Unified: ML, CL
AASHTO: A-6, A-7
5-19; Clay loam, clay
Unified: CL, CH
AASHTO: A-7
19-28; Silica duripan
28+; Unweathered bedrock

0-3; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6
3-8; Gravelly clay loam
Unified: CL, MH
AASHTO: A-6, A-7
8-32; Clay, Gravelly silty clay
Unified: CH
AASHTO: A-7
32+; Silica duripan

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Packwood, Dishner, Ditchcamp, Deven, Aikman and Fordice families and rubbleland.

186 INVILLE-YALLANI FAMILIES COMPLEX, 10 to 20 inch pumice overburden, 2 to 20 percent slopes

Map Unit Components	**Inville family (50 percent)**	**Yallani family, pumice overburden phase (25 percent)**
Position, Slope, and Elevation	On sideslopes of volcanic mountain uplands; 2 to 20 percent slopes; 5300 to 6400 feet.	On sideslopes of volcanic mountain uplands; 2 to 20 percent slopes; 5300 to 6400 feet.
Typical Vegetation and Precipitation (ppt)	Mixed conifer forest of ponderosa pine, white fir, incense-cedar, plus greenleaf manzanita, bitterbrush, squaw carpet, Ross's sedge, bunch grasses; 25 to 40 inches ppt.	Mixed conifer forest of ponderosa pine, white fir, incense-cedar, plus greenleaf manzanita, bitterbrush, squaw carpet, Ross's sedge, bunch grasses; 25 to 40 inches ppt.
Surface Layer	2 to 0 inches; decomposed and undecomposed Jeffrey pine and ponderosa pine needles and twigs, over 12 inches of pumice consisting of dark grayish brown to pale brown very gravelly loamy coarse sand grading to grayish brown gravelly loamy fine sand. (Thickness ranges from 10 to 20 inches). OVER 12 to 15 inches; yellowish brown very gravelly sandy loam, granular structure, soft, pH 6.4.	1 to 0 inches; undecomposed ponderosa pine and white fir needles and twigs, over 17 inches of pumice consisting of gray extremely gravelly loamy coarse sand grading to white extremely gravelly very coarse sand. (Thickness ranges from 10 to 20 inches). OVER 17 to 23 inches; yellowish brown gravelly coarse sandy loam, granular structure, soft, pH 6.2.
Rooting Depth (in.) to Underlying Material	40 plus; basalt, andesite	40 plus; basalt, andesite
Erosion Factor (K)	.17	.15
Max. Erosion Hazard	Low to moderate	Low
Soil Permeability	Rapid in the pumice overburden and moderate below.	Rapid in the pumice overburden and moderately rapid below.
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	 2ep II	 2ep
Forest Site Class	4-5 (3-4)	5 (4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Very Slow
Watershed Sensitivity	8 (Low)	8
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.3 inches	Moderate 2.3 inches
Susceptibility to Burning Damage	High	High
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate	Moderate
Rating for Timber Site	Fair (5)	Fair (3, 5)
R-Value	30-60	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Very gravelly loamy coarse sand Unified: SW-SM, SM AASHTO: A-1-a 6-12; Very gravelly loamy fine sand Unified: SM AASHTO: A-2-4 12-21; Very gravelly sandy loam Unified: SM AASHTO: A-1-b 21-60; Very gravelly loam Unified: SM, SM-SC AASHTO: A-2-4, A-2-6	0-2; Extremely gravelly loamy coarse sand Unified: SW-SM AASHTO: A-1-a 2-17; Extremely gravelly coarse sand Unified: GW-GM AASHTO: A-1-a 17-60; Gravelly coarse sandy loam, extremely stony coarse sandy loam, extremely cobbly coarse sandy loam Unified: SM AASHTO: A-1-b, A-2-4

Included Areas:

Included with these soils in mapping and making up about 25 percent of the acreage are the Stonewell family, pumice overburden, unnamed cindery over medial-skeletal, frigid soils, Lithic Xerorthents, frigid, and rock outcrop.

187 JACKET-DEVEN-HIIBNER FAMILIES ASSOCIATION, 1 to 15 percent slopes

Map Unit Components	Jacket family (45 percent)	Deven family (30 percent)	Hiibner family (15 percent)
Position, Slope, and Elevation	On smooth sideslopes and concave areas of mountain uplands; 1 to 15 percent slopes; 4400 to 5800 feet.	On upper sideslopes ridges and knolls of mountain uplands; 5 to 15 percent slopes; 4400 to 5800 feet.	On sideslopes and sight convex areas of mountain uplands; 1 to 15 percent slopes; 4400 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, incense-cedar, black oak, few white fir and western juniper, snowberry, serviceberry, big sagebrush, greenleaf manzanita, lupine, Ross's sedge, vetch, grasses; 16 to 20 inches ppt.	Western juniper, low sagebrush, big sagebrush, lupine, wild onion, mulesear, cheatgrass, bottlebrush, Idaho fescue, sandberg bluegrass; 16 to 20 inches ppt.	
Surface Layer	1 to 0 inches, ponderosa pine needles and twigs, over 0 to 2 inches; very dark grayish brown cobbly clay loam, granular structure, slightly hard, pH 6.2.	0 to 2 inches; brown cobbly clay loam, platy and granular structure, slightly hard, pH 7.0.	Thin mantle of ponderosa pine needles over 0 to 12 inches; brown stony loam and very cobbly clay loam, granular and blocky structure, slightly hard, pH 6.6.
Substratum	34 plus inches; weathered in place platy to massive semi-soft volcanic tuff.	13 to 25 plus inches; weathered in place platy to massive soft to hard volcanic tuff.	
Rooting Depth (in.) to Underlying Material	20 to 40; tuff	10 to 20; soft to hard tuff, basalt	20 to 40; tuff, basalt
Erosion Factor (K)	.32	.37	.37
Max. Erosion Hazard	Low to moderate	Moderate	Low to moderate
Soil Permeability	Slow	Slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2e II	2edx	2ep
Forest Site Class	5-6 (3-5)	7 (non-commercial)	6 (4-5)
Range Site	Not placed in a range site.	23, 8	Not placed in a range site.
Water Runoff Potential	Slow	Moderate	Slow
Watershed Sensitivity	6 (Moderate)	5	6
Hydrologic Soil Group	C	D	C
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.6 inches	Low 1.5 to 2.9 inches	Low to Moderate 2.3 inches
Susceptibility to Burning Damage	Moderate	Low	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate	Not Rated	Low
Rating for Timber Site	Fair (7,10)	Not Rated	Fair (1,3,7,10)
R-Value	0-30	0-30	0-30

Soil horizons in inches, USDA, Unified, AASHTO

0-2; Cobbly clay loam
Unified: CL, MH
AASHTO: A-6, A-7
2-34; Clay
Unified: CH
AASHTO: A-7
34+; Weathered bedrock

0-2; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6
2-13; Clay loam, clay
Unified: CL, CH
AASHTO: A-7
13+; Weathered bedrock

0-3; Stony loam
Unified: ML, CL
AASHTO: A-4, A-6
3-12; Very cobbly clay loam
Unified: CL, MH
AASHTO: A-6, A-7
12-26; Very cobbly clay
Unified: CH
AASHTO: A-7
25+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 10 percent of the acreage are the Gwin, Pass Canyon, Fordice, Lawyer, Elmore and Keating families, Jacket Family deep, and Lithic Xerorthents, mesic.

188 JACKET-DEVEN-HIIBNER FAMILIES ASSOCIATION, 15 to 35 percent slopes

Map Unit Components	Jacket family (40 percent)	Deven family (30 percent)	Hiibner family (15 percent)
Position, Slope, and Elevation	On smooth sideslopes and concave areas of mountain uplands; 15 to 35 percent slopes; 4400 to 5800 feet.	On upper sideslopes ridges and knolls of mountain uplands; 15 to 35 percent slopes; 4400 to 5800 feet.	On sideslopes and slight convex areas of mountain uplands; 15 to 35 percent slopes; 4400 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, incense-cedar, black oak, few white fir and western juniper, snowberry, serviceberry, big sagebrush, greenleaf manzanita, lupine, vetch, Ross's sedge, grasses; 16 to 20 inches ppt.	Western juniper, low sagebrush, big sagebrush, lupine, wild onion, mulesear, cheatgrass, bottlebrush, Idaho fescue, sandberg bluegrass; 16 to 20 inches ppt.	
Surface Layer	1 to 0 inches, ponderosa pine needles and twigs, over 0 to 2 inches; very dark grayish brown cobbly clay loam, granular structure, slightly hard, pH 6.2.	0 to 2 inches; brown cobbly clay loam, platy and granular structure, slightly hard, pH 7.0.	Thin mantle of ponderosa pine needles over 0 to 12 inches; brown stony loam and very cobbly clay loam, granular and blocky structure, slightly hard, pH 6.6.
Substratum	34 plus inches; weathered in place platy to massive semi-soft volcanic tuff.	13 to 25 plus inches; weathered in place platy to massive soft to hard volcanic tuff.	
Rooting Depth (in.) to Underlying Material	20 to 40; tuff	10 to 20; soft to hard tuff, basalt.	20 to 40; tuff, basalt.
Erosion Factor (K)	.32	.37	.37
Max. Erosion Hazard	Moderate	Moderate to high	Moderate
Soil Permeability	Slow	Slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	 2s II	 3Edx	 2sp
Forest Site Class	5-6 (3-5)	7 (non-commercial)	6 (4-5)
Range Site	Not placed in a range site.	23, 8	Not placed in a range site.
Water Runoff Potential	Moderate	Rapid	Moderate
Watershed Sensitivity	5 (Moderate)	4	5
Hydrologic Soil Group	C	D	C
Available Water Capacity (AWC) Upper 20 inches	 2.6 inches	 1.5 to 2.9 inches	 2.3 inches
Susceptibility to Burning Damage	Moderate	Low	Moderate
Slope Stability Hazard	Low to Moderate	Low to Moderate	Low to Moderate
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate	Not Rated	Low
Rating for Timber Site	Fair (7,11)	Not Rated	Fair (1,3,7,11)
R-Value	0-30	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 2-34; Clay Unified: CH AASHTO: A-7 34+; Weathered bedrock	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-13; Clay loam, clay Unified: CL, CH AASHTO: A-7 13+; Weathered bedrock	0-3; Stony loam Unified: ML, CL AASHTO: A-4, A-6 3-12; Very cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12-25; Very cobbly clay

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Gwin, Pass Canyon, Fordice, Lawyer, Elmore and Keating families, Jacket family deep, and Lithic Xerorthents, mesic.

189 JACKET-DEVEN-HIIBNER FAMILIES ASSOCIATION, 35 to 60 percent slopes

Map Unit Components	Jacket family (30 percent)	Deven family (30 percent)	Hiibner family (25 percent)
Position, Slope, and Elevation	On smooth sideslopes and concave areas of mountain uplands; 35 to 60 percent slopes; 4400 to 5800 feet.	On upper sideslopes ridges and knolls of mountain uplands; 35 to 60 percent slopes; 4400 to 5800 feet.	On sideslopes and slight convex areas of mountain uplands; 35 to 60 percent slopes; 4400 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, incense-cedar, black oak, few white fir and western juniper, snowberry, serviceberry, big sagebrush, greenleaf manzanita, lupine, vetch, Ross's sedge, grasses; 16 to 20 inches ppt.	Western juniper, low sagebrush, big sagebrush, lupine, wild onion, mulesear, cheatgrass, bottlebrush, Idaho fescue, sandberg bluegrass; 16 to 20 inches ppt.	
Surface Layer	1 to 0 inches, ponderosa pine needles and twigs, over 0 to 2 inches; very dark grayish brown cobbly clay loam, granular structure, slightly hard, pH 6.2.	0 to 2 inches; brown cobbly clay loam, platy and granular structure, slightly hard, pH 7.0.	Thin mantle of ponderosa pine needles over 0 to 12 inches; brown stony loam and very cobbly clay loam, granular and blocky structure, slightly hard, pH 6.6.
Substratum	34 plus inches; weathered in place platy to massive semi-soft volcanic tuff.	13 to 25 plus inches; weathered in place platy to massive soft to hard volcanic tuff.	
Rooting Depth (in.) to Underlying Material	20 to 40; tuff	10 to 20; soft to hard tuff, basalt.	20 to 40; tuff, basalt.
Erosion Factor (K)	.32	.37	.37
Max. Erosion Hazard	High	High to very high	High
Soil Permeability	Slow	Slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class	3s	3Edx	3Sp
Group	III		
Forest Site Class	5-6 (3-5)	7 (non-commercial)	6 (4-5)
Range Site	Not placed in a range site.	23, 8	Not placed in a range site.
Water Runoff Potential	Rapid	Rapid	Rapid
Watershed Sensitivity	4 (High)	3	4
Hydrologic Soil Group	C	D	C
Available Water Capacity (AWC)	Low to Moderate	Low	Low to Moderate
Upper 20 inches	2.6 inches	1.5 to 2.9 inches	2.3 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate to high
Slope Stability Hazard	High	High	High
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate	Not Rated	Low
Rating for Timber Site	Poor (7,9,12)	Not Rated	Poor (1,3,7,9,12)
R-Value	0-30	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Cobbly clay loam Unified: CL, MH AASHTO: A-6,A-7 2-34; Clay Unified: CH AASHTO: A-7, 34+; Weathered bedrock	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-13; Clay loam, clay Unified: CL, CH AASHTO: A-7 13+; Weathered bedrock	0-3; Stony loam Unified: ML,CL AASHTO: A-4, A-6 3-12; Very cobbly clay loam Unified: CL,CH AASHTO: A-6,A-7 12-25; Very cobbly clay

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Gwin, Pass Canyon, Fordice, Lawyer, Elmore and Keating families, Jacket family deep, and Lithic Xerorthents, mesic.

190 JACKNIFE-AIKMAN FAMILIES ASSOCIATION, 0 to 5 percent slopes

Map Unit Components	**Jacknife family (50 percent)**	**Aikman family (30 Percent)**
Position, Slope, and Elevation	On alluvial fans on basalt plateaus and mountain uplands; 1 to 5 percent slopes; 4400 to 5300 feet.	On slightly concave alluvial basins and drainages (subject to spring flooding); 0 to 2 percent slopes; 4400 to 5300 feet.
Typical Vegetation and Precipitation (ppt)	Few western juniper, few scattered ponderosa pine, big sagebrush, rabbitbrush, western yarrow, lupine, Idaho fescue, Poa spp., other grasses; 14 to 18 inches ppt.	Silver sagebrush, rabbitbrush, low sagebrush, sedges, forbes, timothy, bottlebrush, cheatgrass, other grasses; 14 to 18 inches ppt.
Surface Layer	0 to 4 inches; brown loam platy and granular structure, hard, pH 6.2.	0 to 4 inches; dark gray and dark grayish brown silty clay, granular and platy structure; very hard, pH 6.6 to 7.0.
Substratum	42 to 60 inches; brown stratified lenses of laom, sandy loam and loamy sand, platy and massive, hard to loose, pH 6.6.	4 to 60 inches; dark grayish brown to grayish brown silty clay, prismatic and blocky structure to massive, very hard to extremely hard, pH 7.0 to 7.4.
Rooting Depth (in.) to Underlying Material	40 plus; alluvium, basalt	40 plus; alluvium, basalt
Erosion Factor (K)	.37	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Slow	Very slow
Drainage Class	Well drained	Moderately well drained
Soil Manageability Class Group	2e II	2ew
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	13	24, 26
Water Runoff Potential	Slow	Very Slow
Watershed Sensitivity	6 (Moderate)	6
Hydrologic Soil Group	C	D
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 3.0 inches	Moderate to High 2.6 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	5 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Loam Unified: CL AASHTO: A-4, A-6 4-17; Silty clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 17-42; Silty clay, clay Unified: CH AASHTO: A-7 42-60; Loam, sandy loam, loamy sand Unified: ML,ML-CL,CL, SM AASHTO: A-4, A-6, A-2-4	0-60; Silty clay Unified: CH AASHTO: A-7
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Barnard, Supan, Los Gatos, Cardon, Bieber, and Keating families.	

191 KEATING-DEVEN FAMILIES ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	Keating family (45 percent)	Deven family (35 percent)
Position, Slope, and Elevation	On smooth sideslopes of mountain uplands; 1 to 20 percent slopes; 4400 to 6000 feet.	On upper sideslopes and knolls of mountain uplands; 5 to 20 percent slopes; 4400 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Big sagebrush, western juniper, bitter- brush, mountain mahogany, rabbitbrush, grasses; 14 to 18 inches ppt.	Western juniper, low sagebrush, Phlox spp., cheatgrass, other grasses; 14 to 18 inches ppt.
Surface Layer	0 to 2 inches; dark grayish brown cobbly clay loam, granular structure, hard, pH 6.8.	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt, tuff	10 to 20; basalt, tuff
Erosion Factor (K)	.32	.37
Max. Erosion Hazard	Low to moderate	Moderate
Soil Permeability	Slow	Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2e	2edx
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	18	8, 23
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	6 (Moderate)	5
Hydrologic Soil Group	C	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate	Very Low to Low
	2.7 inches	1.4 to 2.8 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Cobbly clay loam, clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 6-32; Clay Unified: CH AASHTO: A-7 32+; Unweathered bedrock	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Pass Canyon, Aikman, Ruckles, Bieber, Roval, Gwin, Puls and Los gatos families and Rock outcrop.	

192 KEATING-DEVEN FAMILIES ASSOCIATION, 20 to 40 percent slopes

Map Unit Components	Keating family (45 percent)	Deven family (35 percent)
Position, Slope, and Elevation	On smooth sideslopes of mountain uplands; 20 to 35 percent slopes; 4400 to 6000 feet.	On upper sideslopes, ridges and knolls of mountain uplands, 20 to 40 percent slopes; 4400 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Big sagebrush, western juniper, mountain mahogany, rabbitbrush, grasses; 14 to 18 inches ppt.	Western juniper, low sagebrush, big sagebrush, Phlox spp., cheatgrass, other grasses; 14 to 18 inches ppt.
Surface Layer	0 to 2 inches; dark grayish brown cobbly clay loam, granular structure, hard, pH 6.8.	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt, tuff	10 to 20; basalt tuff
Erosion Factor (K)	.32	.37
Max. Erosion Hazard	Moderate	Moderate to high
Soil Permeability	Slow	Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2e	3Edx
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	18	8,23
Water Runoff Potential	Rapid	Rapid
Watershed Sensitivity	5 (Moderate)	4
Hydrologic Soil Group	C	D
Available Water Capacity (AWC)	Low to Moderate	Very Low to Low
Upper 20 inches	2.7 inches	1.4 to 2.8 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low to Moderate	Low to Moderate
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Cobbly clay loam, Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 6-32; Clay Unified: CH AASHTO: A-7 32+; Unweathered bedrock	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the Pass Canyon, Aikman, Bieber, Gwin, Ruckles, Roval and Los Gatos families and Rock outcrop.

193 KINZEL-LAPINE-DIVERS FAMILIES ASSOCIATION, 2 to 12 inch pumice overburden, 1 to 15 percent slopes

Map Unit Components	**Kinzel family (40 percent)**	**Lapine family, pumice overburden phase (25 percent)**	**Divers family, pumice overburden phase (20 percent)**
Position, Slope, and Elevation	On concave areas of the Medicine Lake Caldera and its proximity; 1 to 10 percent slopes; 6500 to 7200 feet.	On smooth areas of the Medicine Lake Caldera and it proximity; 1 to 10 percent slopes; 6500 to 7200 feet.	On sideslopes and knolls of the Medicine Lake Caldera and its proximity; 5 to 15 percent slopes; 6500 to 7200 feet.
Typical Vegetation and Precipitation (ppt)	Western white pine, lodgepole pine, rabbitbrush, lupine, mint., Ross's sedge, grasses; 35 to 45 inches ppt.	Red fir forest, or mixed conifer forest of red fir, western white pine, mint., snowberry, carex species; 35 to 45 inches ppt.	
Surface Layer	A thin 2 to 12 inch pumice overburden is present on most pedons, OVER 0 to 10 inches; dark grayish brown gravelly loamy sand to very cobbly sandy loam, single grain and subangular blocky structure, loose and soft, pH 5.5 to 6.0. *SUBSOIL: 10 to 30 inches; yellowish brown to pale brown extremely stony sandy loam, subangular blocky structure, soft, pH 6.5.	1 to 0 inches; red fir needles and twigs, over 23 inches of pumice overburden consisting of grayish brown very gravelly coarse sand to a pale brown extremely gravelly coarse sand: (Thickness in this unit ranges from 2 to 12 inches.) OVER 23 to 26 inches; yellowish brown very gravelly sandy loam, granular structure, loose, pH 6.0.	15 inches of pumice overburden consisting of light brownish gray gravelly sandy loam grading to a white very gravelly sand texture (Thickness ranges from 2 to 12 inches) OVER 15 to 26 inches; brown very gravelly loamy sand with extremely cobbly sandy loam, platy and granular structure, soft, pH 5.2. *SUBSOIL: 26 to 60 inches; yellowish brown extremely cobbly sandy loam, subangular blocky structure, soft, pH 5.4 to 5.8.
Substratum	30 to 41 plus inches; light yellowish gray weakly cemented volcanic ash that rubs to a sandy loam texture, massive, very hard.	26 to 60 inches; brownish yellow extremely stony sandy loam, extremely gravelly sandy loam and extremely gravelly loamy coarse sand, massive and single grained, soft to loose pH 6.2 to 6.6.	
Rooting Depth (in.) to Underlying Material	20 to 40; volcanic ash, hard basalt	30 plus; cinders, basalt, andesite	30 plus; basalt, andesite
Erosion Factor (K)	.17	.20	.17
Max. Erosion Hazard	Low to moderate	Low	Low to moderate
Soil Permeability	Moderately rapid	Rapid	Moderately rapid
Drainage Class	Well drained	Somewhat excessively drained	Somewhat excessively drained
Soil Manageability Class	2ep	1	2ep
Group	II		
Forest Site Class	6 (4-5)	5-6 (3-5)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very Slow	Very Slow	Very Slow
Watershed Sensitivity	7 (Low)	9	8
Hydrologic Soil Group	C	A	A
Available Water Capacity (AWC)	Low to Moderate	Moderate to High	Moderate
Upper 20 inches	2.2 inches	2.5 inches	2.6 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	3 tons/acre/year	3 tons/acre/year

Chance of Seedling Survival	Moderate	Moderate to High	Moderate to High
Rating for Timber Site	Fair (3,5,7)	Fair (5)	Fair (1,3,5)
R-Value	60+	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Gravelly sand Unified: SM AASHTO: A-1-b 6-30; Very cobbly sandy loam Unified: SM, SM-SC AASHTO: A-2-4 30+; Weathered bedrock	0-2; Very gravelly coarse sand Unified: SW-SM AASHTO: A-1-a 2-23; Extremely gravelly coarse sand Unified: GP AASHTO: A-1-a 23-50; Very gravelly sandy loam, extremely stony sandy loam extremely gravelly sandy loam	0-4; Gravelly sandy loam Unified: SM AASHTO: A-1-b 4-15; Very gravelly sand Unified: SW-SM, SM AASHTO: A-1-a, A-1-b 15-60; Gravelly loamy sand, extremely cobbly sandy loam Unified: SM AASHTO: A-1-b

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage are the Wuksi family, Rock outcrop and obsidian and lava flow rock.

194 LAMONDI-SMARTS deep FAMILIES COMPLEX, 2 to 20 percent slopes

Map Unit Components	Lamondi family (55 percent)	Smarts family, deep (25 percent)
Position, Slope, and Elevation	On smooth sideslops of mountain uplands; 2 to 20 percent slopes; 5500 to 7500 feet.	On smooth sideslopes and concave areas of mountain uplands; 2 to 20 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus snowberry, serviceberry, Ribes spp., Ross's sedge, few grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus snowberry, serviceberry, Ribes spp., Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	4 to 0 inches of decomposed and undecomposed white fir needles and twigs, over 0 to 26 inches; brown gravelly loam to very gravelly loam, granular and blocky structure; soft, pH 6.2 to 6.4.	2 to 0 inches of decompossed and undecomposed white fir needles and twigs, over 0 to 18 inches; brown stony loam, granular structure, soft, pH 6.2.
Substratum		32 to 50 inches; pale brown extremely gravelly loam, massive, soft, pH 6.0.
Rooting Depth (in.) to Underlying Material	40 plus; andesite, tuff	40 plus; basalt, tuff
Erosion Factor (K)	.32	.32
Max. Erosion Hazard	Low to moderate	Low to moderate
Soil Permeability	Moderate	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	2e II	2ep
Forest Site Class	4-5 (2-4)	4 (2-3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very slow	Slow
Watershed Sensitivity	8 (Low)	8
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.7 inches	Moderate 2.6 inches
Susceptibility to Burning Damage	Low to Moderate	Low to Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate to High	Moderate
Rating for Timber Site	Good	Fair (1)
R-Value	30-60, 60+	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-26; Gravelly loam, very gravelly loam Unified: SM, SM-SC AASHTO: A-4 26-42; Extremely gravelly loam Unified: GM, GM-GC AASHTO: A-1-b, A-2-4 42+; Weathered bedrock	0-18; Stony loam Unified: ML-CL, CL AASHTO: A-4 18-50; Extremely gravelly clay loam, extremely gravelly loam Unified: SC AASHTO: A-2-6, A-6 50+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the DeMasters, Patio, Wapal, and Anatone families and unnamed soils similar to the Smarts family but not Pachic.	

195 LAMONDI-SMARTS deep FAMILIES COMPLEX, 20 to 40 percent slopes

Map Unit Components	Lamondi family (60 percent)	Smarts family, deep (25 percent)
Position, Slope, and Elevation	On smooth sideslopes of mountain uplands; 20 to 40 percent slopes; 5500 to 7500 feet.	On smooth sideslopes and concave areas of mountain uplands; 20 to 40 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus snowberry, serviceberry, Ribes spp., Ross's sedges, few grasses; 20 to 30 inches ppt.	White fir forest or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus snowberry, serviceberry, Ribes spp., Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	4 to 0 inches of decomposed and undecomposed white fir needles and twigs, over 0 to 26 inches; brown gravelly loam to very gravelly loam, granular and blocky structure; soft, pH 6.2 to 6.4	2 to 0 inches of decomposed and undecomposed white fir needles and twigs, over 0 to 18 inches; brown stony loam, granular structure, soft, pH 6.2
Substratum		32 to 50 inches; pale brown extremely gravelly loam, massive, soft, pH 6.0.
Rooting Depth (in.) to Underlying Material	40 plus; andesite, tuff	40 plus; basalt, tuff
Erosion Factor (K)	.32	.32
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderate	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2e	2ep
Group	II	
Forest Site Class	4-5 (2-4)	4 (2-3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	7 (Moderate)	7
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High	Moderate
	2.7 inches	2.6 inches
Susceptibility to Burning Damage	Moderate	Low to Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate to High	Moderate to High
Rating for Timber Site	Good	Fair (1)
R-Value	30-60, 60+	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-26; Gravelly loam, very gravelly loam Unified: SM, SM-SC AASHTO: A-4 26-42; Extremely gravelly loam Unified: GM, GM-GC AASHTO: A-1-b, A-2-4 42+; Weathered bedrock	0-18; Stony loam Unified: ML-CL, CL AASHTO: A-4 18-50; Extremely gravelly clay loam, extremely gravelly loam Unified: SC AASHTO: A-2-6, A-6 50+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the DeMasters, Patio, Wapal, and Anatone families, Rock outcrop and unnamed soils similar to DeMasters family but colder and not Pachic.	

196 LAMONDI-SMARTS deep FAMILIES COMPLEX, 40 to 60 percent slopes

Map Unit Components	Lamondi family (60 percent)	Smarts family, deep (20 percent)
Position, Slope, and Elevation	On smooth sideslopes of mountain uplands; 40 to 60 percent slopes; 5500 to 7500 feet.	On smooth sideslopes and concave areas of mountain uplands; 40 to 60 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus snowberry, serviceberry, Ribes spp., Ross's sedge, few grasses; 20 to 30 inches ppt.	White fir forest or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus snowberry, serviceberry, Ribes spp., Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	4 to 0 inches of decomposed and undecomposed white fir needles and twigs, over 0 to 26 inches; brown gravelly loam to very gravelly loam, granular and blocky structure; soft, pH 6.2 to 6.4	2 to 0 inches of decomposed and undecomposed white fir needles and twigs, over 0 to 18 inches; brown stony loam, granular structure, soft, pH 6.2
Substratum		32 to 50 inches; pale brown extremely gravelly loam, massive, soft, pH 6.0.
Rooting Depth (in.) to Underlying Material	40 plus; andesite, tuff	40 plus; basalt, tuff
Erosion Factor (K)	.32	.32
Max. Erosion Hazard	High	High
Soil Permeability	Moderate	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	3e III	3ep
Forest Site Class	4-5 (2-4)	4 (2-3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	6 (Moderate)	6
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.7 inches	Moderate 2.6 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	High	Moderate to High
Rating for Timber Site	Fair (8)	Fair (1,8)
R-Value	30-60, 60+	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-26; Gravelly loam, very gravelly loam Unified: SM, SM-SC AASHTO: A-4 26-42; Extremely gravelly loam Unified: GM, GM-GC AASHTO: A-1-b, A-2-4 42+; Weathered bedrock	0-18; Stony loam Unified: ML-CL, CL AASHTO: A-4 18-50; Extremely gravelly clay loam, extremely gravelly loam Unified: SC AASHTO: A-2-6, A-6 50+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the DeMasters, Patio, Wapal, Anatone families, Lithic Xerorthents, frigid, and Rock outcrop.	

197 LAPINE-DIVERS FAMILIES ASSOCIATION, 10 to 24 inch pumice overburden, 20 to 40 percent slopes

Map Unit Components	**Lapine family, pumice overburden phase (60 percent)**	**Divers family, pumice overburden phase (20 percent)**
Position, Slope, and Elevation	On smooth sideslopes of volcanic mountain uplands; 20 to 40 percent slopes; 7000 to to 7600 feet.	On upper sideslopes, ridges and knolls of volcanic mountain uplands, 20 to 40 percent slopes; 7000 to 7600 feet.
Typical Vegetation and Precipitation (ppt)	Red fir forest, or mixed conifer forest of red fir, mountain hemlock, western white pine, lodgepole pine, plus penstamen, mint.; 40 to 45 inches ppt.	Red fir forest, or mixed conifer forest of red fir, mountain hemlock, western white pine, lodgepole pine, plus chinqupine, prostrate manzanita, mint.; 40 to 45 inches ppt.
Surface Layer	1 to 0 inches; red fir needles and twigs, over 23 inches of pumice overburden consisting of grayish brown very gravelly coarse sand to a pale brown extremely gravelly coarse sand (Thickness in this unit ranges from 10 to 24 inches.) OVER 23 to 26 inches; yellowish brown very gravelly sandy loam, granular structure, loose, pH 6.0	15 inches of pumice overburden consisting of light brownish gray gravelly sandy loam grading to a white very gravelly sand texture (Thickness ranges from 10 to 24 inches) OVER 15 to 26 inches; brown very gravelly loamy sand and extremely cobbly sandy loam, platy and granular structure, soft, pH 5.2.
Substratum	26 to 60 inches; brownish yellow extremely stony sandy loam, extremely gravelly sandy loam and extremely gravelly loamy coarse sand, massive and single grained, soft to loose, pH 6.2 to 6.6	26 to 60 inches; yellowish brown extremely cobbly sandy loam, subangular blocky structure, soft, pH 5.4 to 5.8.
Rooting Depth (in.) to Underlying Material	40 plus; cinders, basalt	40 plus; basalt, andesite
Erosion Factor (K)	.20	.17
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Rapid	Rapid in the overburden over moderately rapid below
Drainage Class	Somewhat excessively drained	Somewhat excessively drained
Soil Manageability Class	2ep	2ep
Group	II	
Forest Site Class	5 (3-4)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	SLow
Watershed Sensitivity	8 (Low)	8
Hydrologic Soil Group	A	A
Available Water Capacity (AWC)	Moderate to High	Moderate
Upper 20 inches	2.5 inches	2.6 inches
Susceptibility to Burning Damage	Moderate to High	Moderate to High
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate to High	Moderate to High
Rating for Timber Site	Fair (5)	Fair 3,5)
R-Value	60+	60+

Soil horizons in inches, USDA, Unified, AASHTO

0-2; Very gravelly coarse sand
Unified: SW-SM
AASHTO: A-1-a

2-23; Extremely gravelly coarse sand
Unified: GP
AASHTO: A-1-a

23-50; Very gravelly sandy loam, extremely stony sandy loam, extremely gravelly sandy loam
Unified: SW-SM, SM
AASHTO: A-1-a, A-1-b

50-60; Extremely gravelly loamy coarse sand
Unified: GP, GW-GM
AASHTO: A-1-a

0-4; Gravelley sandy loam
Unified: SM
AASHTO: A-1-b

4-15; Very gravelly sand
Unified: SW-SM, SM
AASHTO: A-1-a, A-1-b

15-60; Gravelly loamy sand, extremely cobbly sandy loam
Unified: SM
AASHTO: A-1-b

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Wuksi and Kinzel families, and Rock outcrop.

198 LAPINE-DIVERS FAMILIES ASSOCIATION, 10 to 24 inch pumic overburden, 40 to 60 percent slopes

Map Unit Components	**Lapine family, pumice overburden phase (55 percent)**	**Divers family, pumice overburden phase (25 percent)**
Position, Slope, and Elevation	On smooth sideslopes of volcanic mountain uplands; 40 to 60 percent slopes; 6800 to to 7600 feet.	On upper sideslopes, ridges and knolls of volcanic mountain uplands, 40 to 60 percent slopes; 6800 to 7600 feet.
Typical Vegetation and Precipitation (ppt)	Red fir forest, or mixed conifer forest of red fir, mountain hemlock, western white pine, lodgepole pine, plus penstamen, mint.; 35 to 45 inches ppt.	Red fir forest, or mixed conifer forest of red fir, mountain hemlock, western white pine, lodgepole pine, plus chinqupine, prostrate manzanita, mint.; 35 to 45 inches ppt.
Surface Layer	1 to 0 inches; red fir needles and twigs, over 23 inches of pumice overburden consisting of grayish brown very gravelly coarse sand to a pale brown extremely gravelly coarse sand (Thickness in this unit ranges from 10 to 24 inches.) OVER 23 to 26 inches; yellowish brown very gravelly sandy loam, granular structure, loose, pH 6.0	15 inches of pumice overburden consisting of light brownish gray gravelly sandy loam grading to a white very gravelly sand texture (Thickness ranges from 10 to 24 inches) OVER 15 to 26 inches; brown very gravelly loamy sand and extremely cobbly sandy loam, platy and granular structure, soft, pH 5.2.
Substratum	26 to 60 inches; brownish yellow extremely stony sandy loam, extremely gravelly sandy loam and extremely gravelly loamy coarse sand, massive and single grained, soft to loose, pH 6.2 to 6.6	26 to 60 inches; yellowish brown extremely cobbly sandy loam, subangular blocky structure, soft, pH 5.4 to 5.8.
Rooting Depth (in.) to Underlying Material	40 plus; cinders, basalt	40 plus; basalt, andesite
Erosion Factor (K)	.20	.17
Max. Erosion Hazard	High	High
Soil Permeability	Rapid	Rapid in the overburden over moderately rapid below.
Drainage Class	Somewhat excessively drained	Somewhat excessively drained
Soil Manageability Class Group	3Ep III	3Ep
Forest Site Class	5 (3-4)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	7 (Moderate)	7
Hydrologic Soil Group	A	A
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.5 inches	Moderate 2.6 inches
Susceptibility to Burning Damage	High	High
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate to High	Moderate to High
Rating for Timber Site	Fair (5,8)	Fair (3,5,8)
R-Value	60+	60+

Soil horizons in inches, USDA, Unified, AASHTO

0-2; Very gravelly coarse sand
Unified: SW-SM
AASHTO: A-1-a

2-23; Extremely gravelly coarse sand
Unified: GP
AASHTO: A-1-a

23-50; Very gravelly sandy loam, extremely stony sandy loam, extremely gravelly sandy loam
Unified: SW-SM, SM
AASHTO: A-1-a, A-1-b

50-60; Extremely gravelly loamy coarse sand
Unified: GP, GW-GM
AASHTO: A-1-a

0-4; Gravelly sandy loam
Unified: SM
AASHTO: A-1-b

4-15; Very gravelly sand
Unified: SW-SM, SM
AASHTO: A-1-a, A-1-b

15-60; Gravelly loamy sand, extremely cobbly sandy loam
Unified: SM
AASHTO: A-1-b

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Wuksi and Kinzel families, and Rock outcrop.

199 LAPINE-WUKSI-DIVERS FAMILIES ASSOCIATION, 2 to 8 inch pumice overburden, 5 to 30 percent slopes

Map Unit Components	**Lapine family, pumice overburden phase (35 percent)**	**Wuksi family (30 percent)**	**Divers family, pumice overburden phase (20 percent)**
Position, Slope, and Elevation	On sideslopes on south end of the Medicine Lake Caldera; 5 to 15 percent slopes; 6600 to 7000 feet.	On the basalt/cinder contact zone on ridges and knolls on the south end of the Medicine Lake Caldera; 5 to 30 percent slopes; 6600 to 7000 feet.	On upper sideslopes and ridges on the south end of the Medicine Lake Caldera; 5 to 30 percent slopes; 6600 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	Red fir forest, or mixed conifer forest of red fir, western white pine, plus mint., prostrate manzanita; 40 to 45 inches ppt.	Western white pine, lodgepole pine, red fir, prostrate manzanita, penstament; 40 to 45 inches ppt.	
Surface Layer	1 to 0 inches; red fir needles and twigs, over 23 inches of pumice overburden consisting of grayish brown very gravelly coarse sand to a pale brown extremely gravelly coarse sand; (Thickness in this unit ranges from 2 to 8 inches.) OVER 23 to 26 inches; yellowish brown very gravelly sandy loam, granular structure loose, pH 6.0.	1 to 0 inches of western white pine and red fir needles and twigs, over 2 to 8 inches of light gray gravelly coarse sand composed of pumice (thickness ranges from 2 to 8 inches); OVER 8 to 18 inches; pale brown extremely gravelly loamy coarse sand, single grain, loose pH 6.2	15 inches of pumice overburden consisting of light brownish gray gravelly sandy loam grading to a white very gravelly sand texture (Thickness ranges from 2 to 8 inches OVER 15 to 26 inches; brown very gravelly loamy sand with extremely cobbly sandy loam, platy and granular structure, soft, pH 5.2.
Subsoil			26 to 60 inches; yellowish brown extremely cobbly sandy loam, subangular blocky structure, soft, pH 5.4 to 5.8.
Substratum	26 to 60 inches; brownish yellow extremely stony sandy loam, extemely gravelly sandy loam and extremely gravelly loamy coarse snad, massive and single grained, soft to loose; pH 6.2 to 6.6.	18 to 32 inches; yellowish brown extremely cobbly loamy coarse sand, single grain, loose, pH 6.0.	
Rooting Depth (in.) to Underlying Material	30 plus; cinders, basalt	20 to 40; cinders, scoriacious basalt	30 plus; basalt andesite
Erosion Factor (K)	.20	.17	.17
Max. Erosion Hazard	Low to Moderate	Low to Moderate	Low to Moderate
Soil Permeability	Rapid	Rapid	Moderately rapid
Drainage Class	Somewhat excessively drained	Somewhat excessively drained	Somewhat excessively drained
Soil Manageability Class	2ep	2ep	2ep
Group	II		
Forest Site Class	5-6 (3-5)	6 (5)	5 (3-4)
Range Site	Not placed in range site.	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very Slow	Very Slow	Very Slow
Watershed Sensitivity	8 (Low)	8	8
Hydrologic Soil Group	A	A	A
Available Water Capacity (AWC)	Moderate to High	Low	Moderate
Upper 20 inches	2.5 inches	1.8 inches	2.6 inches
Susceptibility to Burning Damage	Moderate	High	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	3 tons/acre/year	2 tons/acre/year	3 tons/acre/year

Chance of Seedling Survival	Moderate High	Low to Moderate	Moderate to High
Rating for Timber Site	Fair (5)	Poor (1,4,5,7)	Fair (1,3,5)
R-Value	60+	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Very gravelly coarse sand Unified: SW-SM AASHTO: A-1-a 2-23; Extremely gravelly coarse sand Unified: GP AASHTO: A-1-a 23-50; Very gravelly sandy loam, extremely stony sandy loam, extremely gravelly sandy loam Unified: SW-SM, SM AASHTO: A-1-a, A-1-b 50-60; Extremely gravelly loamy coarse sand Unified: GP, GW-GM AASHTO: A-1-a	0-8; Gravelly coarse sand Unified: SM AASHTO: A-1-a 8-32; Extremely gravelly loamy coarse sand, extremely cobbly loamy coarse sand Unified: SW-SM AASHTO: A-1-a 32+; Weathered bedrock	0-4; Gravelly sandy loam Unified: SM AASHTO: A-1-b 4-15; Very gravelly sand Unified: SW-SM, SM AASHTO: A-1-a, A-1-b 15-60; Gravelly loamy sand, extremely cobbly sandy loam Unified: SM AASHTO: A-1-b

Included Areas: Included with these soils in mapping and making up about 15 percent if the acreage is the Kinzel family and Rock outcrop.

200 LAWYER deep-LAWYER FAMILY COMPLEX, 1 to 20 percent slopes

Map Unit Components	Lawyer family, deep (50 percent)	Lawyer family (30 percent)
Position, Slope, and Elevation	On lower slopes of undulating basalt plateaus; 1 to 15 percent slopes; 4900 to 5800 feet.	On upper sideslopes and ridges of undulating basalt plateaus; 2 to 20 percent slopes; 4900 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, incense-cedar, greenleaf manzanita, squaw carpet, big sagebrush, Ross's sedge, few grasses; 18 to 25 inches ppt.	Ponderosa pine, western juniper, squaw carpet, mountain mahogany, greenleaf manza- nita, big sagebrush, few grasses; 18 to 25 inches ppt.
Surface Layer	1 to 0 inches of ponderosa pine needles and twigs, over 0 to 13 inches; dark reddish brown and reddish brown loam, granular and blocky structure, slightly hard, pH 6.2 and 6.0	2 to 0 inches of ponderosa pine needles and twigs, over 0 to 8 inches; dark brown stony loam, granular structure, soft, pH 6.2.
Rooting Depth (in.) to Underlying Material	40 plus; soft to hard basalt.	20 to 40; soft to hard basalt.
Erosion Factor (K)	.37	.37
Max. Erosion Hazard	Low	Low to Moderate
Soil Permeability	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	1 I	2e
Forest Site Class	5 (3-4)	6 (4-5)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very Slow	Slow
Watershed Sensitivity	8 (Low)	7
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 3.0 inches	Low to Moderate 2.6 inches
Susceptibility to Burning Damage	Low	Low to Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate	Low to Moderate
Rating for Timber Site	Good (10)	Fair (7,10)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-21; Loam, gravelly loam Unified: ML-CL, CL AASHTO: A-4, A-6 21-45; Extremely gravelly clay loam Unified: GC AASHTO: A-2-6, A-2-7 45+; Weathered bedrock	0-8; Stony loam Unified: SM, SM-SC, ML, ML-CL AASHTO: A-4 8-24; Cobbly clay loam, extremely cobbly clay loam Unified: SC AASHTO: A-6 24+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Deven, Elmore, Jacket, Hiibner and Pass Canyon families and Rock outcrop.	

201 LAWYER-ELMORE FAMILIES, deep ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	Lawyer family, deep (50 percent)	Elmore family, deep (40 percent)
Position, Slope, and Elevation	On upper sideslopes, ridges and knolls of undulating basalt plateaus and mountain uplands; 1 to 20 percent slopes; 4300 to 6000 feet.	On lower sideslopes, and concave areas of undulating basalt plateaus and mountain uplands; 1 to 20 percent slopes; 4300 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, few western juniper and incense-cedar, big sagebrush, bitterbrush, greenleaf manzanita, squaw carpet, Ross's sedge, grasses; 16 to 25 inches ppt.	Ponderosa pine, Jeffrey pine, incense-cedar, big sagebrush, bitterbrush, greenleaf, manza- nita, ceonothus, squaw carpet, Ross's sedge, grasses; 16 to 25 inches ppt.
Surface Layer	1 to 0 inches; undecomposed ponderosa pine needles and twigs, over 0 to 21 inches; brown to reddish brown stony loam cobbly loam and very cobbly loam, granular and blocky structure, soft to slightly hard, pH 6.0 to 6.2.	2 to 0 inches; decomposed and undecomposed ponderosa pine needles and twigs, over 0 to 13 inches; dark brown and reddish brown loam, granular structure, very friable, pH 6.4 to 6.6.
Rooting Depth (in.) to Underlying Material	40 plus; soft to hard basalt.	40 plus; soft to hard basalt.
Erosion Factor (K)	.32	.37
Max. Erosion Hazard	Low to moderate	Low to moderate
Soil Permeability	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2e	1
Group	II	
Forest Site Class	5 (3-4)	5 (2-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	8 (Low)	8
Hydrologic Soil Group	B	B
Available Water Capacity (AWC)	Moderate to High	High
Upper 20 inches	2.6 inches	3.4 inches
Susceptibility to Burning Damage	Low to Moderate	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Moderate to High
Rating for Timber Site	Fair (1,3,10)	Good (10)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-21; Stony loam, cobbly loam, very cobbly loam Unified: SM, SC, ML, CL AASHTO: A-4, A-6 21-50; Very cobbly clay loam, extremely cobbly clay loam Unified: SC, CL, MH AASHTO: A-6, A-7 50+; Weathered bedrock	0-13; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 13-48; Gravelly loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 48+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 10 percent of the acreage are the Jacket, Hiibner, Fordice, Gwin, Lamondi, SMarts deep, DeMasters deep, Pass Canyon families and unnamed soils similar to the Skalan family and Rock outcrop.

202 LAWYER-ELMORE FAMILIES, deep ASSOCIATION, 20 to 40 percent slopes

Map Unit Components	**Lawyer family, deep (55 percent)**	**Elmore family, deep (30 percent)**
Position, Slope, and Elevation	On upper sideslopes, ridges and knolls of mountain uplands; 20 to 40 percent slopes; 4600 to 6000 feet.	On sideslopes and concave acres of mountain uplands; 20 to 40 percent slopes; 4600 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, few western juniper and Incense-cedar, big sagebrush, bitterbrush, greenleaf manzanita, squaw carpet, Ross's sedge, grasses; 16 to 25 inches ppt.	Ponderosa pine, Jeffrey pine, incense-cedar, big sagebrush, bitterbrush, greenleaf manzanita, ceonothus, squaw carpet, Ross's sedge, grasses; 16 to 25 inches ppt.
Surface Layer	1 to 0 inches; undecomposed ponderosa pine needles and twigs, over 0 to 21 inches; brown to reddish brown stony loam cobbly loam and very cobbly loam, granular and blocky structure, soft to slightly hard, pH 6.0 to 6.2.	2 to 0 inches; decomposed and undecomposed ponderosa pine needles and twigs, over 0 to 13 inches; dark brown and reddish brown loam, granular structure, very friable, pH 6.4 to 6.6
Rooting Depth (in.) to Underlying Material	40 plus; soft to hard basalt.	40 plus; soft to hard basalt.
Erosion Factor (K)	.32	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	2e II	2e
Forest Site Class	5 (3-4)	5 (2-4)
Range Site	Not placed in a range site	Not placed in a range site.
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	7 (Moderate)	7
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.6 inches	High 3.4 inches
Susceptibility to Burning Damage	Moderate	Low to Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Moderate to High
Rating for Timber Site	Fair (1,3,10)	Good (10)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-21; Stony loam, cobbly loam, very cobbly loam Unified: SM, SC, ML, CL AASHTO: A-4, A-6 21-50; Very cobbly clay loam, extremely cobbly clay loam Unified: SC, CL, MH AASHTO: A-6, A-7 50+; Weathered bedrock	0-13; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 13-48; Gravelly loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 48+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Jacket, Hiibner, Fordice, Gwin, Lamondi, Smarts deep, DeMasters deep, Pass Canyon families and Rock outcrop.	

203 LAWYER-ELMORE FAMILIES, deep ASSOCIATION, 40 to 60 percent slopes

Map Unit Components	Lawyer family, deep (60 percent)	Elmore family, deep (25 percent)
Position, Slope, and Elevation	On sideslopes, ridges and knolls of mountain uplands; 40 to 60 percent slopes; 4600 to 6000 feet.	On lower sideslopes and concave acres of mountain uplands; 40 to 50 percent slopes; 4600 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, few western juniper and Incense-cedar, big sagebrush, bitterbrush, greenleaf manzanita, squaw carpet, Ross's sedge, grasses; 16 to 25 inches ppt.	Ponderosa pine, Jeffrey pine, incense-cedar, big sagebrush, bitterbrush, greenleaf manzanita, ceonothus, squaw carpet, Ross's sedge, grasses; 16 to 25 inches ppt.
Surface Layer	1 to 0 inches; undecomposed ponderosa pine needles and twigs, over 0 to 21 inches; brown to reddish brown stony loam cobbly loam and very cobbly loam, granular and blocky structure, soft to slightly hard, pH 6.0 to 6.2.	2 to 0 inches; decomposed and undecomposed ponderosa pine needles and twigs, over 0 to 13 inches; dark brown and reddish brown loam, granular structure, very friable, pH 6.4 to 6.6
Rooting Depth (in.) to Underlying Material	40 plus; soft to hard basalt.	40 plus; soft to hard basalt.
Erosion Factor (K)	.32	.37
Max. Erosion Hazard	High	High
Soil Permeability	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	3e III	3e
Forest Site Class	5 (3-4)	5 (2-4)
Range Site	Not placed in a range site	Not placed in a range site.
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	6 (Moderate)	7
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.6 inches	High 3.4 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Moderate to High
Rating for Timber Site	Fair (1,3,8,10)	Fair (8,10)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-21; Stony loam, cobbly loam, very cobbly loam Unified: SM, SC, ML, CL AASHTO: A-4, A-6 21-50; Very cobbly clay loam, extremely cobbly clay loam Unified: SC, CL, MH AASHTO: A-6, A-7 50+; Weathered bedrock	0-13; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 13-48; Gravelly loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 48+; Weathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Jacket, Hiibner, Fordice, Gwin, Lamondi, Smarts deep, DeMasters deep, Pass Canyon families and Rock outcrop.

204 LAWYER-ELMORE-GWIN FAMILIES ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	Lawyer family (35 percent)	Elmore family (30 Percent)	Gwin family (15 percent)
Position, Slope, and Elevation	On undulating basalt plateaus and sideslopes of mountain uplands; 1 to 20 percent slopes; 4300 to 6000 feet.	On undulating basalt plateaus and sideslopes of mountain uplands; 1 to 20 percent slopes; 4300 to 6000 feet.	On upper sideslopes, ridges and knolls of undulating basalt plateaus and mountain uplands; 5 to 20 percent slopes; 4300 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, western juniper, (few black oak in the south- western portion of the survey area) big sagebrush, mountain mahogany, bitterbrush, squaw carpet, mulesear, lupine, western yarrow, Ross's sedge, grasses; 16 to 20 inches ppt.	Ponderosa pine, Jeffry pine, western juniper, (few black oak in the south- western portion of the survey area) big sagebrush, bitterbrush, squaw carpet, gooseberry, chokecherry, lupine, mulesear, western yarrow, Ross's sedge, grasses; 16 to 20 inches ppt.	
Surface Layer	2 to 0 inches on ponderosa pine needles and twigs over 0 to 8 inches; dark brown stony loam, granular structure, soft, pH 6.2	1 to 0 inches of ponderosa pine needles and twigs, over 0 to 8 inches; brown loam, platy and granular structure, slightly hard, pH 6.0.	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure; slightly hard, pH 6.8.
Rooting Depth (in.) to Underlying Material	20 to 40 inches; soft to hard basalt, andesite	20 to 40 inches; soft to hard basalt, andesite, tuff	10 to 20 inches; basalt, andesite
Erosion Factor (K)	.32	.32	.37
Max. Erosion Hazard	Low to Moderate	Low to moderate	Moderate
Soil Permeability	Moderately slow	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2e II	2e	2edx
Forest Site Class	6 (4-5)	5-6 (3-5)	7 (non-commercial)
Range Site	Not placed in a range site	Not placed in a range site.	8
Water Runoff Potential	SLow	SLow	Moderate
Watershed Sensitivity	7 (Moderate)	8	6
Hydrologic Soil Group	B	B	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.6 inches	Low to Moderate 3.2 inches	Very Low to Low 1.0 to 2.0 inches
Susceptibility to Burning Damage	Low to Moderate	Low to Moderate	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Moderate	Not Rated
Rating for Timber Site	Fair (1,3,7,10)	Fair (7,10)	Not Rated
R-Value	30-60	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-8; Stony loam Unified: SM, SM-SC, ML, ML-CL AASHTO: A-4 8-24; Very cobbly clay loam, extremely cobbly clay loam Unified: SC AASHTO: A-6 24+; Weathered bedrock	0-8; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 8-27; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 27+; Unweathered bedrock	0-11; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 11-18; Extremely cobbly clay loam Unified: SC, CL AASHTO: A-6 18+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Elmore and Lawyer families deeper than 40 inches, Deven, Pass Canyon, Packwood, Bieber, DeMasters, Smarts, Jacket and Fordice families and Rock outcrop.

205 LAWYER-ELMORE-GWIN FAMILIES ASSOCIATION, 20 to 40 percent slopes

Map Unit Components	**Lawyer family (40 percent)**	**Elmore family (25 Percent)**	**Gwin family (15 percent)**
Position, Slope, and Elevation	On sideslopes and slightly convex areas of mountain uplands; 20 to 40 percent slopes; 4300 to 6000 feet.	On sideslopes and concave areas of mountain uplands; 20 to 40 percent slopes; 4600 to 6000 feet.	On upper sideslopes, ridges and knolls of mountain uplands; 20 to 40 percent slopes; 4600 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, western juniper, (few black oak in the south- western portion of the survey area) big sagebrush, mountain mahogany, bitterbrush, squaw carpet, mulesear, lupine, western yarrow, Ross's sedge, grasses; 16 to 20 inches ppt.	Ponderosa pine, Jeffry pine, western juniper, (few black oak in the south- western portion of the survey area) big sagebrush, bitterbrush, squaw carpet, gooseberry, chokecherry, lupine, mulesear, western yarrow, Ross's sedge, grasses; 16 to 20 inches ppt.	
Surface Layer	2 to 0 inches on ponderosa pine needles and twigs over 0 to 8 inches; dark brown stony loam, granular structure, soft, pH 6.2	1 to 0 inches of ponderosa pine needles and twigs, over 0 to 8 inches; brown loam, platy and granular structure, slightly hard, pH 6.0.	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure; slightly hard, pH 6.8.
Rooting Depth (in.) to Underlying Material	20 to 40 inches; soft to hard basalt, andesite	20 to 40 inches; soft to hard basalt, andesite, tuff	10 to 20 inches; basalt, andesite
Erosion Factor (K)	.32	.32	.37
Max. Erosion Hazard	Moderate	Moderate	Moderate to high
Soil Permeability	Moderately slow	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	 2e II	 2e	 3Edx
Forest Site Class	6 (4-5)	5-6 (3-5)	7 (non-commercial)
Range Site	Not placed in a range site	Not placed in a range site.	8
Water Runoff Potential	Slow	Slow	Rapid
Watershed Sensitivity	7 (Moderate)	7	5
Hydrologic Soil Group	B	B	D
Available Water Capacity (AWC) Upper 20 inches	 2.6 inches	 3.2 inches	 1.0 to 2.0 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Moderate	Not Rated
Rating for Timber Site	Fair (1,3,7,10)	Fair (7,10)	Not Rated
R-Value	30-60	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-8; Stony loam Unified: SM, SM-SC, ML, ML-CL AASHTO: A-4 8-24; Very cobbly clay loam, extremely cobbly clay loam Unified: SC AASHTO: A-6 24+; Weathered bedrock	0-8; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 8-27; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 27+; Unweathered bedrock	0-11; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 11-18; Extremely cobbly clay loam Unified: SC, CL AASHTO: A-6 18+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Elmore and Lawyer families deeper than 40 inches, Deven, Pass Canyon, Packwood, Bieber, DeMasters, Smarts, Jacket and Fordice families and Rock outcrop.

206 LAWYER-ELMORE-GWIN FAMILIES ASSOCIATION, 40 to 60 percent slopes

Map Unit Components	**Lawyer family (50 percent)**	**Elmore family (15 Percent)**	**Gwin family (15 percent)**
Position, Slope, and Elevation	On sideslopes and slightly convex areas of mountain uplands; 40 to 60 percent slopes; 4300 to 6000 feet.	On sideslopes and concave areas of mountain uplands; 40 to 50 percent slopes; 4600 to 6000 feet.	On upper sideslopes, ridges and knolls of mountain uplands; 40 to 60 percent slopes; 4600 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, Jeffrey pine, western juniper, (few black oak in the south- western portion of the survey area) big sagebrush, mountain mahogany, bitterbrush, squaw carpet, mulesear, lupine, western yarrow, Ross's sedge, grasses; 16 to 20 inches ppt.	Ponderosa pine, Jeffery pine, western juniper, (few black oak in the south- western portion of the survey area) big sagebrush, bitterbrush, squaw carpet, gooseberry, chokecherry, lupine, mulesear, western yarrow, Ross's sedge, grasses; 16 to 20 inches ppt.	
Surface Layer	2 to 0 inches on ponderosa pine needles and twigs over 0 to 8 inches; dark brown stony loam, granular structure, soft, pH 6.2	1 to 0 inches of ponderosa pine needles and twigs, over 0 to 8 inches; brown loam, platy and granular structure, slightly hard, pH 6.0.	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure; slightly hard, pH 6.8.
Rooting Depth (in.) to Underlying Material	20 to 40 inches; soft to hard basalt, andesite	20 to 40 inches; soft to hard basalt, andesite, tuff	10 to 20 inches; basalt, andesite
Erosion Factor (K)	.32	.32	.37
Max. Erosion Hazard	High	High	High to very high
Soil Permeability	Moderately slow	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	3e III	3e	3Edx
Forest Site Class	6 (4-5)	5-6 (3-5)	7 (non-commercial)
Range Site	Not placed in a range site	Not placed in a range site.	8
Water Runoff Potential	Moderate	Moderate	Very Rapid
Watershed Sensitivity	6 (Moderate)	6	4
Hydrologic Soil Group	B	B	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.6 inches	Low to Moderate 3.2 inches	Very Low to Low 1.0 to 2.0 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Moderate	Not Rated
Rating for Timber Site	Fair (1,3,7,8,10)	Fair (7,8,10)	Not Rated
R-Value	30-60	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-8; Stony loam Unified: SM, SM-SC, ML, ML-CL AASHTO: A-4 8-24; Very cobbly clay loam, extremely cobbly clay loam Unified: SC AASHTO: A-6 24+; Weathered bedrock	0-8; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 8-27; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 27+; Unweathered bedrock	0-11; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 11-18; Extremely cobbly clay loam Unified: SC, CL AASHTO: A-6 18+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Elmore and Lawyer families deeper than 40 inches, Deven, Pass Canyon, Packwood, Bieber, DeMasters, Smarts, Jacket and Fordice families and Rock outcrop.

207 LITHIC CRYOCHREPTS-CHEADLE FAMILY ASSOCIATION, 10 to 40 percent slopes

Map Unit Components	Lithic Cryochrepts (45 percent)	Cheadle family (35 percent)
Position, Slope, and Elevation	On smooth sideslopes and concave areas of mountain uplands; 10 to 40 percent slopes; 7300 to 8000 feet.	On upper sideslopes, ridges and knolls of mountain uplands; 15 to 40 percent slopes; 7300 to 8000 feet.
Typical Vegetation and Precipitation (ppt)	Low sagebrush, big sagebrush, lupine, Phlox spp., buckwheat, Idaho fescue, other grasses; 30 to 35 inches ppt.	Few white bark pine and lodgepole pine, low sagebrush, Phlox spp., mountain mahogany, Idaho fescue, other grasses; 30 to 35 inches ppt.
Surface Layer	0 to 2 inches; grayish brown extremely gravelly clay; blocky and granular structure, hard, pH 7.0	0 to 17 inches; dark grayish browth to brown very cobbly loam to very cobbly clay loam; granular and subangular blocky structure, slightly hard to hard, pH 6.6.
Rooting Depth (in.) to Underlying Material	6 to 20; tuff, andesite, basalt	10 to 20; andesite tuff.
Erosion Factor (K)	Variable	.37
Max. Erosion Hazard	Moderate to high	Moderate to high
Soil Permeability	Slow	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class	3Ed	3Ed
Group	III	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	9, 1	9
Water Runoff Potential	Rapid	Rapid
Watershed Sensitivity	3 (High)	4
Hydrologic Soil Group	D	D
Available Water Capacity (AWC)	Very low to Low	Very Low to Low
Upper 20 inches	0.6 to 2.0 inches	1.2 to 2.4 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low to Moderate	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	Not Rated	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-16; Variable Unified: Not Rated AASHTO: Not Rated 16+; Unweathered bedrock	0-12; Very cobbly loam Unified: SM-SC, SC AASHTO: A-4, A-6 12-17; Very cobbly clay loam Unified: SC AASHTO: A-6, A-7 17+; Unweathered bedrock

Included Areas: Included with these soils is mapping and making up about 20 percent of the acreage are the Friana, Duncom, Behanin and Gallatin families, Rock outcrop and areas of greater slopes.

208 LITHIC XERORTHENTS, MESIC-DEVEN FAMILY COMPLEX, 1 to 15 percent slopes

Map Unit Components	**Litchic Xerorthents, mesic (45 percent)**	**Deven family (35 percent)**
Position, Slope, and Elevation	On upper sideslopes and convex areas of mountain uplands and basalt plateaus; 1 to 15 percent slopes; 4300 to 5200 feet	On upper sideslopes and convex areas of mountain uplands and basalt plateaus; 1 to 15 percent slopes; 4300 to 5200 feet
Typical Vegetation and Precipitation (ppt)	Few western juniper, low sagebrush, Phlox spp., buckwheat, cheatgrass; 14 to 16 inches ppt.	Western juniper, low sagebrush, big sage- brush, rabbitbrush, Idaho fescue, bottle- brush, cheatgrass; 14 to 16 inches ppt.
Surface Layer	0 to 5 inches; brown and yellowish brown very cobbly loam and gravelly loam; platy and granular struc- ture; slightly hard; pH 6.6 to 6.8.	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3
Rooting Depth (in.) to Underlying Material	4 to 10; basalt, tuff.	10 to 20; basalt, soft to hard tuff.
Erosion Factor (K)	Variable	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderate	Moderate
Drainage Class	Somewhat excessively drained.	Well drained
Soil Manageability Class	3eDx	2edX
Group	III	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	1	8
Water Runoff Potential	Rapid	Moderate
Watershed Sensitivity	4 (High)	5
Hydrologic Soil Group	D	D
Available Water Capacity (AWC)	Very Low	Very Low to Low
Upper 20 inches	0.6 to 1.5 inches	1.4 to 2.8 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	Not Rated	Not Rated
Soil horizons in inches, USDA, Unified, AASHTO	0-5; Variable Unified: Not Rated AASHTO: Not Rated 5+; Unweathered bedrock	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the Pass Canyon, Gwin, Stukel, Bakeoven, Dishner families and Rock outcrop.

209 LITHIC XERORTHENTS, MESIC-LAVA FLOW COMPLEX, 1 to 20 percent slopes

Map Unit Components	**Lithic Xerorthents, mesic (45 percent)**	**Lava flow (30 percent)**
Position, Slope, and Elevation	In depressions between hummocky lava flow rock; 1 to 10 percent slopes; 4200 to 5000 feet.	Hummocky lava flow rock in an interlocking maze; 5 to 20 percent slopes; 4200 to 5000 feet.
Typical Vegetation and Precipitation (ppt)	Mountain mahogany, western juniper, bitterbrush, big sagebrush, rabbitbrush, grasses; 10 to 14 inches ppt.	Mostly barren with mountain mahogany and western juniper in some fractures; 10 to 14 inches ppt.
Surface Layer	0 to 15 inches; brown and yellowish brown very gravelly sandy loam and very gravelly coarse sandy loam; loose and granular structure; soft; pH 6.6 to 6.8.	NOT APPLICABLE; Fractured vesicular basalt flow rock with minor accumulations of aeolian soil deposition in some fractures
Rooting Depth (in.) to Underlying Material	10 to 20; basalt	
Erosion Factor (K)	Variable	
Max. Erosion Hazard	Moderate	
Soil Permeability	Moderately rapid	
Drainage Class	Somewhat excessively drained	
Soil Manageability Class Group	 3edX III	
Forest Site Class	7 (non-commercial)	
Range Site	7	
Water Runoff Potential	Slow	Moderate
Watershed Sensitivity	7 (Moderate)	4
Hydrologic Soil Group	D	
Available Water Capacity (AWC) Upper 20 inches	Low 1.5 to 2.5 inches	
Susceptibility to Burning Damage	Low	
Slope Stability Hazard	Low	
Allowable Soil Loss	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	
Rating for Timber Site	Not Rated	
R-Value	Not Rated	
Soil horizons in inches, USDA, Unified, AASHTO	0-15; Variable Unified: Not Rated AASHTO: Not Rated 15+; Unweathered bedrock	

Included Areas:

Included with this unit in mapping and making up about 25 percent of the acreage are the Searles, Stukel, Bakeoven, Alcot and Neer families and lava flow rock with steeper slopes.

210 LITHIC XERORTHENTS, MESIC-XEROFLUVENTS, MESIC-AQUOLLS ASSOCIATION, 0 to 20 percent slopes

Map Unit Components	**Lithic Xerorthents, mesic (35 percent)**	**Xerofluvents, mesic (20 percent)**	**Aquolls (20 percent)**
Position, Slope, and Elevation	On sideslopes of narrow incised drainages and ridge crests adjacent to drainages; 1 to 20 percent slopes; 4300 to 5500 feet.	On lower sideslopes of alluvial drainages (subject to spring flooding); 1 to 10 percent slopes; 4300 to 5500 feet.	On concave areas of alluvial drainages (subject to flooding); 0 to 2 percent slopes; 4300 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, buckwheat, cheatgrass, other grasses; 14 to 18 inches ppt.	Western juniper, low sagebrush, big sagebrush, rabbitbrush, grasses; 14 to 18 inches ppt.	
Surface Layer	0 to 5 inches; brown and yellowish brown very cobbly loam and gravelly loam; platy and granular structure; slightly hard; pH 6.6 to 6.8.	0 to 37 inches; dark gray, grayish brown and light brownish gray silty clay loam, sandy loam, coarse sandy loam and loam; prismatic, blocky and massive structure; soft, slightly hard and hard; pH 6.8 to 8.0.	0 to 4 inches; dark grayish brown silty clay loam, granular structure, hard, pH 6.6. *SUBSOIL: 4 to 26 inches; dark grayish brown and grayish brown clay with yellowish brown mottles in lower part, prismatic and blocky structure, very hard, pH 6.8 to 7.0.
Substratum		37 to 60 inches; very pale brown sandy loam, platy structure, slightly hard, pH 7.4.	26 to 60 inches; gray and dark gray clay and stratified gravelly clay and very gravelly clay loam, massive, hard and very hard, pH 6.4 to 6.6.
Rooting Depth (in.) to Underlying Material	4 to 10; basalt	20 plus; alluvium, basalt	40 plus; alluvium, basalt
Erosion Factor (K)	Variable	Variable	Variable
Max. Erosion Hazard	Moderate to high	Moderate	Moderate
Soil Permeability	Moderate	Slow	Variable
Drainage Class	Somewhat excessively drained	Well drained	Poorly drained
Soil Manageability Class Group	 3EDX III	 2e	 3eW
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	1	18, 13	25
Water Runoff Potential	Rapid	Slow	Very Slow
Watershed Sensitivity	3 (Moderate)	6	7
Hydrologic Soil Group	D	C	D
Available Water Capacity (AWC) Upper 20 inches	 0.6 to 1.5 inches	 2.8 inches	 3.0 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	2, 3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	Not Rated	Not Rated	Not Rated
Soil horizons in inches, USDA, Unified, AASHTO	0-5; Variable Unified: Not Rated AASHTO: Not Rated 5+; Unweathered bedrock	0-60; Variable Unified: Not Rated AASHTO: Not Rated	0-60; Variable Unified: Not Rated AASHTO: Not Rated

Included Areas:

Included with these soils in mapping and making up about 25 percent of the acreage are the Pass Canyon, Gwin, Roval, Bieber, Deven and Fordice families, unnamed fluvaquents, Rock outcrop, Rubble land and areas with steeper slopes.

211 LOBERG-FRIANA-CHEADLE FAMILIES ASSOCIATION, 30 to 65 percent slopes

Map Unit Components	Loberg famiy (40 percent)	Friana family (25 percent)	Cheadle family (20 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 30 to 60 percent slopes; 7000 to 8000 feet.	On lower sideslopes and toeslopes of mountain uplands; 30 to 60 percent slopes; 7000 to 8000 feet.	On upper sideslopes, ridges and knolls of mountain uplands; 35 to 65 percent slopes; 7000 to 8000 feet.
Typical Vegetation and Precipitation (ppt)	Lodgepole pine, white fir, western white pine, prostrate manzanita, few forbes, few grasses; 25 to 30 inches ppt.	Lodgepole pine, white fir, big sagebrush, lupine, ceonothus, bottlebrush, needlegrass; 25 to 30 inches ppt.	
Surface Layer	2 to 0 inches of lodgepole pine needles and twigs, over 0 to 15 inches; brown and light brown gravelly loam to very gravelly loam, granular and blocky structure, slightly hard, pH 5.8 to 6.0.	1/2 to 0 inches of lodgepole pine and white fir needles, over 0 to 11 inches; dark grayish brown silty clay loam, granular and blocky structure, slightly hard and hard, pH 6.2 to 6.4.	0 to 17 inches; dark grayish brown to brown very cobbly loam to very cobbly clay loam; granular and subangular blocky structure, slightly hard to hard; pH 6.6.
Substratum	37 to 60 inches; weathering in place semi-soft light brown tuff conglomerate which rubs to a clay loam.		
Rooting Depth (in.) to Underlying Material	20 to 40; tuff	30 plus; tuff	10 to 20; andesite, tuff
Erosion Factor (K)	.43	.37	.37
Max. Erosion Hazard	High	High	High to very high
Soil Permeability	Slow	Slow	Moderate
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	 3S III	 3S	 3Ed
Forest Site Class	6(5)	6 (4-5)	7 (non-commercial)
Range Site	Not placed in a range site.	Not placed in a range site.	9
Water Runoff Potential	Rapid	Rapid	Very Rapid
Watershed Sensitivity	3 (High)	3	3
Hydrologic Soil Group	C	C	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.6 inches	Moderate to High 3.0 inches	Very Low to Low 1.2 to 2.4 inches
Susceptibility to Burning Damage	High	moderate	Moderate
Slope Stability Hazard	Moderate to high	Moderate to High	Low
Allowable Soil Loss	2 tons/acre/year	2, 3 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Moderate	High	Not Rated
Rating for Timber Site	Fair (12)	Fair (12)	Not Rated
R-Value	0-30	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-15; Gravelly loam, very gravelly loam Unified: SC, CL AASHTO: A-6 15-37; Very gravelly clay loam Unified: SC, CH AASHTO: A-7 37+; Weathered bedrock	0-11; Silty clay loam Unified: CL, CH AASHTO: A-6, A-7 11-38; Silty clay Unified: CH AASHTO: A-7 38-53; Very gravelly silty clay loam Unified: GC, CH AASHTO: A-7 53+; Weathered bedrock	0-12; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4, A_6 12-17; Very cobbly clay loam Unified: SC AASHTO: A-6, A-7 17+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Supervisor, Behanin, Gralic families, Lithic Cryochrepts, Rock outcrop, and Rubble land.

212 MANILA-MERLIN-MASCAMP FAMILIES ASSOCIATION, 10 to 35 percent slopes

Map Unit Components	Manila family (40 percent)	Merlin family (25 percent)	Mascamp family (20 percent)
Position, Slope, and Elevation	On sideslopes, toeslopes and draws of mountain uplands; 10 to 35 percent slopes; 5500 to 7000 feet.	On middle to upper sideslopes of mountain uplands; 10 to 35 percent slopes; 5500 to 7000 feet.	On upper sideslopes, ridges and knolls of mountain uplands; 15 to 35 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few white fir and ponderosa pine, big sagebrush, current spp., mulesear, Idaho fescue; 20 to 25 inches ppt.	western juniper, low sagebrush, big sagebrush, western yarrow, Phlox spp., Idaho fescue, other grasses; 20 to 25 inches ppt.	
Surface Layer	0 to 4 inches; dark grayish brown cobbly clay loam, platy and granular structure, slightly hard, pH 6.6.	0 to 2 inches; grayish brown very cobbly clay loam, granular structure, slightly hard, pH 6.4.	0 to 6 inches; dark grayish brown very cobbly loam, granular structure, slightly hard, pH 6.8.
Substratum	27 plus inches; weathering in place light brownish gray semi-soft tuff conglomerate which rubs to a clay loam.		
Rooting Depth (in.) to Underlying Material	20 to 40; conglomerated tuff	10 to 20; conglomerated tuff	8 to 20; andesite, conglomerated tuff, basalt
Erosion Factor (K)	.32	.32	.37
Max. Erosion Hazard	Moderate	Moderate to High	Moderate to high
Soil Permeability	Slow	Slow	Moderate
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2s II	3Ed	3Ed
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	19	9	9, 1
Water Runoff Potential	Moderate	Rapid	Rapid
Watershed Sensitivity	5 (High)	3	4
Hydrologic Soil Group	C	D	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.7 inches	Very Low to Low 1.1 to 2.3 inches	Very Low to Low 1.0 to 1.9 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low to Moderate	Low to Moderate	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-13; Cobbly clay loam, clay loam Unified: CL, CH AASHTO: A-6, A-7 13-27; Silty clay, gravelly silty clay Unified: CH AASHTO: A-7 27+; Weathered bedrock	0-2; Very cobbly clay loam Unified: SC, CL AASHTO: A-6 2-12; Gravelly clay Unified: CH AASHTO: A-7 12+; Unweathered bedrock	0-12; Very cobbly loam, very gravelly loam Unified: SM-SC, SC AASHTO: A-4 12-19; Very gravelly clay loam Unified: SC AASHTO: A-2-6, A-6 19+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Bertag, Smarts, DeMasters, Vipont, Los Gatos, Ridd, Bearskin, and Anatone families and Rock outcrop.		

213 MANILA-MERLIN-MASCAMP FAMILIES ASSOCIATION, 35 to 60 percent slopes

Map Unit Components	**Manila family (40 percent)**	**Merlin family (25 percent)**	**Mascamp family (20 percent)**
Position, Slope, and Elevation	On sideslopes, toeslopes and draws of mountain uplands; 35 to 50 percent slopes; 5500 to 7000 feet.	On middle to upper sideslopes of mountain uplands; 35 to 60 percent slopes; 5500 to 7000 feet.	On upper sideslopes, ridges and knolls of mountain uplands; 35 to 60 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few white fir and ponderosa pine, big sagebrush, current spp., mulesear, Idaho fescue; 20 to 25 inches ppt.	Western juniper, low sagebrush, big sagebrush, western yarrow, Phlox spp., Idaho fescue, other grasses; 20 to 25 inches ppt.	
Surface Layer	0 to 4 inches; dark grayish brown cobbly clay loam, platy and granular structure, slightly hard, pH 6.6.	0 to 2 inches; grayish brown very cobbly clay loam, granular structure, slightly hard, pH 6.4	0 to 6 inches; dark grayish brown very cobbly loam, granular structure, slightly hard, pH 6.8.
Substratum	27 plus inches; weathering in place light brownish gray semi-soft tuff conflomerate which rubs to a clay loam.		
Rooting Depth (in.) to Underlying Material	20 to 40; conglomerated tuff	10 to 20; conglomerated tuff	8 to 20; andesite, conglomerated tuff, basalt
Erosion Factor (K)	.32	.32	.37
Max. Erosion Hazard	High	High to very high	High to very high
Soil Permeability	Slow	Slow	Moderate
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	3S III	3Sd	3Ed
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	19	9	9, 1
Water Runoff Potential	Rapid	Very Rapid	Rapid
Watershed Sensitivity	3 (High)	2	4
Hydrologic Soil Group	C	D	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.7 inches	Very Low to Low 1.1 to 2.3 inches	Very Low to Low 1.0 to 1.9 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	High	High	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	0-30	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-13; Cobbly clay loam, clay loam Unified: CL, CH AASHTO: A-6, A-7 13-27; Silty clay, gravelly silty clay Unified: CH AASHTO: A-7 27+; Weathered bedrock	0-2; Very cobbly clay loam Unified: SC, CL AASHTO: A-6 2-12; Gravelly clay Unified: CH AASHTO: A-7 12+; Unweathered bedrock	0-12; Very cobbly loam, very gravelly loam Unified: SM-SC, SC AASHTO: A-4 12-19; Very gravelly clay loam Unified: SC AASHTO: A-2-6, A-6 19+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Bertag, Smarts, DeMasters, Vipont, Bearskin, and Anatone families and Rock outcrop.		

Map Unit Components	**Merlin family (75 percent)**
Position, Slope, and Elevation	On basalt plateaus; 1 to 10 percent slopes; 5800 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	Few western juniper, trace of ponderosa pine, low sagebrush, big sagebrush, buckwheat, Phlox spp., Idaho fescue, Poa spp., other grasses; 20 to 30 inches ppt.
Surface Layer	0 to 2 inches; grayish brown very cobbly clay loam, granular structure, slightly hard, pH 6.4.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt, tuff
Erosion Factor (K)	.32
Max. Erosion Hazard	Moderate
Soil Permeability	Slow
Drainage Class	Well drained
Soil Manageability Class Group	 2ed II
Forest Site Class	7 (non-commercial)
Range Site	9
Water Runoff Potential	Moderate
Watershed Sensitivity	4 (High)
Hydrologic Soil Group	D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.1 to 2.3 inches
Susceptibility to Burning Damage	Low
Slope Stability Hazard	Low
Allowable Soil Loss	1 tons/acre/year
Chance of Seedling Survival	Not Rated
Rating for Timber Site	Not Rated
R-Value	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Very cobbly clay loam Unified: SC, CL AASHTO: A-6 2-12; Gravelly clay Unified: CH AASHTO: A-7 12+; Unweathered bedrock
Included Areas:	Included with this soil in mapping and making up about 25 percent of the acreage are the Manila, Bearskin, Mascamp, Anatone, Smarts, and Bertag families and Lithic Xerorthents, frigid.

215 GRALIC-LOBERG FAMILIES-RUBBLE LAND ASSOCIATION, 35 to 80 percent slopes

Map Unit Components	Gralic family (35 percent)	Loberg family (30 percent)	Rubble land (20 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 35 to 65 percent slopes; 7000 to 8000 feet.	On sideslopes and toeslopes of mountain uplands; 35 to 60 percent slopes; 7000 to 8000 feet.	On scarp breaks and upper sideslopes of mountain uplands; 50 to 80 percent slopes; 7000 to 8000 feet.
Typical Vegetation and Precipitation (ppt)	Lodgepole pine, white fir, prostrate manzanita, current spp., princess pine, Ross's sedge, few grasses; 25 to 30 inches ppt.	Lodgepole pine, white fir, prostrate manzanita, current spp., princess pine, bottlebrush, needlegrass, Ross's sedge, Poa spp.; 25 to 30 inches ppt.	
Surface Layer	1 to 0 inches; lodgepole pine needles, over 0 to 17 inches; grayish brown to pale brown very gravelly fine sandy loam, granular structure, soft, pH 6.2.	2 to 0 inches of lodgepole pine needles and twigs, over 0 to 15 inches; brown and light brown gravelly loam to very gravelly loam, granular and blocky structure, slightly hard, pH 5.8 to 6.0.	NOT APPLICABLE: Colluvial deposition of angular cobbles, stones and boulders of basalt or andesite rock material.
Substratum	17 to 60 inches; light yellowish brown to very pale brown very gravelly sandy loam to very gravelly loamy sand, single grain and massive, loose and soft, pH 6.2 to 6.4.	37 to 60 inches; weathering in place semi-soft light brown tuff conflomerate which rubs to a clay loam.	
Rooting Depth (in.) to Underlying Material	30 plus; andesite	20 to 40; tuff	
Erosion Factor (K)	.24	.43	
Max. Erosion Hazard	High	High	
Soil Permeability	Moderately rapid	SLow	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	3Ep III	3S	
Forest Site Class	6-7 (5 to non-commercial)	6 (5)	
Range Site	Not placed in a range site.	Not placed in a range site.	
Water Runoff Potential	Moderate	Rapid	Very Rapid
Watershed Sensitivity	6 (High)	3	2
Hydrologic Soil Group	B	C	
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 1.8 inches	Low to Moderate 2.6 inches	
Susceptibility to Burning Damage	High	High	
Slope Stability Hazard	Low	High	
Allowable Soil Loss	2-3 tons/acre/year	2 tons/acre/year	
Chance of Seedling Survival	Low to Moderate	Moderate	
Rating for Timber Site	Fair (12)	Fair (12)	
R-Value	60+	0-30	

Soil horizons in inches, USDA, Unified, AASHTO

0-17; Very gravelly fine sandy loam
Unified: SM
AASHTO: A-2-4

17-60; Very gravelly sandy loam, very gravelly loamy sand
Unified: SM
AASHTO: A-1-b

0-15; Gravelly loam, very gravelly loam
Unified: SC, CL
AASHTO: A-6

15-37; Very gravelly clay loam
Unified: SC, CH
AASHTO: A-7

37+; Weathered bedrock

Included Areas:

Included with this unit in mapping and making up about 15 percent of the acreage are the Supervisor, Cheadle, Friana families and Lithic Cryochrepts and Rock outcrop and areas of lesser slopes.

216 GRALIC-SUPERVISOR FAMILIES COMPLEX, 10 to 35 percent slopes

Map Unit Components	Gralic family (60 percent)	Supervisor family (25 percent)
Position, Slope, and Elevation	On sideslopes and convex areas of mountain uplands; 10 to 35 percent slopes; 7000 to 7800 feet.	On sideslopes of mountain uplands; 10 to 35 percent slopes; 7000 to 7800 feet.
Typical Vegetation and Precipitation (ppt)	Lodgepole pine, washoe pine, white fir, western white pine, prostrate manzanita, ceonothus, few forbes, Ross's sedge, few grasses; 25 to 30 inches ppt.	Lodgepole pine, washoe pine, white fir, western white pine, prostrate manzanita, ceonothus, few forbes, Ross's sedge, few grasses; 25 to 30 inches ppt.
Surface Layer	1 to 0 inches; lodgepole pine needles, over 0 to 17 inches, grayish brown to pale brown very gravelly fine sandy loam, granular structure, soft, pH 6.2.	1 to 0 inches; lodgepole pine needles, over 0 to 12 inches; dark grayish brown to brown gravelly fine sandy loam, granular and blocky structure, slightly hard, pH 6.0 to 6.2.
Substratum	17 to 60 inches; light yellowish brown to very pale brown very gravelly sandy loam to very gravelly loamy sand, single grain and massive, loose and soft, pH 6.2 to 6.4.	26 to 37 inches; weathering in place pale brown to reddish brown semi-soft tuff conglomerate.
Rooting Depth (in.) to Underlying Material	30 plus; andesite, obsidian.	20 to 40; andesite tuff, obsidian.
Erosion Factor (K)	.24	.20
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderately rapid	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	2ep II	2ep
Forest Site Class	6-7 (5 to non-commercial)	6 (4-5)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	7 (Moderate)	7
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 1.8 inches	Low to Moderate 2.2 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	2,3 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Low to Moderate
Rating for Timber Site	Fair (12)	Fair (7,12)
R-Value	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-17; Very gravelly fine sandy loam Unified: SM AASHTO: A-2-4 17-60; Very gravelly sandy loam, very gravelly loamy sand Unified: SM AASHTO: A-1-b	0-12; Gravelly fine sandy loam Unified: SM AASHTO: A-2-4, A-4 12-26; Very gravelly sandy loam Unified: SM AASHTO: A-1-b 26+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Wapal, Patio, Cheadle families and soils similar to the Supervisor family but deeper than 40 inches, and Rock outcrop.	

217 GRALIC-SUPERVISOR FAMILIES COMPLEX, 10 to 35 percent slopes

Map Unit Components	Gralic family (60 percent)	Supervisor family (25 percent)
Position, Slope, and Elevation	On sideslopes and convex areas of mountain uplands; 35 to 60 percent slopes; 7000 to 7800 feet.	On sideslopes of mountain uplands; 35 to 60 percent slopes; 7000 to 7800 feet.
Typical Vegetation and Precipitation (ppt)	Lodgepole pine, washoe pine, white fir, western white pine, prostrate manzanita, ceonothus, few forbes, Ross's sedge, few grasses; 25 to 30 inches ppt.	Lodgepole pine, washoe pine, white fir, western white pine, prostrate manzanita, ceonothus, few forbes, Ross's sedge, few grasses; 25 to 30 inches ppt.
Surface Layer	1 to 0 inches; lodgepole pine needles, over 0 to 17 inches, grayish brown to pale brown very gravelly fine sandy loam, granular structure, soft, pH 6.2.	1 to 0 inches; lodgepole pine needles, over 0 to 12 inches; dark grayish brown to brown gravelly fine sandy loam, granular and blocky structure, slightly hard, pH 6.0 to 6.2.
Substratum	17 to 60 inches; light yellowish brown to very pale brown very gravelly sandy loam to very gravelly loamy sand, single grain and massive, loose and soft, pH 6.2 to 6.4.	26 to 37 inches; weathering in place pale brown to reddish brown semi-soft tuff conglomerate.
Rooting Depth (in.) to Underlying Material	30 plus; andesite, obsidian.	20 to 40; andesite tuff, obsidian.
Erosion Factor (K)	.24	.20
Max. Erosion Hazard	High	High
Soil Permeability	Moderately rapid	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	3Ep III	3Ep
Forest Site Class	6-7 (5 to non-commercial)	6 (4-5)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	6 (Moderate)	6
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 1.8 inches	Low to Moderate 2.2 inches
Susceptibility to Burning Damage	High	Moderate to High
Slope Stability Hazard	Low	Low
Allowable Soil Loss	2-3 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Low to Moderate
Rating for Timber Site	Fair (8,12)	Fair (7,8,12)
R-Value	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-17; Very gravelly fine sandy loam Unified: SM AASHTO: A-2-4 17-60; Very gravelly sandy loam, very gravelly loamy sand Unified: SM AASHTO: A-1-b	0-12; Gravelly fine sandy loam Unified: SM AASHTO: A-2-4, A-4 12-26; Very gravelly sandy loam Unified: SM AASHTO: A-1-b 26+; Weathered bedrock

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage are the Wapal, Patio, Cheadle families and soils similar to the Supervisor family but deeper than 40 inches, Rock outcrop and Rubble land.

218 PACKWOOD-BIEBER FAMILIES COMPLEX, 1 to 10 percent slopes

Map Unit Components	Packwood family (45 percent)	Bieber family (40 percent)
Position, Slope, and Elevation	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4700 to 5500 feet.	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4700 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, sandburg bluegrass, Idaho fescue, cheatgrass, other grasses; 14 to 16 inches ppt.	Western juniper, low sagebrush, black sagebrush, cheatgrass, sandburg bluegrass, other grasses; 14 to 16 inches ppt.
Surface Layer	0 to 5 inches; light yellowish brown very stony loam and platy and blocky structure, slightly hard to hard, pH 6.2 to 6.5	0 to 4 inches; brown very cobbly loam, blocky and granular structure, hard, pH 6.8.
Substratum	8 to 16 inches; weakly to strongly cemented yellow and brown silica duripan.	18 plus inches; strongly cemented silica duripan.
Rooting Depth (in.) to Underlying Material	7 to 15; silica duripan over basalt	8 to 20; silica duripan over basalt.
Erosion Factor (K)	.43	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Slow	Very slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	2edx II	2edx
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	8, 1	8, 1
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	6 (Moderate)	5
Hydrologic Soil Group	D	D
Available Water Capacity (AWC) Upper 20 inches	Very low to low 1.1 to 2.3 inches	Very low to low 1.0 to 2.5 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-5; Very stony loam, loam Unified: CL-ML, CL AASHTO: A-4, A-6 5-8; Clay loam Unified: CL AASHTO: A-6 8-16; Silica duripan 16+; Unweathered bedrock	0-4; Very cobbly loam Unified: SC, CL AASHTO: A-6 4-18; Clay Unified: CH AASHTO: A-7 18+; Silica duripan
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Ditchcamp, Roval, Puls, Barnard, Deven and Pass Canyon families, Rock outcrop and Rubble land.	

219 PACKWOOD-DITCHCAMP FAMILIES-ROCK OUTCROP COMPLEX, 1 to 10 percent slopes

Map Unit Components	**Packwood family (50 percent)**	**Ditchcamp family (20 percent)**	**Rock outcrop (15 percent)**
Position, Slope, and Elevation	On intermound areas between 10 to 30 foot diameter mounds on basalt plateaus; 1 to 5 percent slopes; 4500 to 5200 feet.	On 10 to 30 foot diameter mounds normally spaced within 100 feet of each other on basalt plateaus; 2 to 10 percent slopes; 4500 to 5200 feet.	On upper sideslopes and slightly convex areas on basalt plateaus; 2 to 10 percent slopes; 4500 to 5200 feet.
Typical Vegetation and Precipitation (ppt)	Low sagebrush, black sagebrush, Phlox spp., buckwheat, Idaho fescue, cheatgrass, other grasses; 12 to 14 inches ppt.	Big sagebrush, low sagebrush, western juniper, Idaho fescue, Poa spp., other grasses; 12 to 14 inches ppt.	
Surface Layer	0 to 5 inches; light yellowish brown very stony loam to loam, platy, and blocky structure, slightly hard to hard, pH 6.2 to 6.5.	0 to 15 inches; brown loam, platy and blocky structure, hard, pH 6.5	NOT APPLICABLE: Basalt or andesite bedrock with minor accumulations of aeolian soil deposition in some fractures.
Substratum	8 to 16 inches; weakly to strongly cemented yellow and brown silica duripan.	30 to 34 inches; strongly cemented reddish yellow silica duripan.	
Rooting Depth (in.) to Underlying Material	7 to 20; silica duripan over basalt bedrock	20 to 35; silica duripan over basalt bedrock	
Erosion Factor (K)	.43	.43	
Max. Erosion Hazard	Moderate	Moderate	
Soil Permeability	Slow	Slow	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	2edx II	2e	
Forest Site Class	7 (non-commercial)	7 (non-commercial)	
Range Site	7, 1	12	
Water Runoff Potential	Slow	Slow	Rapid
Watershed Sensitivity	6 (Moderate)	7	4
Hydrologic Soil Group	D	C	
Available Water Capacity (AWC) Upper 20 inches	Very low to low 1.1 to 3.1 inches	Low to moderate 3.4 inches	
Susceptibility to Burning Damage	Low	Low	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year	
Chance of Seedling Survival	Not Rated	Not Rated	
Rating for Timber Site	Not Rated	Not Rated	
R-Value	30-60	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-5; Very stony loam, loam Unified: ML-CL AASHTO: A-4, A-6 5-8; Clay loam Unified: CL AASHTO: A-6 8-16; Silica duripan 16+; Unweathered bedrock	0-15; Loam Unified: ML-CL, CL AASHTO: A-4. A-6 15-30; Clay loam Unified: CL, CH AASHTO: A-6, A-7 30-34; Silica Duripan 34+; Unweathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 15 percent of the acreage are the Deven, Bieber, Roval, Puls and Aikman families and Lithic Xerorthents, mesic and rubble land.		

220 PACKWOOD-PULS FAMILIES COMPLEX, 1 to 5 percent slopes

Map Unit Components	**Packwood family (50 percent)**	**Puls family (20 percent)**
Position, Slope, and Elevation	On upper areas of undulating basalt plateaus; 2 to 5 percent slopes; 4400 to 5300 feet.	On nearly flat to concave areas of gently undulating basalt plateaus; 1 to 3 percent slopes; 4400 to 5300 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, phlox spp., Idaho fescue, cheatgrass, sandburg bluegrass other grasses; 14 to 16 inches ppt.	Low sagebrush, black sage cheatgrass, few forbs; 14 to 16 inches ppt.
Surface Layer	0 to 5 inches; light yellowish brown very stony loam and platy and blocky structure, slightly hard to hard, pH 6.2 to 6.5	0 to 5 inches; pinkish gray very stony clay loam, granular structure, slightly hard, pH 6.3.
Substratum	8 to 16 inches; weakly to strongly cemented yellow and brown silica duripan.	19 to 28 plus inches; indurated cemented silica duripan.
Rooting Depth (in.) to Underlying Material	7 to 15; silica duripan over basalt	8 to 20; silica duripan over basalt.
Erosion Factor (K)	.43	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Slow	Very slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2edx	3edx
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	8, 1	1
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	6 (Moderate)	5
Hydrologic Soil Group	D	D
Available Water Capacity (AWC)	Very low to low	Very low to low
Upper 20 inches	1.1 to 2.3 inches	1.0 to 2.5 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-5; Very stony loam, loam Unified: CL-ML, CL AASHTO: A-4, A-6 5-8; Clay loam Unified: CL AASHTO: A-6 8-16; Silica duripan 16+; Unweathered bedrock	0-5; Very stony clay loam Unified: GC, MH AASHTO: A-2-6, A-6 5-9; Clay loam Unified: CL, MH AASHTO: A-6 9-19; Clay Unified: CH AASHTO: A-7-5, A-7-65 19-28; Silica duripan
Included Areas:	Included with these soils in mapping and making up about 30 percent of the acreage are the Bieber, Ditchcamp, Roval, Barnard, Deven and Pass Canyon families, Rock outcrop and Rubble land.	

221 PASS CANYON-DISHNER-DEVEN FAMILIES ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	**Pass Canyon family (40 percent)**	**Dishner family (25 percent)**	**Deven family (15 percent)**
Position, Slope, and Elevation	On upper sideslopes and ridges of basalt plateaus; 2 to 20 percent slopes; 4300 to 4800 feet.	On sideslopes and toeslopes of basalt plateaus; 1 to 15 percent slopes; 4300 to 4800 feet.	On sideslopes of basalt plateaus; 1 to 20 percent slopes; 4300 to 4800 feet.
Typical Vegetation and Precipitation (ppt)	Rabbitbrush, low sagebrush, big sagebrush, few western juniper, Phlox spp., Idaho fescue, sandberg bluegrass, cheatgrass; 10 to 14 inches ppt.	Low sagebrush, rabbitbrush, few western juniper, bottlebrush, cheatgrass; 10 to 14 inches ppt.	
Surface Layer	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam granular and platy structure, slightly hard, pH 6.8 to 6.6.	0 to 5 inches; light brownish gray cobbly sandy clay loam, platy and granular structure, slightly hard, pH 6.8.	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.
Rooting Depth (in.) to Underlying Material	8 to 15; basalt	10 to 20; basalt	10 to 20; basalt
Erosion Factor (K)	.32	.43	.37
Max. Erosion Hazard	Moderate	Moderate	Moderate
Soil Permeability	Moderately slow	Slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2ed II	2ed	2ed
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	7, 1	7	7
Water Runoff Potential	Slow	Slow	Slow
Watershed Sensitivity	6 (Moderate)	5	5
Hydrologic Soil Group	D	D	D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.0 to 2.0 inches	Very Low to Low 1.4 to 2.8 inches	Very Low to Low 1.4 to 2.8 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	30-60	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-4; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 4-12; Clay loam, cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12+; Unweathered bedrock	0-9; Cobbly sandy clay loam, silty clay loam Unified: CL AASHTO: A-6 9-16; Clay loam, cobbly clay Unified: CL, CH AASHTO: A-7 16+; Unweathered bedrock	0-2; Cobbly Loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Gwin, Bakeoven, Stukel, Castlevale, Cowiche families, Lithic Xerorthents, mesic, and Rock outcrop.		

222 PASS CANYON-ELMORE FAMILIES-LAVA FLOW ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	**Pass Canyon family (40 percent)**	**Elmore family (30 percent)**	**Lava flow (15 percent)**
Position, Slope, and Elevation	On nearly level to convex areas on or immediately adjacent to hummocky lava flow rock on undulating basalt plateaus; 1 to 10 percent slopes; 4300 to 5800 feet.	On isolated concave 0.1 to 2 acre pockets between broken and hummocky lava flow rock on udulating basalt plateaus; 1 to 5 percent slopes; 4300 to 5800 feet.	Hummocky, disaggregated lava flow rock with slope lengths of 5 to 30 feet on undulating basalt plateaus; 5 to 20 percent slopes; 4300 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Few ponderosa pine, western juniper, low sagebrush, big sagebrush, rabbitbrush, bitterbrush, sandberg bluegrass, Idaho fescue, cheatgrass; 16 to 18 inches ppt.	Ponderosa pine, Jeffrey pine, western juniper, big sagebrush, bitterbrush, bluebunch wheatgrass, bottlebrush, Ross's sedge, needlegrass; 16 to 18 inches ppt.	
Surface Layer	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam, granular and platy structure, slightly hard, pH 6.8 to 6.6.	1 to 0 inches of ponderosa pine needles and twigs, over 0 to 8 inches; brown loam, platy and granular structure slightly hard, pH 6.0.	NOT APPLICALBLE: Fractured vesicular basalt flow rock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt	20 to 40; basalt	
Erosion Factor (K)	.32	.37	
Max. Erosion Hazard	Moderate	Low	
Soil Permeability	Moderately slow	Moderately slow	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	2ed II	2x	
Forest Site Class	7 (non-commercial)	5-6 (3-5)	
Range Site	8	Not placed in a range site.	
Water Runoff Potential	Moderate	Slow	Rapid
Watershed Sensitivity	6 (Moderate)	8	5
Hydrologic Soil Group	D	B	
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.3 to 2.6 inches	Low to Moderate 3.2 inches	
Susceptibility to Burning Damage	Low	Moderate	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year	
Chance of Seedling Survival	Not Rated	Moderate	
Rating for Timber Site	Not Rated	FAIR (1,7,10)	
R-Value	30-60	30-60	

Soil horizons in inches, USDA, Unified, AASHTO

0-2; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

2-4; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

4-12; Clay loam, cobbly clay loam
Unified: CL, MH
AASHTO: A-6, A-7

12+; Unweathered bedrock

0-8; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

8-27; Clay loam, gravelly clay loam
Unified: CL, MH
AASHTO: A-6, A-7

27+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 of the acreage is Lithic Xerorthents, mesic, Los Gatos, Keating, Germany, Gwin, Deven, Bieber, Lawyer, Stukel and Bakeoven families and Lava flow rock with steeper slopes.

223 PASS CANYON-ELMORE-PACKWOOD FAMILIES ASSOCIATION, 1 to 10 percent slopes

Map Unit Components	**Pass Canyon family (40 percent)**	**Elmore family (25 percent)**	**Packwood family (20 percent)**
Position, Slope, and Elevation	On lower sideslopes of undulating basalt plateaus 1 to 10 percent slopes, 4400 to 5800 feet.	On gentle knolls and ridges of undulating basalt plateaus; 1 to 10 percent slopes; 4400 to 5800 feet.	On nearly level to slightly concave areas of undulating basalt plateaus; 1 to 5 percent slopes; 4400 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, big sagebrush, low sage- brush, bitterbrush, Idaho fescue, sand- burg bluegrass, other grasses; 16 to 18 inches ppt.	Ponderosa pine, Jeffrey pine, western juniper, big sagebrush, bitterbrush, mountain mahogany, squaw carpet, Ross's sedge, grasses; 16 to 18 inches ppt.	
Surface Layer	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam, granular and platy structure, slightly hard, pH 6.8 to 6.6	1 to 0 inches of ponderosa pine needles and twigs, over 0 to 8 inches; brown loam, platy and granular structure, slightly hard, pH 6.0.	0 to 5 inches; light yellowish brown very stony loam to loam, platy and blocky structure, slightly hard to hard, pH 6.2 to 6.5.
Substratum			8 to 16 inches; weakly to strongly cemented yellow and brown silica duripan.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt	20 to 40; basalt	7 to 20; silica duripan over basalt
Erosion Factor (K)	.32	.37	.43
Max. Erosion Hazard	Moderate	Low	Moderate
Soil Permeability	Moderately slow	Moderately slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2ed II	1	2edx
Forest Site Class	7 (non-commercial)	5-6 (3-5)	7 (non-commercial)
Range Site	8	Not placed in a range site.	8, 1
Water Runoff Potential	Moderate	Slow	Moderate
Watershed Sensitivity	6 (Moderate)	8	6
Hydrologic Soil Group	D	B	D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.3 to 2.6 inches	Low to Moderate 3.2 inches	Very Low to Low 1.1 to 3.1 inches
Susceptibility to Burning Damage	Low	Moderate	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Moderate	Not Rated
Rating for Timber Site	Not Rated	Fair (1,7,10)	Not Rated
R-Value	30-60	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-4; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 4-12; Clay loam, cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12+; Unweathered bedrock	0-8; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 8-27; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 27+; Unweathered bedrock	0-5; Very stony loam, loam Unified: ML-CL, CL AASHTO: A-4, A-6 5-8; Clay loam Unified: CL AASHTO: A-6 8-16; Silica duripan 16+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Deven, Gwin, Lawyer, Bieber and Barnard families and Rock outcrop.

224 PASS CANYON-FORDICE-GWIN FAMILIES ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	Pass Canyon family (35 percent)	Fordice family (25 percent)	Gwin family (20 percent)
Position, Slope, and Elevation	Mainly on southeast to westerly aspects of sideslopes, ridges and knolls of undulating basalt plateaus and mountain uplands; 1 to 20 percent slopes; 4400 to 6000 feet.	Mainly on southeast to westerly aspects of concave areas of undulating basalt plateaus and mountain uplands; 1 to 20 percent slopes; 4400 to 6000 feet	Mainly on southeast to westerly aspects of sideslopes, ridges and knolls of undulating basalt plateaus and mountain uplands; 5 to 20 percent slopes; 4400 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few scattered ponderosa pine, low sagebrush, big sagebrush, mulesear, buckwheat, western yarrow, sandberg bluegrass, Idaho fescue, cheatgrass; 16 to 20 inches ppt.	Ponderosa pine, Jeffrey pine, western juniper, big sagebrush, bitterbrush, squaw carpet, lupine, bluebunch wheatgrass, Junegrass, Ross's sedge, other grasses; 16 to 20 inches ppt.	
Surface Layer	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam, and loam, granular and platy structure, slightly hard, pH 6.6 to 6.8.	1 to 0 inches; of ponderosa pine and Jeffrey needles, over 0 to 9 inches; dark grayish brown and grayish brown very stony loam and extremely cobbly loam, granular and subangular blocky structure, friable, pH t.2 to 6.4.	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure, slightly hard, pH 6.8.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt, andesite	20 to 40; basalt, andesite	10 to 20; basalt, andesite
Erosion Factor (K)	.32	.28	.37
Max. Erosion Hazard	Moderate	Low to Moderate	Moderate
Soil Permeability	Moderately slow	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class	2edx	2epx	2edx
Group	II		
Forest Site Class	7 (non-commercial)	6 (4-5)	7 (non-commercial)
Range Site	8	Not placed in a range site.	8
Water Runoff Potential	Moderate	Slow	Moderate
Watershed Sensitivity	6 (Moderate)	7	6
Hydrologic Soil Group	D	B	D
Available Water Capacity (AWC)	Very Low to Low	Low to Moderate	Very Low to Low
Upper 20 inches	1.3 to 2.6 inches	2.0 inches	1.0 to 2.0 inches
Susceptibility to Burning Damage	Low	Moderate	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Very Low	Not Rated
Rating for Timber Site	Not Rated	Poor (1,4,7,11)	Not Rated
R-Value	30-60	30-60	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-2; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

2-4; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

4-12; Clay loam, cobbly clay loam
Unified: CL, MH
AASHTO: A-6, A-7

12+; Unweathered bedrock

0-9; Very stony loam, extremely cobbly loam
Unified: SM, SM-SC
AASHTO: A-4, A-6

9-28; Extremely cobbly clay loam
Unified: GC, CL
AASHTO: A-6

28+; Unweathered bedrock

0-11; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

11-18; Extremely cobbly clay loam
Unified: SC, CL
AASHTO: A-6

18+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Deven, Stukel, Elmore and Lawyer families, Lithic Xerorthents, mesic and Rock outcrop.

225 PASS CANYON-FORDICE-GWIN FAMILIES ASSOCIATION, 20 to 40 percent slopes

Map Unit Components	Pass Canyon family (35 percent)	Fordice family (25 percent)	Gwin family (20 percent)
Position, Slope, and Elevation	Mainly on southeast to westerly aspects of sideslopes, ridges and knolls of mountain uplands; 20 to 40 percent slopes; 4400 to 6000 feet.	Mainly on southeast to westerly aspects of smooth sideslopes and concave areas of mountain uplands; 20 to 40 percent slopes; 4400 to 6000 feet.	Mainly on southeast to westerly aspects of upper sideslopes, ridges and knolls of mountain uplands; 20 to 40 percent slopes; 4400 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few scattered ponderosa pine, low sagebrush, big sagebrush, mulesear, buckwheat, western yarrow, sandberg blue- grass, Idaho fescue, cheatgrass; 16 to 20 inches ppt.	Ponderosa pine, Jeffrey pine, western juniper, big sagebrush, bitterbrush, squaw carpet, lupine, bluebunch wheatgrass, June- grass, Ross's sedge, other grasses; 16 to 20 inches ppt.	
Surface Layer	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam, granular and platy structure slightly hard, pH 6.6 yo 6.8.	1 to 0 inches; ponderosa pine and juniper needles, over 0 to 9 inches; dark grayish brown and grayish brown very stony loam and extremely cobbly loam, granular structure, friable, pH 6.2 to 6.4.	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure, slightly hard, pH 6.8.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt andesite	20 to 40; basalt andesite	10 to 20; basalt, andesite
Erosion Factor (K)	.32	.28	.37
Max. Erosion Hazard	Moderate to high	Moderate	Moderately to high
Soil Permeability	Moderately slow	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	3Edx III	2Epx	3Edx
Forest Site Class	7 (non-commercial)	6 (4-5)	7 (non-commercial)
Range Site	8	Not placed in a range site.	8
Water Runoff Potential	Rapid	Slow	Rapid
Watershed Sensitivity	5 (Moderate)	7	5
Hydrologic Soil Group	D	B	D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.3 to 2.6 inches	Low to Moderate 2.0 inches	Very Low to Low 1.0 to 2.0 inches
Susceptibility to Burning Damage	Moderate	Moderate to High	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Very Low	Not Rated
Rating for Timber Site	Not Rated	Poor (1,4,7,11)	Not Rated
R-Value	30-60	30-60	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-2; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

2-4; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

4-12; Clay loam, cobbly clay loam
Unified: CL, MH
AASHTO: A-6, A-7

12+; Unweathered bedrock

0-9; Very stony loam, extremely cobbly loam
Unified: SM, SM-SC
AASHTO: A-4, A-6

9-28; Extremely cobbly clay loam
Unified: GC, CL
AASHTO: A-6

28+; Unweathered bedrock

0-11; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

11-18; Extremely cobbly clay loam
Unified: SC, CL
AASHTO: A-6

18+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Deven, Stukel, Bakeoven, Ruckles, Elmore and Lawyer families Lithic Xerorthents, mesic and Rock outcrop.

226 PASS CANYON-GWIN-FORDICE FAMILIES ASSOCIATION, 40 to 70 percent slopes

Map Unit Components	Pass Canyon family (35 percent)	Gwin family (30 percent)	Fordice family (15 percent)
Position, Slope, and Elevation	Mainly on southeast to westerly aspects of sideslopes, ridges and knolls of mountain uplands; 40 to 70 percent slopes, 4400 to 6000 feet.	Mainly on southeast to westerly aspects of upper sideslopes, ridges and knolls of mountain uplands; 40 to 70 percent slopes; 4400 to 6000 feet.	Mainly on southeast to westerly aspects of smooth sideslopes and concave areas of mountain uplands; 40 to 60 percent slopes; 4400 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few scattered ponderosa pine, low sagebrush, big sagebrush, mulesear, buckwheat, western yarrow, sandberg blue- grass, Idaho fescue, cheatgrass; 16 to 20 inches ppt.	Western juniper, mountain mahogany, current spp., big sagebrush, low sagebrush, mulesear, Phlox spp., bottlebrush, Idaho fescue, cheat- grass; 16 to 20 inches ppt.	
Surface Layer	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam, granular and platy structure slightly hard, pH 6.6 yo 6.8.	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure, slightly hard, pH 6.8.	1 to 0 inches; of ponderosa pine and juniper needles, over 0 to 9 inches; inches; dark grayish brown and grayish brown very stony loam and extremely cobbly loam, granular and subgranular blocky structure, friable, pH 6.2 to 6.4.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt andesite	10 to 20; basalt andesite	20 to 40; basalt, andesite
Erosion Factor (K)	.32	.37	.28
Max. Erosion Hazard	High to very high	High to very high	High
Soil Permeability	Moderately slow	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	3Edx III	3Epx	3Edx
Forest Site Class	7 (non-commercial)	7 (non-commercial)	6 (4-5)
Range Site	8	8	Not placed in a range site.
Water Runoff Potential	Rapid	Very Rapid	Moderate
Watershed Sensitivity	4 (High)	3	6
Hydrologic Soil Group	D	D	B
Available Water Capacity (AWC) Upper 20 inches	Very low to Low 1.3 to 2.6 inches	Very Low to Low 1.0 to 2.0 inches	Low to Moderate 2.0 inches
Susceptibility to Burning Damage	Moderate	Moderate	High
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Very Low
Rating for Timber Site	Not Rated	Not Rated	Poor (1,4,7,8,11)
R-Value	30-60	30-60	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-2; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

2-4; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

4-12; Clay loam, cobbly clay loam
Unified: CL, MH
AASHTO: A-6, A-7

12+; Unweathered bedrock

0-11; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

11-18; Extremely cobbly clay loam
Unified: SC, CL
AASHTO: A-6

18+; Unweathered bedrock

0-9; Very stony loam, extremely cobbly loam
Unified: SM, SM-SC
AASHTO: A-4, A-6

9-28; Extremely cobbly clay loam
Unified: GC, CL
AASHTO: A-6

28+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Deven, Bakeoven, Ruckles, Elmore and Lawyer families Lithic Xerorthents, mesic and Rock outcrop.

227 PASS CANYON FAMILY-LITHIC XERORTHENTS, MESIC COMPLEX, 1 to 15 percent slopes

Map Unit Components	**Pass Canyon family (45 percent)**	**Lithic Xerorthents, mesic (35 percent)**
Position, Slope, and Elevation	On undulating basalt plateaus; 1 to 15 percent slopes; 4500 to 5700 feet.	On nearly level cobble pavement flats, knolls and ridges of undulating basalt plateaus; 1 to 15 percent slopes; 4500 to 5700 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, few big sagebrush, Idaho fescue, sandberg blue- grass, cheatgrass; 14 to 18 inches ppt.	Low sagebrush, buckwheat, cheatgrass; 14 to 18 inches ppt.
Surface Layer	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam, granular and platy structure, slightly hard, pH 6.8 to 6.6.	0 to 5 inches; brown and yellowish brown very cobbly loam and gravelly loam; platy and granular structure; slightly hard; pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	8 to 15; basalt	4 to 10; basalt andesite
Erosion Factor (K)	.32	Variable
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderately slow	Moderate
Drainage Class	Well drained	Somewhat excessively drained
Soil Manageability Class Group	 2ed II	 3eDx
Forest Site Class	7 (non-commercial)	7 (non-commercial
Range Site	8,1	1
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	6 (Moderate	5
Hydrologic Soil Group	D	D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.0 to 2.0 inches	Very Low 0.6 to 1.5 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	30-60	Not Rated
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-4; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 4-12; Clay loam, cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12+; Unweathered bedrock	0-5; Variable Unified: Not Rated AASHTO: Not Rated 5+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Deven, Indian Creek, Packwood, Keating families and Rock outcrop.	

228 PASS CANYON-LOS GATOS FAMILIES COMPLEX, 1 to 20 percent slopes

Map Unit Components	Pass Canyon family (45 percent)	Los Gatos family (35 percent)
Position, Slope, and Elevation	On undulating basalt plateaus and sideslopes of mountain uplands; 1 to 20 percent slopes; 4400 to 5500 feet.	On undulating basalt plateaus and lower sideslopes of mountain uplands; 1 to 15 percent slopes; 4400 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, big sagebrush, rabbitbrush, Idaho fescue, Poa spp., cheatgrass; 14 to 18 inches ppt.	Western juniper, few scattered ponderosa pine, big sagebrush, bitterbrush, rabbit- brush, Idaho fescue, Poa spp., other grasses; 14 to 18 inches ppt.
Surface Layer	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam, granular and platy structure, slightly hard, pH 6.8 to 6.6.	0 to 19 inches; brown gravelly loam, granular and blocky structure, soft, pH 6.8 to 7.0
Rooting Depth (in.) to Underlying Material	10 to 20; hard fractured basalt, tuff	20 to 40; hard fractured basalt, tuff
Erosion Factor (K)	.32	.32
Max. Erosion Hazard	Moderate	Low
Soil Permeability	Moderately slow	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	2ed II	1
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	8,4	13
Water Runoff Potential	Moderate	Slow
Watershed Sensitivity	6 (Moderate)	8
Hydrologic Soil Group	D	B
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.3 to 2.6 inches	Low to Moderate 2.8 inches
Susceptibility to Burning Damage	Low	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-4; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 4-12; Clay loam, cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12+; Unweathered bedrock	0-19; Gravelly loam Unified: ML, ML-CL AASHTO: A-4 19-38; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 38+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the Ridd, Stukel, Supan, Keating, Alicel, Cowiche, Elmore, Deven and Roval families and Rock outcrop, and unnamed soils similar to the Gwin family but over soft tuff.

229 PASS CANYON-ROVAL FAMILIES COMPLEX, 1 to 15 percent slopes

Map Unit Components	Pass Canyon family (60 percent)	Roval family (25 percent)
Position, Slope, and Elevation	On undulating basalt plateaus and lower sideslopes of mountain uplands; 1 to 15 percent slopes; 4700 to 6000 feet.	On undulating basalt plateaus and lower sideslopes of mountain uplands; 1 to 15 percent slopes; 4700 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, rabbit- brush, Phlox spp., Idaho fescue, sandberg bluegrass, cheatgrass; 14 to 16 inches ppt.	Western juniper, low sagebrush, rabbit- brush, Phlox spp., Idaho fescue, sandberg bluegrass, cheatgrass; 14 to 16 inches ppt.
Surface Layer	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam, granular and platy structure, slightly hard, pH 6.8 to 6.6.	0 to 2 inches; brown very cobbly loam, platy and granular structure, slightly hard, pH 6.6.
Substratum		12 to 14 inches; strongly cemented silica duripan
Rooting Depth (in.) to Underlying Material	10 to 20; basalt	10 to 20; silica duripan over basalt.
Erosion Factor (K)	.32	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderately slow	Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2ed	2ed
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	8	8
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	6 (Moderate)	6
Hydrologic Soil Group	D	D
Available Water Capacity (AWC)	Very Low to Low	Low
Upper 20 inches	1.3 to 2.6 inches	1.5 to 3.0 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-4; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 4-12; Clay loam, cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12+; Unweathered bedrock	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-10; Clay loam Unified: CL, MH AASHTO: A-6, A-7 10-13; Clay Unified: CH AASHTO: A-7 13-14; Silica duripan 14+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage are the Bieber, Deven, Stukel, Los Gatos and Fordice families, Lithic Xerothents, mesic, and Rock outcrop.

230 PATIO deep-GLEASON-MERKEL FAMILIES COMPLEX, 10 to 40 percent slopes

Map Unit Components	**Patio family, deep (35 percent)**	**Gleason family (30 percent)**	**Merkel family (25 percent)**
Position, Slope, and Elevation	On sideslopes of mountain uplands; 15 to 40 percent slopes; 4800 to 6200 feet.	On sideslopes of mountain uplands; 10 to 40 percent slopes; 4800 to 6200 feet.	On toeslopes and sideslopes of mountain uplands; 10 to 35 percent slopes; 4800 to 6200 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, few incense-cedar and white fir, rabbitbrush, ceonothus, snowberry, squaw carpet, Ross's sedge, few grasses; 16 to 25 inches ppt.	Ponderosa pine, few incense-cedar and white fir, rabbitbrush, ceonothus, snowberry, squaw carpet, Ross's sedge, few grasses; 16 to 25 inches ppt.	
Surface Layer	1 to 0 inches of white fir needles, over 0 to 18 inches; yellowish brown very gravelly loam, granular structure, slightly hard, pH 6.2 to 6.8.	1 to 0 inches; undecomposed ponderosa pine needles and twigs, over 0 to 22 inches; grayish brown gravelly sandy loam and sandy loam, granular and massive structure, soft, pH 6.0 to 6.5.	1 to 0 inches of white fir needles, over 0 to 11 inches pale brown very gravelly loam, granular and blocky structure, soft, pH 6.8.
Substratum		22 to 50 inches; light gray and very pale brown gravelly sandy loam to very gravelly coarse sand, massive, slightly hard to hard, pH 6.2.	
Rooting Depth (in.) to Underlying Material	40 plus; andesite, obsidian	40 plus; andesite obsidian or tuff	30 plus; tuff, andesite
Erosion Factor (K)	.28	.17	.32
Max. Erosion Hazard	Moderate	Low to Moderate	Moderate
Soil Permeability	Moderate	Moderately rapid	Moderate
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2ep II	2e	2e
Forest Site Class	5 (3-4)	5 (3-4)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow	Slow
Watershed Sensitivity	7 (Moderate)	8	7
Hydrologic Soil Group	B	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.3 inches	Moderate 2.5 inches	Moderate 2.4 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year	2,3 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Moderate	Low to Moderate
Rating for Timber Site	Good (10)	Good (10)	Good (10)
R-Value	30-60	60+	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-60; Very gravelly loam, extremely gravely loam, extremely cobbly loam
Unified: SM, SM-SC
AASHTO: A-2-4, A-2-6

0-35; Gravelly sandy loam, sandy loam
Unified: SM
AASHTO: A-2-4
35-50; Very gravelly coarse sand
Unified: SW-SM, SM
AASHTO: A-1-b
50+; Weathered bedrock

0-32; Very gravelly loam, extremely cobbly loam
Unified: SM, SC
AASHTO: A-2-4, A-2-6, A-4, A-6
32+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 10 percent of the acreage are the Lamondi, Wapal, Smarts, DeMasters, Inville, Mascamp, Alicel, and Anatone families and areas with less slope.

231 PATIO deep-MERKEL FAMILIES COMPLEX, 15 to 35 percent slopes

Map Unit Components	**Patio family, deep (60 percent)**	**Merkel family (20 percent)**
Position, Slope, and Elevation	On sideslopes of mountain uplands; 15 to 35 percent slopes; 5500 to 7000 feet.	On sideslopes of mountain uplands; 15 to 35 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, few lodgepole pine at higher elevations, plus snowberry, current spp., squaw carpet, Ross's sedge, few grasses; 20 to 30 inches, ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, few lodgepole pine at higher elevations, plus snowberry, current spp., squaw carpet, Ross's sedge, grasses; 20 to 30 inches ppt.
Surface Layer	1 to 0 inches of white fir needles, over 0 to 18 inches; yellowish brown very gravelly loam, granular structure, slightly hard, pH 6.2 to 6.8	1 to 0 inches of white fir needles, over 0 to 11 inches pale brown very gravelly loam, granular and blocky structure, soft, pH 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; basalt, andesite	30 plus; tuff, andesite
Erosion Factor (K)	.28	.32
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderate	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	2ep II	2e
Forest Site Class	5 (3-4)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	7 (Moderate)	7
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.3 inches	Moderate 2.4 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	2,3 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Low to Moderate
Rating for Timber Site	Good	Good
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-60; Very gravelly loam, extremely gravelly loam, extremely cobbly loam Unified: SM, SM-SC AASHTO: A-2-4, A-2-6	0-32; Very gravelly loam, extremely cobbly loam Unified: SM, SC AASHTO: A-2-4, A-2-6, A-4, A-6 32+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up 20 pecent of the acreage are the Smarts, Lamondi, Wapal, Gleason, Anatone families, Lithic Xerorthents, frigid, and Rock outcrop.	

232 PATIO deep-MERKEL FAMILIES COMPLEX, 35 to 60 percent slopes

Map Unit Components	Patio family, deep (55 percent)	Merkel family (25 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 35 to 60 percent slopes; 5500 to 7000 feet.	On sideslopes of mountain uplands; 35 to 60 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, few lodgepole pine at higher elevations, plus snowberry, current spp., squaw carpet, Ross's sedge, few grasses; 20 to 30 inches, ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, few lodgepole pine at higher elevations, plus snowberry, current spp., squaw carpet, Ross's sedge, grasses; 20 to 30 inches ppt.
Surface Layer	1 to 0 inches of white fir needles, over 0 to 18 inches; yellowish brown very gravelly loam, granular structure, slightly hard, pH 6.2 to 6.8	1 to 0 inches of white fir needles, over 0 to 11 inches pale brown very gravelly loam, granular and blocky structure, soft, pH 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; basalt, andesite	30 plus; tuff, andesite
Erosion Factor (K)	.28	.32
Max. Erosion Hazard	High	High
Soil Permeability	Moderate	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class	3Ep	3E
Group	III	
Forest Site Class	5 (3-4)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	6 (Moderate)	5
Hydrologic Soil Group	B	B
Available Water Capacity (AWC)	Moderate	Moderate
Upper 20 inches	2.3 inches	2.4 inches
Susceptibility to Burning Damage	Moderate to High	Moderate to High
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	2,3 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Low to Moderate
Rating for Timber Site	Fair (8)	Fair (8)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-60; Very gravelly loam, extremely gravelly loam, extremely cobbly loam Unified: SM, SM-SC AASHTO: A-2-4, A-2-6	0-32; Very gravelly loam, extremely cobbly loam Unified: SM, SC AASHTO: A-2-4, A-2-6, A-4, A-6 32+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up 20 pecent of the acreage are the Smarts, Lamondi, Wapal, Gleason, Anatone families, Rubble land, Rock outcrop and unnamed soils similar to the Inville family.

233 PATIO-SMARTS-ANATONE FAMILIES ASSOCIATION, 15 to 35 percent slopes

Map Unit Components	**Patio family (35 percent)**	**Smarts family (30 percent)**	**Anatone family (20 percent)**
Position, Slope, and Elevation	On sideslopes and ridges of mountain uplands; 15 to 35 percent slopes; 5800 to 6700 feet.	On lower sideslopes and toeslopes of mountain uplands; 15 to 30 percent slopes; 5800 to 6700 feet.	On upper sideslopes, ridges and knolls of mountain uplands; 20 to 35 percent slopes; 5800 to 6700 feet.
Typical Vegetation and Precipitation (ppt)	Few ponderosa pine, white fir, western juniper, dense rabbitbrush, big sagebrush, some bitterbrush, paintbrush, mulesear, bottlebrush, Ross's sedge, other grasses; 20 to 30 inches ppt.	Few ponderosa pine, white fir, western juniper, dense rabbitbrush, big sagebrush, some bitterbrush, paintbrush, mulesear, bottlebrush, Ross's sedge, other grasses; 20 to 30 inches ppt.	
Surface Layer	0 to 19 inches; dark grayish brown to brown very gravelly loam, granular and blocky structure, soft, pH 6.8.	1/2 to 0 inches; ponderosa pine and white fir needles and twigs, over 0 to 20 inches; reddish brown stony loam and very cobbly loam, granular and blocky struc- ture, slightly hard and hard, pH 6.6 to 6.8.	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and subangular blocky structure, slightly hard, pH 7.0 to 6.8.
Rooting Depth (in.) to Underlying Material	20 to 40; andesite	20 to 40; basalt, andesite	10 to 20; andesite, basalt
Erosion Factor (K)	.28	.32	.37
Max. Erosion Hazard	Moderate	Moderate	Moderate to high
Soil Permeability	Moderate	Moderately slow	Moderate
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	3epX III	3epX	3EdX
Forest Site Class	6 (4-5)	5-6 (3-5)	7 (non-commercial)
Range Site	Not placed in a range site.	Not placed in a range site.	9
Water Runoff Potential	Slow	Slow	Rapid
Watershed Sensitivity	7 (Moderate)	7	4
Hydrologic Soil Group	B	B	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.3 inches	Low to Moderate 2.1 inches	Very Low to Low 1.2 to 2.5 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Low	Not Rated
Rating for Timber Site	Poor (1,4,7)	Poor (1,4,7)	Not Rated
R-Value	30-60	30-60	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-28; Very gravelly loam
Unified: SM, SM-SC
AASHTO: A-2-4, A-2-6
28+; Unweathered bedrock

0-20; Stony loam, very cobbly loam
Unified: ML, ML-CL
AASHTO: A-4
20-28; Very gravelly loam
Unified: SM-SC, SC
AASHTO: A-4, A-6
28-35; Extremely gravelly clay loam
Unified: GC
AASHTO: A-2-6, A-2-7
35+; Weathered bedrock

0-8; Cobbly loam
Unified: ML, ML-CL
AASHTO: A-4
8-17; Very cobbly loam
Unified: SM, SC
AASHTO: A-4, A-6
17+; Unweathered bedrock

Included Areas:

Included with these units in mapping and making up about 15 percent of the acreage are the Lamondi, Wapal, Mascamp families, Patio and Smarts families, deep, Lithic Xerorthents, frigid, and Rock outcrop.

235 PULS-PACKWOOD-DITCHCAMP FAMILIES COMPLEX 1 to 10 percent slopes

Map Unit Components	**Puls family (40 percent)**	**Packwood family (30 perent)**	**Ditchcamp family (15 percent)**
Position, Slope, and Elevation	On intermound areas between 10 to 30 foot diameter mounds on basalt plateaus; 1 to 2 percent slopes; 4400 to 5500 feet.	On intermound areas between 10 to 30 foot diameter mounds on basalt plateaus; 1 to 3 percent slopes; 4400 to 5500 feet.	On 10 to 30 foot diameter mounds normally from 100 to 150 feet of each other on basalt plateaus; 2 to 10 percent slopes; 4400 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Black sagebrush, low sagebrush, few western juniper, buckwheat, Idaho fescue, other grasses; 12 to 14 inches ppt.	Low sagebrush, few western juniper, bluebunch wheatgrass, cheatgrass, other grasses; 12 to 14 inches ppt.	
Surface Layer	0 to 5 inches; pinkish gray very stony clay loam, granular structure, slightly hard, pH 6.3.	0 to 5 inches; light yellowish brown very stony loam to loam, platy and blocky structure, slightly hard to hard, pH 6.2 to 6.5.	0 to 15 inches; brown loam, platy and blocky structure, hard, pH 6.5.
Substratum	19 to 28 inches; indurated silica cemented duripan.	8 to 16 inches; weakly to strongly cemented yellow and brown silica duripan.	30 to 34 inches; strongly cemented reddish yellow silica duripan.
Rooting Depth (in.) to Underlying Material	5 to 10; dense very hard clay over silica duripan at 10 to 20 inches	7 to 20; silica duripan over basalt	20 to 35; silica duripan over basalt
Erosion Factor (K)	.37	.43	.43
Max. Erosion Hazard	Moderate	Moderate	Moderate
Soil Permeability	Very slow	Slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	3eDx II	2edx	2e
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	1	7,1	12
Water Runoff Potential	Moderate	Moderate	Slow
Watershed Sensitivity	5 (Moderate)	6	7
Hydrologic Soil Group	D	D	C
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.1 to 2.7 inches	Very Low to Low 1.3 to 3.1 inches	Low to Moderate 3.4 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-5; Very stony clay loam Unified: ML,CL AASHTO: A-6, A-7 5-19; Clay loam, clay Unified: CL, CH AASHTO: A-7 19-28; Silica duripan 28+; Unweathered bedrock	0-5; Very stony loam, loam Unified: ML-CL, CL AASHTO: A-4, A-6 5-8; Clay loam Unified: CL AASHTO: A-6 8-16; Silcia duripan 16+; Unweathered bedrock	0-15; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 15-30; Clay loam Unified: CL, CH AASHTO: A-6, A-7 30-34; Silica duripan 34+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Castlevale, Dishner, Aikman, Bieber and Roval families, Lithic Xerorthents, mesic, Rock outcrop, and unnamed soils similar to Ditchcamp family but are Mollisols.		

236 PULS-ROVAL-DISHNER FAMILIES COMPLEX, 0 to 5 percent slopes

Map Unit Components	Puls family (50 percent)	Roval family (20 percent)	Dishner family (15 percent)
Position, Slope, and Elevation	On shallow nearly level basins on undulating basalt plateaus; 0 to 2 percent slopes; 4500 to 5500 feet.	On upper areas of undulating basalt plateaus; 1 to 5 percent slopes; 4500 to 5500 feet.	On upper areas and gentle sideslopes of undulating basalt plateaus; 1 to 5 percent slopes; 4500 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Low sagebrush, black sagebrush, few forbes, cheatgrass; 14 to 16 inches ppt.	Western juniper, low sagebrush, few big sagebrush, Idaho fescue, sandberg bluegrass, bottlegrass, cheatgrass; 14 to 16 inches ppt.	
Surface Layer	0 to 5 inches; pinkish gray very stony clay loam, granular structure, slightly hard, pH 6.3.	0 to 2 inches; brown very cobbly loam, platy and granular structure, slightly hard, pH 6.6.	0 to 5 inches; light brownish gray cobbly sandy clay loam, platy and granular structure, slightly hard, pH 6.8.
Substratum	19 to 28 inches; indurated silica cemented duripan.	13 to 14 inches; strongly cemented silica duripan.	
Rooting Depth (in.) to Underlying Material	5 to 10; dense very hard clay over silica duripan below 10 to 20 inches.	10 to 20; silica duripan over basalt.	8 to 16; basalt
Erosion Factor (K)	.37	.37	.43
Max. Erosion Hazard	Moderate	Moderate	Moderate
Soil Permeability	Very Slow	Slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	3eDX III	2ed	2ed
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	1	8	8,1
Water Runoff Potential	Moderate	Moderate	Moderate
Watershed Sensitivity	4 (Moderate)	6	5
Hydrologic Soil Group	D	D	D
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.1 to 2.7 inches	Low 1.5 to 3.0 inches	Very Low to Low 1.1 to 2.1 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	0-30	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-5; Very stony clay loam Unified: ML, CL AASHTO: A-6, A-7 5-19; Clay loam, Unified: CL, CH AASHTO: A-7 19-28; Silica duripan 28+; Unweathered bedrock	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-10; Clay loam Unified: CL, MH AASHTO: A-6, A-7 10-13; Clay Unified: CH AASHTO: A-7 13-14; Silica duripan 14+; Unweathered bedrock	0-9; Cobbly sandy clay loam silty clay loam Unified: CL AASHTO: A-6 9-16; Clay loam, cobbly clay Unified: CL, CH AASHTO: A-7 16+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Aikman, Bierber, Castlevale, Packwood, Indian Creek, Barnard, Deven and Ditchcamp families, Lithic Xerorthents, mesic, and Rock outcrop.		

237 RIDD-LOS GATOS-GWIN FAMILIES ASSOCIATION, 5 to 35 percent slopes

Map Unit Components	Ridd family (40 percent)	Los Gatos family (25 percent)	Gwin family (20 pecent)
Position, Slope, and Elevation	On sideslopes and convex areas of mountain uplands; 5 to 35 percent slopes; 4400 to 5800 feet.	On lower sideslopes and toeslopes of mountain uplands; 5 to 30 percent slopes; 4400 to 5800 feet.	On upper sideslopes ridges and convex areas of mountain uplands; 10 to 35 percent slopes; 4400 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few ponderosa pine, big sagebrush, rabbitbrush, bitterbrush, vetch, mulesear, Phlox spp., Idaho fescue, sandberg bluegrass, bluebunch wheatgrass; 14 to 18 inches ppt.	Western juniper, few ponderosa pine, big sagebrush, rabbitbrush, bitterbrush, vetch mulesear, Phlox spp., Idaho fescue, sandberg bluegrass, bluebunch wheatgrass; 14 to 18 inches ppt.	
Surface Layer	0 to 15 inches; dark grayish brown cobbly loam, granular structure, slightly hard, pH 6.0.	0 to 19 inches; brown gravelly loam, granular and blocky structure, soft, pH 6.8 to 7.0.	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure, slightly hard, pH 6.8.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt	20 to 40; basalt	10 to 20; basalt
Erosion Factor (K)	.32	.32	.37
Max. Erosion Hazard	Low to moderate	Low to moderate	Moderate
Soil Permeability	Moderately slow	Moderate	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2e II	2e	2ed
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	18	13	8
Water Runoff Potential	Slow	Slow	Rapid
Watershed Sensitivity	7 (Moderate)	7	5
Hydrologic Soil Group	B	B	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.4 inches	Low to Moderate 2.8 inches	Very Low to Low 1.0 to 2.0 inches
Susceptibility to Burning Damage	Moderate	Moderate	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	30-60	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-5; Cobbly loam Unified: ML, ML-CL AASHTO: A-4 5-37; Very cobbly clay loam Unified: CL AASHTO: A-6, A-7 37+; Unweathered bedrock	0-19; Gravelly loam Unified: ML, ML-CL AASHTO: A-4 19-38; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 38+; Unweathered bedrock	0-11; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 11-18; Extremely cobbly clay loam Unified: SC, CL AASHTO: A-6 18+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Supan, Keating, Bakeoven and Pass Canyon families and Rock outcrop.		

238 RIDD-RUCKLES-KEATING FAMILIES COMPLEX, 1 to 20 percent slopes

Map Unit Components	Ridd family (35 percent)	Ruckles family (30 percent)	Keating family (20 percent)
Position, Slope, and Elevation	On smooth lower sideslopes and toeslopes of mountain uplands and alluvial fans; 1 to 20 percent slopes; 4400 to 5500 feet.	On knolls and ridges and upper sideslopes of mountain uplands and alluvial fans; 2 to 20 percent slopes; 4400 to 5500 feet.	On smooth lower sideslopes and toeslopes of mountain uplands and alluvial fans; 1 to 20 percent slopes; 4400 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Big sagebrush, rabbitbrush, bitterbrush, few western juniper, Idaho fescue, Poa spp., needlegrass; bottlebrush; 14 to 18 inches inches.	Western juniper, low sagebrush, big sage- brush, buckwheat, Phlox spp., Idaho fescue, cheatgrass; 14 to 18 inches ppt.	
Surface Layer	0 to 5 inches; dark grayish brown cobbly loam, granular structure, slightly hard, pH 6.0.	0 to 4 inches; brown very cobbly loam, granular structure, soft, pH 7.0.	0 to 2 inches; dark grayish brown cobbly clay loam, granular structure, hard, pH 6.8.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt, tuff	10 to 20; basalt, tuff	20 to 40; basalt, tuff
Erosion Factor (K)	.32	.37	.32
Max. Erosion Hazard	Low to moderate	Moderate	Low to moderate
Soil Permeability	Moderately slow	Slow	Slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2e II	2ed	2e
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	18	8	18
Water Runoff Potential	Slow	Moderate	Slow
Watershed Sensitivity	8 (moderate)	5	6
Hydrologic Soil Group	B	D	C
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.4 inches	Very Low to Low 1.0 to 2.0 inches	Low to Moderate 2.7 inches
Susceptibility to Burning Damage	Low	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	30-60	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-5; Cobbly loam Unified: ML, ML-CL AASHTO: A-4 5-37; Very cobbly clay loam Unified: CL AASHTO: A-6, A-7 37+; Unweathered bedrock	0-4; Very cobbly loam Unified: SM, SC AASHTO: A-4, A-6 4-14; Very gravelly clay Unified: GC, CH AASHTO: A-7 14+; Unweathered bedrock	0-6; Cobbly clay loam, clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 6-32; Clay Unified: CH AASHTO: A-7 32+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Supan, Puls, Bieber, Deven, and Gwin families.		

239 ROCK OUTCROP-BAKEOVEN-WENATCHEE FAMILIES ASSOCIATION, 20 to 60 percent slopes

Map Unit Components	**Rock outcrop (40 percent)**	**Bakeoven family (30 percent)**	**Wentchee family (15 percent)**
Position, Slope, and Elevation	On upper slopes and ridges of mountain uplands and basalt plateau breaks; 30 to 60 percent slopes; 4200 to 5500 feet.	On sideslopes and convex areas of mountain uplands and plateau breaks; 20 to 50 percent slopes; 4200 to 5500 feet.	On lower sideslopes and toeslopes of mountain uplands and plateau breaks; 20 to 40 percent slopes; 4200 to 5500 feet.
Typical Vegetation and Precipitation (ppt)	Barren; 10 to 16 inches ppt.	Western juniper, rabbitbrush, big sage- brush, low sagebrush, Ribes spp., mules-ear, cheatgrass, sandberg bluegrass, needlegrass, Idaho fescue; 10 to 16 inches ppt.	
Surface Layer	NOT APPLICABLE: Basalt, bedrock with minor accumulations of aeolian soil deposition in some fractures.	A thin pumice overburden of up to 5 inches thick may be present, OVER 0 to 11 inches; dark grayish brown and grayish brown very cobbly fine sandy loam, subangular blocky structure; slightly hard, pH 6.6.	9 inches of pumice overburden consisting of brown gravelly coarse sandy loam over very pale brown extremely gravelly coarse loamy sand (pumice thickness in this map unit ranges from 0 to 5 inches) OVER 9 to 15 inches; pale brown fine sandy loam, subangular blocky sturcture, soft, pH 6.8.
Rooting Depth (in.) to Underlying Material		8 to 20; basalt	20 to 40; basalt
Erosion Factor (K)		.24	.20
Max. Erosion Hazard		Moderate to high	Moderate
Soil Permeability		Moderately rapid	Moderate
Drainage Class		Well drained	Well drained
Soil Manageability Class Group	Not rated III	3EPx	2e
Forest Site Class		7 (non-commercial)	7 (non-commercial
Range Site		7,1	16
Water Runoff Potential	Very Rapid	Rapid	Slow
Watershed Sensitivity	2 (High)	5	7
Hydrologic Soil Group		D	B
Available Water Capacity (AWC) Upper 20 inches		Very Low to Low 0.8 to 1.9 inches	Low to Moderate 2.6 inches
Susceptibility to Burning Damage		Low	Moderate
Slope Stability Hazard		Low	Low
Allowable Soil Loss		1 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival		Not Rated	Not Rated
Rating for Timber Site		Not Rated	Not Rated
R-Value		30-60	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-11;	Very cobbly fine sandy loam Unified: SM, SM-SC AASHTO: A-4	0-5;	Gravelly coarse sandy loam Unified: SM AASHTO: A-1-b
11+;	Unweathered bedrock	5-9;	Extremely gravelly loamy coarse sand Unified: SW-SM AASHTO: A-1-a
		9-27;	Fine sandy loam, loam Unified: ML, ML-CL, CL AASHTO: A-4, A-6
		27+;	Unweathered bedrock

Included Areas:

Included with this unit in mapping and making up about 15 percent of the acreage are the Searles, Fordice, Elmore, Cowiche and Stukel families.

240 ROCK OUTCROP-RUBBLE LAND-BAKEOVEN FAMILY ASSOCIATION, 40 to 90 percent slopes

Map Unit Components	**Rock outcrop (35 percent)**	**Rubble land (30 percent)**	**Bakeoven family (20 percent)**
Position, Slope, and Elevation	On ridge tops and scarp breaks of mountain uplands; 40 to 90 percent slopes; 4400 to 7000 feet.	On smooth concave mountain sideslopes; 50 to 90 percent slopes; 4400 to 7000 feet.	On smooth mountain sideslopes; 40 to 70 percent slopes; 4400 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	Generally barren with few scattered trees, forbes, shrubs and grasses in some rock fractures; 14 to 20 inches ppt.	Barren; 14 to 20 inches ppt.	
Surface Layer	NOT APPLICABLE; Basalt, andesite or conglomerated tuff bedrock with minor accumulations of aeolian soil deposition in some fractures.	NOT APPLICABLE: Colluvial deposition of angular cobbles, stones and boulders of basalt or andesite rock material.	0 to 11 inches; dark grayish brown and grayish brown very cobbly fine sandy loam, subangular blocky structure; slightly hard, pH 6.6.
Rooting Depth (in.) to Underlying Material			7 to 20; basalt, andesite
Erosion Factor (K)			.24
Max. Erosion Hazard			High to Very High
Soil Permeability			Moderately rapid
Drainage Class			Well drained
Soil Manageability Class Group	Not Rated IV	4GdX	
Forest Site Class			7 (non-commercial)
Range Site			8,1
Water Runoff Potential	Very Rapid	Very Rapid	Rapid
Watershed Sensitivity	0 (Very High)	2	4
Hydrologic Soil Group			D
Available Water Capacity (AWC) Upper 20 inches			Very Low to Low 0.6 to 1.9 inches
Susceptibility to Burning Damage			Moderate
Slope Stability Hazard			Low to Moderate
Allowable Soil Loss			1 tons/acre/year
Chance of Seedling Survival			Not Rated
Rating for Timber Site			Not Rated
R-Value			30-60
Soil horizons in inches, USDA, Unified, AASHTO			0-11; Very cobbly fine sandy loam Unified: SM, SM-SC AASHTO: A-4
Included Areas:	Included with this unit in mapping and making up about 15 percent of the acreage are the Fordice, Smarts, Keating, Gwin, Anatone families and Lithic Xerorthents.		

241 ROCK OUTCROP-RUBBLE LAND-CHEADLE FAMILY ASSOCIATION, 60 to 100 percent slopes

Map Unit Components	Rock outcrop (35 percent)	Rubble land (30 percent)	Cheadle family (25 percent)
Position, Slope, and Elevation	On ridges and scarp breaks of mountain uplands; 60 to 100 percent slopes; 7000 to 9900 feet.	On smooth sideslopes and strongly disected drainages of mountain uplands; 60 to 100 percent slopes; 7000 to 9900 feet.	On sideslopes and ridges of mountain uplands; 60 to 90 percent slopes; 7000 to 9900 feet.
Typical Vegetation and Precipitation (ppt)	Barren; 25 to 35 inches ppt.	Barren; 25 to 35 inches ppt.	
Surface Layer	NOT APPLICABLE; Basalt, andesite or conglomerated tuff bedrock with minor accumulations of aeolian soil deposition in some fractures.	NOT APPLICABLE: Colluvial deposition of angular cobbles, stones and boulders of basalt or andesite rock material.	0 to 17 inches; dark grayish brown to brown very cobbly loam to very cobbly clay loam; granular and subangular blocky structure, slightly hard to hard, pH 6.6.
Rooting Depth (in.) to Underlying Material			8 to 20; andesite
Erosion Factor (K)			.37
Max. Erosion Hazard			Very High
Soil Permeability			Moderately rapid
Drainage Class			Well drained
Soil Manageability Class Group	Not Rated IV	4Gd	
Forest Site Class			7 (non-commercial)
Range Site			9,1
Water Runoff Potential	Very Rapid	Very Rapid	Very Rapid
Watershed Sensitivity	0 (Very High)	2	2
Hydrologic Soil Group			D
Available Water Capacity (AWC) Upper 20 inches			Very Low to Low 1.0 to 2.4 inches
Susceptibility to Burning Damage			Moderate
Slope Stability Hazard			Moderate
Allowable Soil Loss			1 tons/acre/year
Chance of Seedling Survival			Not Rated
Rating for Timber Site			Not Rated
R-Value			30-60
Soil horizons in inches, USDA, Unified, AASHTO			0-12; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4, A-6 12-17; Very cobbly clay loam Unified: SC AASHTO: A-6, A-7 17+; Unweathered bedrock
Included Areas:	Included with this unit in mapping and making up about 10 percent of the acreage are the Behanin, Supervisor families and Lithic Cryochrepts.		

242 ROVAL-DEVEN FAMILIES ASSOCIATION, 1 to 10 percent slopes

Map Unit Components	Roval family (50 percent)	Deven family (35 percent)
Position, Slope, and Elevation	On upper sideslopes and slightly convex areas of undulating basalt plateaus; 2 to 10 percent slopes; 4700 to 5800 feet.	On nearly level to slight concave areas of undulating basalt plateaus; 1 to 10 percent slopes; 4700 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few ponderosa pine, mountain mahogany, low sagebrush, big sagebrush, sandberg bluegrass, cheatgrass; 14 to 16 inches ppt.	Western juniper, low sagebrush, Phlox spp., sandberg bluegrass, Idaho fescue, cheatgrass, bottlebrush; 14 to 16 inches ppt.
Surface Layer	0 to 2 inches; brown very cobbly loam, platy and granular structure, slightly hard, pH 6.6.	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.
Substratum	13 to 14 inches; strongly cemented silica duripan.	
Rooting Depth (in.) to Underlying Material	10 to 20; silica duripan over basalt	10 to 20; basalt
Erosion Factor (K)	.37	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Slow	Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2ed	2ed
Group	II	
Forest Site Class	7 (non-commercial	7 (non-commercial
Range Site	8	8
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	6 (Moderate)	5
Hydrologic Soil Group	D	D
Available Water Capacity (AWC)	Low	Very Low to Low
Upper 20 inches	1.5 to 3.0 inches	1.4 to 2.8 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-10; Clay loam Unified: CL, MH AASHTO: A-6, A-7 10-13; Clay Unified: CH AASHTO: A-7 13-14; Silica duripan 14+; Unweathered bedrock	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Bieber, Pass Canyon, Barnard families, Lithic Xerorthents, mesic, and Rock outcrop.	

243 ROVAL-PASS CANYON FAMILIES COMPLEX, 1 to 15 percent slopes

Map Unit Components	Roval family (45 percent)	Pass Canyon family (40 percent)
Position, Slope, and Elevation	On nearly level to undulating basalt plateaus; 1 to 15 percent slopes; 4500 to 5800 feet.	On nearly level to undulating basalt plateaus; 1 to 15 percent slopes; 4500 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, rabbitbrush, Plhox spp., Idaho fescue, sandberg bluegrass, bottlebrush, cheatgrass; 14 to 16 inches ppt.	Western juniper, low sagebrush, rabbitbrush, Phlox spp., Idaho fescue, sandberg bluegrass, bottlebrush, cheatgrass; 14 to 16 inches ppt.
Surface Layer	0 to 2 inches; brown very cobbly loam, platy and granular structure, slightly hard, pH 6.6	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam, granular and platy structure, slightly hard, pH 6.8 to 6.6.
Substratum	13 to 14 inches; strongly cemented silica duripan.	
Rooting Depth (in.) to Underlying Material	10 to 20; silica duripan over basalt.	10 to 20; basalt
Erosion Factor (K)	.37	.32
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Slow	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	 2ed II	 2ed
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	8	8
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	6 (Moderate)	6
Hydrologic Soil Group	D	D
Available Water Capacity (AWC) Upper 20 inches	Low 1.5 to 3.0 inches	Very Low to Low 1.3 to 2.6 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-10; Clay loam Unified: CL, MH AASHTO: A-6, A-7 10-13; Clay Unified: CH AASHTO: A-7 13-14; Silica duripan 14+; Unweathered bedrock	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-4; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 4-12; Clay loam, cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Barnard, Bieber, Deven, Puls and Gwin families and Lithic Xerorthents, mesic.	

244 RUCKLES-BIEBER FAMILIES COMPLEX, 2 to 30 percent slopes

Map Unit Components	Ruckles family (45 percent)	Bieber family (35 percent)
Position, Slope, and Elevation	On sideslopes and toeslopes of mountain uplands; 5 to 30 percent slopes; 4800 to 5800 feet.	On toeslopes and alluvial fans of mountain uplands; 2 to 20 percent slopes; 4800 to 5800 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, big sagebrush, rabbitbrush, Idaho fescue, bottlebrush, Poa spp.; 14 to 16 inches ppt.	Few western juniper, low sagebrush, Phlox spp., western yarrow, Idaho fescue, bottlebrush, Poa spp.; 14 to 16 inches ppt.
Surface Layer	0 to 4 inches; brown, very cobbly loam, granular structure, soft, pH 7.0.	0 to 4 inches; brown very cobbly loam, blocky and granular structure, hard, pH 6.8.
Substratum		18 plus inches; strongly cemented silica duripan
Rooting Depth (in.) to Underlying Material	10 to 20; basalt, tuff	10 to 20; silica duripan over basalt, tuff
Erosion Factor (K)	.37	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Slow	Very slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2edx	2edx
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	8	8
Water Runoff Potential	Rapid	Moderate
Watershed Sensitivity	4 (Moderate)	5
Hydrologic Soil Group	D	D
Available Water Capacity (AWC)	Very Low to Low	Very Low to low
Upper 20 inches	1.0 to 2.0 inches	1.2 to 2.5 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low to Moderate	Low
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Very cobbly loam Unified: SM, SC AASHTO: A-4, A-6 4-14; Very gravelly clay Unified: GC, CH AASHTO: A-7 14+; Unweathered bedrock	0-4; Very cobbly loam Unified: SC, CL AASHTO: A-6 4-18; Clay Unified: CH AASHTO: A-7 18+; Silica duripan
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Deven, Aikman and Keating families and Lithic Xerorthents, mesic.	

245 RUCKLES-GWIN FAMILIES-ROCK OUTCROP ASSOCIATION, 20 to 40 percent slopes

Map Unit Components	Ruckles family (35 percent)	Gwin family (30 percent)	Rock outcrop (20 percent)
Position, Slope, and Elevation	Mostly on southerly aspects of sideslopes of mountain uplands; 20 to 40 percent slopes; 4600 to 6000 feet.	Mostly on southerly aspects of upper sideslopes and ridges of mountain uplands; 20 to 40 percent slopes; 4600 to 6000 feet.	On ridges, and knolls of mountain uplands; 20 to 40 percent slopes; 4600 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, few ponderosa pine, mountain mahogany, bitterbrush, mulesear, low sagebrush, Idaho fescue, bottlebrush, sandberg bluegrass; 14 to 18 inches ppt.	Western juniper, mountain mahogany, low sagebrush, big sagebrush, Idaho fescue, sandberg bluegrass, cheatgrass; 14 to 18 inches ppt.	
Surface Layer	0 to 4 inches; brown very cobbly loam, granular structure, soft, pH 7.0.	0 to 11 inches; dark grayish brown very cobbly loam, granular and blocky structure, slightly hard, pH 6.8.	NOT APPLICABLE: Basalt, andesite or conglomerated tuff bedrock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt, tuff	8 to 20; basalt	
Erosion Factor (K)	.37	.37	
Max. Erosion Hazard	Moderate to high	Moderate to high	
Soil Permeability	Slow	Moderately slow	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	 3Ed III	 2Edx	
Forest Site Class	7 (non-commercial)	7 (non-commercial)	
Range Site	8	8, 1	
Water Runoff Potential	Rapid	Rapid	Very Rapid
Watershed Sensitivity	4 (High)	5	2
Hydrologic Soil Group	D	D	
Available Water Capacity (AWC) Upper 20 inches	 1.0 to 2.0 inches	 0.8 to 1.9 inches	
Susceptibility to Burning Damage	Moderate	Moderate	
Slope Stability Hazard	Low to Moderate	Low	
Allowable Soil Loss	1 tons/acre/year	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	Not Rated	
Rating for Timber Site	Not Rated	Not Rated	
R-Value	0-30	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Very cobbly loam Unified: SM, SC AASHTO: A-4, A-6 4-14; Very gravelly clay Unified: GC, CH AASHTO: A-7 14+; Unweathered bedrock	0-11; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 11-18; Extremely cobbly clay loam Unified: SC, CL AASHTO: A-6 18+; Unweathered bedrock	

Included Areas: Included with this unit in mapping and making up about 15 percent of the acreage are the Fordice, Lawyer, Pass Canyon, Deven families and Lithic Xerorthents, mesic.

246 MENZEL-HOLLAND FAMILIES, 4 to 15 inch pumice overburden-ROCK OUTCROP ASSOCIATION, 15 to 40 percent slopes

Map Unit Components	Menzel family (35 percent)	Holland family (25 percent)	Rock outcrop (25 percent)
Position, Slope, and Elevation	On basalt plateau scarp breaks; 15 to 40 percent slopes; 4300 to 4700 feet.	On basalt plateau scarp breaks; 15 to 40 percent slopes; 4300 to 4700 feet.	On ridges and upper sideslopes of basalt plateau scarp breaks; 20 to 40 percent slopes; 4300 to 4700 feet.
Typical Vegetation and Precipitation (ppt)	Ponderosa pine, bitterbrush, big sagebrush, rabbitbrush, greenleaf manzanita, Ross's sedge, few grasses; 16 to 20 inches ppt.	Ponderosa pine, western juniper, big sagebrush, bitterbrush, rabbitbrush, Ribes spp., needlegrass, Idaho fescue, Ross's sedge, other grasses; 16 to 20 inches ppt.	
Surface Layer	1/2 to 0 inches of ponderosa pine needles and pumice gravel pavement, over 14 inches of pumice overburden consisting of grayish brown gravelly coarse sand grading to very pale brown extremely gravelly coarse sand (pumice thickness ranges from 4 to 15 inches) OVER 14 to 18 inches; yellowish brown gravelly sandy loam, granular and blocky structure, soft, pH 6.8.	1 to 0 inches ponderosa pine needles and twigs, over 12 inches of pumice overburden consisting of 0 to 5 inches grayish brown gravelly coarse sand; 5 to 12 inches; very pale brown extremely gravelly coarse sand (thickness ranges from 4 to 15 inches) OVER 12 to 21 inches; brown loam, subangular blocky structure, hard, pH 6.6.	NOT APPLICABLE: Basalt bedrock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	40 plus; basalt, colluvium	20 to 40; basalt	
Erosion Factor (K)	.15	.20	
Max. Erosion Hazard	Moderate	Moderate	
Soil Permeability	Rapid in the pumice overburden to moderately rapid below.	Rapid in the pumice overburden to moderately slow below.	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	2ep II	2ep	
Forest Site Class	5 (3-4)	6 (4-5)	
Range Site	Not placed in a range site.	Not placed in a range site.	
Water Runoff Potential	Very Slow	Slow	Very Rapid
Watershed Sensitivity	9 (Moderate)	8	2
Hydrologic Soil Group	A	B	
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.4 inches	Low to Moderate 2.6 inches	
Susceptibility to Burning Damage	Moderate to High	Moderate to High	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	3 tons/acre/year	2 tons/acre/year	
Chance of Seedling Survival	Moderate	Moderate	
Rating for Timber Site	Fair (5, 10)	Fair (5, 7, 10)	
R-Value	60+	30-60	

246 MENZEL-HOLLAND FAMILIES, 4 to 15 inch pumice overburden-ROCK OUTCROP ASSOCIATION (continued)

Soil horizons in inches, USDA, Unified, AASHTO

0-4; Gravelly coarse sand
Unified: SM
AASHTO: A-1-b

4-14; Extremely gravelly coarse sand
Unified: GW-GM
AASHTO: A-1-a

14-60; Gravelly sandy loam, very gravelly sandy loam
Unified: SM
AASHTO: A-1-b, A-2-4

0-5; Gravelly coarse sand
Unified: SW-SM, SM
AASHTO: A-1-b

5-12; Extremely gravelly coarse sand
Unified: GW-GM
AASHTO: A-1-a

12-21; Loam
Unified: CL
AASHTO: A-6

21-37; Clay loam
Unified: CL, MH
AASHTO: A-6, A-7

37+; Unweathered bedrock

Included Areas:

Included with this unit in mapping and making up about 15 percent of the acreage are the Alcot, Skalan families and Lithic Xerorthents, mesic, areas of steeper slopes, and soils similar to the Menzel and Holland families but with a deeper pumice overburden.

247 SEARLES-GWIN FAMILIES-LAVA FLOW COMPLEX, 1 to 10 percent slopes

Map Unit Components	Searles family (40 percent)	Gwin family (25 percent)	Lava flow (20 percent)
Position, Slope, and Elevation	On knolls and depressions of undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 5000 feet.	On knolls and depressions of undulating basalt plateaus; 1 to 10 percent slopes; 4200 to 5000 feet.	On ridges and moundlike protrusions of fractured and disaggregated lava flow rock on undulating basalt plateaus; 2 to 10 percent slopes 4200 to 5000 feet.
Typical Vegetation and Precipitation (ppt)	Bitterbrush, big sagebrush, mountain mahogany, Idaho fescue, stipa, bluebunch wheatgrass, Bromus spp., other grasses, 10 to 14 inches ppt.	Bitterbrush, big sagebrush, Idaho fescue, bluebunch wheatgrass, Bromus spp., Agropiran spp., Stipa, other grasses, western juniper and mountain mahogany, 10 to 14 inches ppt.	
Surface Layer	0 to 7 inches; brown gravelly sandy loam, granular structure, soft, pH 7.0.	0 to 11 inches; dark grayish brown very cobbly loam, subangular blocky and granular structure, slightly hard, pH 6.8.	NOT APPLICABLE: Fractured vesicular basalt flow rock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt	10 to 20; basalt	
Erosion Factor (K)	.24	.37	
Max. Erosion Hazard	Low	Moderate	
Soil Permeability	Moderately slow	Moderately slow	
Drainage Class	Well drained	Well drained	
Soil Manageability Class	2x	2edx	
Group	II		
Forest Site Class	7 (non-commercial)	7 (non-commercial)	
Range Site	17, 16	7	
Water Runoff Potential	Very Slow	Slow	Rapid
Watershed Sensitivity	8 (Moderate)	6	5
Hydrologic Soil Group	B	D	
Available Water Capacity (AWC)	Low to Moderate	Very Low to Low	
Upper 20 inches	2.3 inches	1.0 to 2.0 inches	
Susceptibility to Burning Damage	Low	Low	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	Not Rated	
Rating for Timber Site	Not Rated	Not Rated	
R-Value	30-60	30-60	

Soil horizons in inches, USDA, Unified, AASHTO

0-7; Gravelly sandy loam
Unified: SM, SM-SC
AASHTO: A-4

7-14; Cobbly loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

14-34; Exteremly cobbly loam
Unified: SC
AASHTO: A-6

34+; Unweathered bedrock

0-11; Very cobbly loam
Unified: SM, SM-SC
AASHTO: A-4

11-18; Extremely cobbly clay loam
Unified: SC, CL
AASHTO: A-6

18+; Unweathered bedrock

Included Areas:

Included with this unit in mapping and making up about 15 percent of the acreage are the Lithic Xerorthents, mesic, Pass Canyon, Bakeoven, Stukel, Fordice, and Neer families and lava flow rock with steeper slopes.

249 SHELD-AHART FAMILIES ASSOCIATION, 2 to 20 percent slopes

Map Unit Components	Sheld family (50 percent)	Ahart family (30 percent)
Position, Slope, and Elevation	On sideslopes of volcanic mountain uplands; 5 to 20 percent slopes; 5600 to 6200 feet.	On toeslopes and alluvial draws of volcanic mountain uplands; 2 to 15 percent slopes; 5600 to 6200 feet.
Typical Vegetation and Precipitation (ppt)	Mixed conifer forest of white fir, ponderosa pine, incense cedar, plus greenleaf manzanita, snowberry ceonothus, currant spp., Ross's sedge, grasses; 30 to 40 inches ppt.	Mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus greenleaf manzanita, snowberry, coenothus, currant spp., Ross's sedge, grasses; 30 to 40 ppt.
Surface Layer	2 to 0 inches of white fir and ponderosa pine needles and twigs, over 0 to 25 inches; dark grayish brown and brown gravelly fine sandy loam and very cobbly loam, granular and subangular blocky structure; soft, pH 5.8 to 6.2.	1/2 to 0 inches mostly undecomposed white fir needles and grass over 0 to 12 inches; brown gravelly fine sandy loam; granular structure; soft; pH 6.2.
Substratum	44 to 50 inches; light yellowish brown extremely cobbly loam, massive, soft, pH 6.2.	28 to 60 inches; light yellowish brown very gravelly fine sandy loam; massive; soft; pH 6.0.
Rooting Depth (in.) to Underlying Material	40 plus inches; hard basalt.	40 plus inches; hard basalt, alluvium
Erosion Factor (K)	.20	.20
Max. Erosion Hazard	Low to moderate	Low
Soil Permeability	Moderate	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class	2e	1
Group	II	
Forest Site Class	4 (2-3)	4 (2-3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Very slow
Watershed Sensitivity	9 (Low)	9
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 3.1 inches	Moderate to High 3.0 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	High	High
Rating for Timber Site	Good	Good
R-Value	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-12; Gravelly fine sandy loam Unified: SM AASHTO: A-4 12-50; Very cobbly loam, very gravelly loam,extremely cobbly loam Unified: SM, SM-SC AASHTO: A-4 50+; Unweathered bedrock	0-60; Gravelly fine sandy loam Unified: SM AASHTO: A-2-4, A-4

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the Lithic Xerumbrepts, Stonewell and Yallani families and Rock outcrop.

250 SIMPSON FAMILY, 1 to 10 percent slopes

Map Unit Components	**Simpson family (75 percent)**
Position, Slope, and Elevation	On lower sideslopes, toeslopes and alluvial basins of basalt plateaus; 1 to 10 percent slopes; 4300 to 4700 feet.
Typical Vegetation and Precipitation (ppt)	Rabbitbrush, big sagebrush, few western juniper, sandberg bluegrass, wheatgrass; 10 to 14 inches ppt.
Surface Layer	0 to 3 inches; brown loam, granular structure, slightly hard, pH 7.2.
Substratum	28 to 30 inches; yellowish brown semi-consolidated ashy tuff which rubs to a clay loam, massive, very hard, pH 7.6.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt
Erosion Factor (K)	.43
Max. Erosion Hazard	Low
Soil Permeability	Slow
Drainage Class	Well drained
Soil Manageability Class Group	 1 I
Forest Site Class	7 (non-commercial)
Range Site	12
Water Runoff Potential	Slow
Watershed Sensitivity	6 (Moderate)
Hydrologic Soil Group	C
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.7 inches
Susceptibility to Burning Damage	Low
Slope Stability Hazard	Low
Allowable Soil Loss	2 tons/acre/year
Chance of Seedling Survival	Not Rated
Rating for Timber Site	Not Rated
R-Value	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-3; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 3-8; Silty clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 8-28; Silty clay Unified: CH AASHTO: A-7 28-30; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 30+; Unweathered bedrock
Included Areas:	Included with this soil in mapping and making up about 25 percent of the acreage are the Deven, Dishner, Pass Canyon families and Lithic Xerorthents, mesic.

251 SIMPSON-DEVEN FAMILIES ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	Simpson family (55 percent)	Deven family (25 percent)
Position, Slope, and Elevation	On lower sideslopes, toeslopes and alluvial fans of basalt plateaus; 1 to 15 percent slopes;4300 to 4800 feet.	On upper sideslopes, ridges and knolls of basalt plateaus; 2 to 20 percent slopes; 4300 to 4800 feet.
Typical Vegetation and Precipitation (ppt)	Big sagebrush, rabbitbrush, Phlox spp., Idaho fescue, sandberg bluegrass; 10 to 14 inches ppt.	Western juniper, low sagebrush, rabbitbrush, Phlox spp., Idaho fescue, sandberg bluegrass cheatgrass; 10 to 14 inches ppt.
Surface Layer	0 to 3 inches; brown loam, granular structure, slightly hard, pH 7.2.	0 to 2 inches; brown cobbly loam, granular structure, soft, pH 6.3.
Substratum	28 to 30 inches; yellowish brown semi-consolidated ashy tuff which rubs to a clay loam, massive, very hard, pH 7.6.	
Rooting Depth (in.) to Underlying Material	20 to 40; hard basalt	10 to 20; hard basalt
Erosion Factor (K)	.43	.37
Max. Erosion Hazard	Low to moderate	Moderate
Soil Permeability	Slow	Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class	2e	2ed
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	12, 17	7
Water Runoff Potential	Slow	Moderate
Watershed Sensitivity	6 (Moderate)	5
Hydrologic Soil Group	C	D
Available Water Capacity (AWC)	Low to Moderate	Very Low to Low
Upper 20 inches	2.7 inches	1.4 to 2.8 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	0-30	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-3; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 3-8; Silty clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 8-28; Silty clay Unified: CH AASHTO: A-7 28-30; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7	0-2; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 2-7; Clay loam Unified: CL, MH, CH AASHTO: A-6, A-7 7-16; Clay Unified: CH AASHTO: A-7 16+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the Dishner, Castlevale, Barnard, Jacknife, Bieber, Pass Canyon Families, Lithic Xerorthents, mesic, and rock outcrop.

252 SMARTS deep-SMARTS FAMILY COMPLEX, 2 to 20 percent slopes

Map Unit Components	Smarts family, deep (50 percent)	Smarts family (30 percent)
Position, Slope, and Elevation	On sideslopes and toeslopes of mountain uplands; 2 to 20 percent slopes; 5300 to 7500 feet.	On upper sideslopes, knolls and incised drainages of mountain uplands; 2 to 20 percent slopes; 5300 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus green leaf manzanita, snowberry, serviceberry, Ross's sedge, few grasses, (Note - in the northeastern part of the survey area stands of ponderosa pine/ jeffrey pine are found); 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus few western juniper, few lodgepole pine at higher elevations, greenleaf manzanita, serviceberry, Ross's sedge, few grasses, (Note- in the northeastern part of the survey area stands of ponderosa pine/jeffrey pine are found); 20 to 30 inches ppt.
Surface Layer	2 to 0 inches of decomposed and undecomposed white for needles and twigs, over 0 to 18 inches; brown stony loam, granular structure, soft, pH 6.2.	1/2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 20 inches reddish brown stony loam and very cobbly loam, granular and blocky structure, slightly hard and hard, pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; basalt, tuff	20 to 40; basalt, tuff
Erosion Factor (K)	.32	.32
Max. Erosion Hazard	Low to moderate	Low to moderate
Soil Permeability	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	 2ep II	 2epx
Forest Site Class	4 (2-3)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site
Water Runoff Potential	Very Slow	Slow
Watershed Sensitivity	8 (Low)	7
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.6 inches	Low to Moderate 2.1 inches
Susceptibility to Burning Damage	Low to Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate	Low
Rating for Timber Site	Fair (1)	Fair (1,3,7)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-18; Stony loam Unified: ML-CL, CL AASHTO: A-4 18-50; Extremely gravelly clay loam, extremely gravelly loam Unified: SC AASHTO: A-2-6, A-6 50+; Weathered bedrock	1-20; Stony loam, very cobbly loam Unified: ML-CL, ML AASHTO: A-4 20-28; Very gravelly loam Unified: SM-SC, SC AASHTO: A-4, A-6 28-35; Extremely gravelly clay loam Unified: GC AASHTO: A-2-6, A-2-7 35+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Mascamp, Lamondi, DeMasters and Merlin families.	

253 SMARTS deep-SMARTS FAMILY COMPLEX, 20 to 40 percent slopes

Map Unit Components	Smarts family, deep (45 percent)	Smarts family (35 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 20 to 35 percent slopes; 5500 to 7500 feet.	On upper sideslopes, ridges and incised drainages of mountain uplands; 20 to 40 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus greenleaf manzanita, snowberry, serviceberry, Ross's sedge, few grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus few western juniper, few lodgepole pine at higher elevations; greenleaf manzanita, mulesear, serviceberry, Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	2 to 0 inches of decomposed and undecomposed white fir needles and twigs over 0 to 18 inches; brown stony loam, granular structure, soft, pH 6.2.	1/2 to 0 inches; ponderosa pine and white fir needles and twigs, over 0 to 20 inches; reddish brown stony loam and very cobbly loam, granular and blocky structure, slightly hard and hard, pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; basalt	20 to 40; basalt
Erosion Factor (K)	.32	.32
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	 2ep II	 2epx
Forest Site Class	4 (2-3)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	7 (Moderate)	7
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.6 inches	Low to Moderate 2.1 inches
Susceptibility to Burning Damage	Low to Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	2 tons/acre/year
Chance of Seedling Survival	Moderate	Low
Rating for Timber Site	Fair (1)	Fair (1,3,7)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-18; Stony loam Unified: ML-CL, CL AASHTO: A-4 18-50; Extremely gravelly clay loam, extremely gravelly loam Unified: SC AASHTO: A-2-6, A-6 50+; Weathered bedrock	0-20; Stony loam, very cobbly loam Unified: ML-CL, ML AASHTO: A-4 20-28; Very gravelly loam Unified: SM-SC, SC AASHTO: A-4, A-6 28-35; Extremely gravelly clay loam Unified: GC AASHTO: A-2-6, A-2-7 35+; Weathered bedrock
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the DeMasters, Lamondi, Mascamp, Anatone families, Lithic Xerorthents, frigid, and rock outcrop.	

254 SMARTS-BERTAG-DEMASTERS FAMILIES, deep ASSOCIATION, 10 to 35 percent slopes

Map Unit Components	Smarts family, deep (35 percent)	Bertag family, deep (25 percent)	DeMasters family, deep (20 percent)
Position, Slope, and Elevation	On upper sideslopes and ridges of mountain uplands;; 10 to 35 percent slopes; 5500 to 7500 feet.	On middle to lower sideslopes and draws of mountain uplands; 10 to 35 percent slopes; 5500 to 7500 feet.	On lower sideslopes, toeslopes and alluvial fans of mountain uplands; 10 to 35 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, plus mountain mahogany, big sagebrush, ceonothus, mulesear, snowberry, Ross's sedge, few grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, plus few quaking aspen, snowberry, serviceberry, current spp., Ross's sedge, few grasses; 20 to 30 inches ppt.	
Surface Layer	2 to 0 inches of decomposed and undecomposed white fir needles and twigs, over 0 to 18 inches; brown stony loam, granular structure, soft, pH 6.2.	1-1/2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 13 inches; dark brown loam, granular and blocky structure, slightly hard, pH 6.4.	1-1/2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 14 inches; brown loam, granular and blocky structure, soft, pH 5.6 to 6.4.
Rooting Depth (in.) to Underlying Material	40 plus; basalt tuff	40 plus; tuff	40 plus; basalt, tuff, alluvium
Erosion Factor (K)	.32	.43	.32
Max. Erosion Hazard	Low to moderate	Moderate	Low to moderate
Soil Permeability	Moderately slow	Slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2ep II	2s	2e
Forest Site Class	4 (2-3)	4 (2-3)	4 (2-3)
Range Site	No placed in a range site.	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Moderate	Slow
Watershed Sensitivity	7 (Moderate)	5	7
Hydrologic Soil Group	B	C	B
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.6 inches	Moderate to High 2.9 inches	Moderate to High 3.4 inches
Susceptibility to Burning Damage	Low to Moderate	Low to Moderate	Low to Moderate
Slope Stability Hazard	Low	Low to Moderate	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate	Moderate to High	High
Rating for Timber Site	Fair (1)	Good	Good
R-Value	30-60	0-30	30-60
Soil horizons in inches, USDA, Unificd, AASHTO	0-18; Stony loam Unified: ML-CL, CL AASHTO: A-4 18-50; Extremely gravelly clay loam, extremely gravelly loam Unified: SC AASHTO: A-2-6, A-6 50+; Weathered bedrock	0-13; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 13-20; Cobbly clay loam Unified: CL, CH AASHTO: A-6, A-7 20-60; Gravelly clay Unified: CH AASHTO: A-7	0-14; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 14-37; Gravelly clay loam Unified: CL AASHTO: A-6 37-60; Extremely cobbly clay loam Unified: SC, CL AASHTO: A-6, A-7

Included Areas:

Included with these soils in mapping and making up about 20 percent of acreage are the Cavanaugh, Mascamp, Merlin, Manila, Lamondi and Vipont families, and moderately deep Smarts and DeMasters families.

255 SMARTS deep-CAVANAUGH FAMILIES COMPLEX, 10 to 35 percent slopes

Map Unit Components	Smarts family, deep (50 percent)	Cavanaugh Family (30 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 10 to 35 percent slopes; 5500 to 6600 feet.	On sideslopes and toeslopes of mountain uplands; 10 to 35 percent slopes; 5500 to 6600 feet.
Typical Vegetation and Precipitation (ppt)	White fire forest, or mixed conifer forest of ponderosa pine, white fir, plus squaw carpet mulesear, snowberry, bitterbrush, Ross's sedge, grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of ponderosa pine, white fir, plus western juniper, mountain mahogany, squaw carpet, big sagebrush, bitterbrush, mulesear, Ross's sedge, grasses; 20 to 30 inches ppt.
Surface Layer	2 to 0 inches of decomposed and undecomposed white fir needles and twigs, over 0 to 18 inches; stony loam, granular structure, soft, pH 6.2.	1 to 0 inches of white fir and ponderosa pine needles, over 0 to 13 inches; dark brown and brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.4.
Substratum	32 to 50 inches; pale brown extremely gravelly loam, massive, soft, pH 6.0.	
Rooting Depth (in.) to Underlying Material	40 plus; basalt, tuff	30 plus; tuff basalt
Erosion Factor (K)	.32	.37
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderately slow	Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	2ep II	2s
Forest Site Class	4 (2-3)	4-5 (3-4)
Range Site	Not palced in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Moderate
Watershed Sensitivity	7 (Moderate)	5
Hydrologic Soil Group	B	C
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.6 inches	Low to Moderate 2.5 inches
Susceptibility to Burning Damage	Low to Moderate	Moderate
Slope Stability Hazard	Low	Low to Moderate
Allowable Soil Loss	3 tons/acre/year	2, 3 tons/acre/year
Chance of Seedling Survival	Moderate	Low to Moderate
Rating for Timber Site	Fair (1)	Fair (3)
R-Value	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-18; Stony loam Unified: ML-CL, CL AASHTO: A-4 18-50; Extremely gravelly clay loam, extremely gravelly loam Unified: SC AASHTO: A-2-6, A-6 50+; Weathered bedrock	0-7; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 7-13; Very cobbly loam Unified: SM-SC, SC AASHTO: A-4, A-6 13-18; Very cobbly clay loam Unified: CL AASHTO: A-6 18-60; Very gravelly clay, extremely gravelly clay loam Unified: GC AASHTO: A-2-7, A-7

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the DeMasters, Manila, Bertag and Anatone families, Rock outcrop and Smarts family, moderately deep.

256 SMARTS deep-CAVANAUGH FAMILIES COMPLEX, 35 to 60 percent slopes

Map Unit Components	Smarts family, deep (55 percent)	Cavanaugh Family (25 percent)
Position, Slope, and Elevation	On sideslopes of basalt plateau breaks and mountain uplands; 35 to 60 percent slopes; 5500 to 6600 feet.	On sideslopes of basalt plateau breaks and mountain uplands; 35 to 60 percent slopes; 5500 to 6600 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of ponderosa pine, white fir, plus squaw carpet mulesear, snowberry, bitterbrush, Ross's sedge, grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of ponderosa pine, white fir, plus western juniper, mountain mahogany, squaw carpet, big sagebrush, bitterbrush, mulesear, Ross's sedge, grasses; 20 to 30 inches ppt.
Surface Layer	2 to 0 inches of decomposed and undecomposed white fir needles and twigs, over 0 to 18 inches; stony loam, granular structure, soft, pH 6.2.	1 to 0 inches of white fir and ponderosa pine needles, over 0 to 13 inches; dark brown and brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.4.
Substratum	32 to 50 inches; pale brown extremely gravelly loam, massive, soft, pH 6.0.	
Rooting Depth (in.) to Underlying Material	40 plus; basalt, tuff	30 plus; tuff basalt
Erosion Factor (K)	.32	.37
Max. Erosion Hazard	High	High
Soil Permeability	Moderately slow	Slow
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	3ep III	3s
Forest Site Class	4 (2-3)	4-5 (3-4)
Range Site	Not palced in a range site.	Not placed in a range site.
Water Runoff Potential	Moderate	Rapid
Watershed Sensitivity	6 (Moderate)	4
Hydrologic Soil Group	B	C
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.6 inches	Low to Moderate 2.5 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	High
Allowable Soil Loss	3 tons/acre/year	2, 3 tons/acre/year
Chance of Seedling Survival	Moderate	Low to Moderate
Rating for Timber Site	Fair (1,8)	Fair (3,8)
R-Value	30-60	0-30
Soil horizons in inches, USDA, Unified, AASHTO	0-18; Stony loam Unified: ML-CL, CL AASHTO: A-4 18-50; Extremely gravelly clay loam, extremely gravelly loam Unified: SC AASHTO: A-2-6, A-6 50+; Weathered bedrock	0-7; Cobbly loam Unified: ML-CL, CL AASHTO: A-4, A-6 7-13; Very cobbly loam Unified: SM-SC, SC AASHTO: A-4, A-6 13-18; Very cobbly clay loam Unified: CL AASHTO: A-6 18-60; Very gravelly clay, extremely gravelly clay loam Unified: GC AASHTO: A-2-7, A-7

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the DeMasters, Manila, Anatone and Merlin families, Rock outcrop and Smarts family, moderately deep.

257 SMARTS-MASCAMP FAMILIES ASSOCIATION, 40 to 60 percent slopes

Map Unit Components	Smarts family (50 percent)	Mascamp family (30 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 40 to 60 percent slopes; 5500 to 7500 feet.	On upper sideslopes, ridges and knolls of mountain uplands; 40 to 60 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus squaw carpet, snowbrush, serviceberry, manzanita, viola, mulesear, Ross's sedge, few grasses; 20 to 30 inches ppt.	Western juniper, low sagebrush, big sagebrush, rabbitbrush, mountain mahogany, Idaho fescue, cheatgrass, other grasses; 20 to 30 inches ppt.
Surface Layer	1/2 to 0 inches; ponderosa pine and white fir needles and twigs, over 0 to 20 inches; reddish brown stony loam and very cobbly loam, granular and blocky structure, slightly hard and hard, pH 6.6 to 6.8.	0 to 6 inches; dark grayish brown very cobbly loam, granular structure, slightly hard, pH 6.8.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt, tuff	10 to 20; basalt, tuff
Erosion Factor (K)	.32	.37
Max. Erosion Hazard	High	High to very high
Soil Permeability	Moderately slow	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class	3Ep	3Ed
Group	III	
Forest Site Class	5 (3-4)	7 (non-commercial)
Range Site	Not placed in a range site	9
Water Runoff Potential	Moderate	Rapid
Watershed Sensitivity	6 (Moderate)	4
Hydrologic Soil Group	B	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate	Very Low to Low
	2.1 inches	1.2 to 2.5 inches
Susceptibility to Burning Damage	Moderate to High	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Not Rated
Rating for Timber Site	Fair (1,3,7,8)	Not Rated
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-20; Stony loam, very cobbly loam Unified: ML, ML-CL AASHTO: A-4 20-28; Very gravelly loam Unified: SM-SC, SC AASHTO: A-4, A-6 28-35; Extremely gravelly clay loam Unified: GC AASHTO: A-2-6, A-2-7 35+; Weathered bedrock	0-12; Very cobbly loam, very gravelly loam Unified: SM-SC, SC AASHTO: A-4 12-19; Very gravelly clay loam Unified: SC AASHTO: A-2-6, A-6 19+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the Anatone, Bearskin, DeMasters, Lamondi, Bertag, Cavanaugh, Hades and Vipont families, Rock outcrop, Rubble land and unnamed soils similar to DeMasters family but not Pachic.

258 SMARTS-MASCAMP-DEMASTERS deep FAMILIES ASSOCIATION, 2 to 20 percent slopes

Map Unit Components	Smarts family (40 percent)	Mascamp family (25 percent)	DeMasters family, deep (20 percent)
Position, Slope, and Elevation	On sideslopes of mountain uplands; 2 to 20 percent slopes; 5500 to 7500 feet.	On upper sideslopes, ridges and knolls of mountain uplands; 5 to 20 percent slopes; 5500 to 7500 feet.	On lower sideslopes and alluvial draws of mountain uplands; 2 to 20 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus squaw carpet, snowbrush, serviceberry, manzanita, viola, mulesear, Ross's sedge, few grasses; 20 to 30 inches ppt.	Western juniper, low sagebrush, big sagebrush, rabbitbrush, mountain mahogany, Idaho fescue, cheatgrass, other grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus few quaking aspen, snowbrush, service- berry, forbes, Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	1/2 to 0 inches; ponderosa pine and white fir needles and twigs, over 0 to 20 inches; reddish brown stony loam and very cobbly loam, granular and blocky structure, stlightly hard and hard, pH 6.6 to 6.8.	0 to 6 inches; dark grayish brown very cobbly loam, granular structure, slightly hard, pH 6.8.	1-1/2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 14 inches; brown loam, granular and blocky structure, soft, pH 5.6 to 6.4.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt, tuff	10 to 20; basalt, tuff	40 plus; basalt, tuff, alluvium
Erosion Factor (K)	.32	.37	.32
Max. Erosion Hazard	Low to Moderate	Moderate	Low to Moderate
Soil Permeability	Moderately slow	Moderate	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class	2ep	2ed	2e
Group	II		
Forest Site Class	5 (3-4)	7 (non-commercial)	4 (2-3)
Range Site	Not placed in a range site	9	Not placed in a range site
Water Runoff Potential	Slow	Moderate	Very Slow
Watershed Sensitivity	7 (Moderate)	6	8
Hydrologic Soil Group	B	D	B
Available Water Capacity (AWC)	Low to Moderate	Very Low to Low	Moderate to High
Upper 20 inches	2.1 inches	1.2 to 2.5 inches	3.4 inches
Susceptibility to Burning Damage	Low to Moderate	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Not Rated	High
Rating for Timber Site	Fair (1,3,7)	Not Rated	Good
R-Value	30-60	30-60	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-20; Stony loam, very cobbly loam
Unified: ML, ML-CL
AASHTO: A-4

20-28; Very gravelly loam
Unified: SM-SC, SC
AASHTO: A-4, A-6

28-35; Extremely gravelly clay loam
Unified: GC
AASHTO: A-2-6, A-2-7

35+; Weathered bedrock

0-12; Very cobbly loam, very gravelly loam
Unified: SM-SC, SC
AASHTO: A-4

12-19; Very gravelly clay loam
Unified: SC
AASHTO: A-2-6, A-6

19+; Unweathered bedrock

0-14; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

14-37; Gravelly clay loam
Unified: CL
AASHTO: A-6

37-60; Extremely cobbly clay laom
Unified: SC, CL
AASHTO: A-6, A-7

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Anatone, Bearskin, Lamondi, Bertag, Cavanaugh, Hades and Vipont families, and Rock outcrop.

259 SMARTS-MASCAMP-DEMASTERS deep FAMILIES ASSOCIATION, 20 to 40 percent slopes

Map Unit Components	**Smarts family (40 percent)**	**Mascamp family (30 percent)**	**DeMasters family, deep (15 percent)**
Position, Slope, and Elevation	On sideslopes of mountain uplands; 20 to 40 percent slopes; 5500 to 7500 feet.	On upper sideslopes, ridges and knolls of mountain uplands; 20 to 40 percent slopes; 5500 to 7500 feet.	On lower sideslopes and alluvial draws of mountain uplands; 20 to 35 percent slopes; 5500 to 7500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus squaw carpet, snowbrush, serviceberry, manzanita, viola, mulesear, Ross's sedge, few grasses; 20 to 30 inches ppt.	Western juniper, low sagebrush, big sagebrush, rabbitbrush, mountain mahogany, Idaho fescue, cheatgrass, other grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus few quaking aspen, snowbrush, service- berry, forbes, Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	1/2 to 0 inches; ponderosa pine and white fir needles and twigs, over 0 to 20 inches; reddish brown stony loam and very cobbly loam, granular and blocky structure, stlightly hard and hard, pH 6.6 to 6.8.	0 to 6 inches; dark grayish brown very cobbly loam, granular structure, slightly hard, pH 6.8.	1-1/2 to 0 inches of ponderosa pine and white fir needles and twigs, over 0 to 14 inches; brown loam, granular and blocky structure, soft, pH 5.6 to 6.4.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt, tuff	10 to 20; basalt, tuff	40 plus; basalt, tuff, alluvium
Erosion Factor (K)	.32	.37	.32
Max. Erosion Hazard	Moderate	Moderate to High	Moderate
Soil Permeability	Moderately slow	Moderate	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2ep II	3Ed	2e
Forest Site Class	5 (3-4)	7 (non-commercial)	4 (2-3)
Range Site	Not placed in a range site	9	Not placed in a range site
Water Runoff Potential	Slow	Rapid	Slow
Watershed Sensitivity	7 (Moderate)	5	7
Hydrologic Soil Group	B	D	B
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.1 inches	Very Low to Low 1.2 to 2.5 inches	Moderate to High 3.4 inches
Susceptibility to Burning Damage	Moderate	Moderate	Low to Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Not Rated	High
Rating for Timber Site	Fair (1,3,7)	Not Rated	Good
R-Value	30-60	30-60	30-60

Soil horizons in inches, USDA, Unified, AASHTO

0-20; Stony loam, very cobbly loam
Unified: ML, ML-CL
AASHTO: A-4

20-28; Very gravelly loam
Unified: SM-SC, SC
AASHTO: A-4, A-6

28-35; Extremely gravelly clay loam
Unified: GC
AASHTO: A-2-6, A-2-7

35+; Weathered bedrock

0-12; Very cobbly loam, very gravelly loam
Unified: SM-SC, SC
AASHTO: A-4

12-19; Very gravelly clay loam
Unified: SC
AASHTO: A-2-6, A-6

19+; Unweathered bedrock

0-14; Loam
Unified: ML-CL, CL
AASHTO: A-4, A-6

14-37; Gravelly clay loam
Unified: CL
AASHTO: A-6

37-60; Extremely cobbly clay laom
Unified: SC, CL
AASHTO: A-6, A-7

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Anatone, Bearskin, Lamondi, Bertag, Cavanaugh, Hades and Vipont families, Rock outcrop and unnamed soils similar to DeMasters and Smarts families but no Pachic.

260 STONEWELL FAMILY, 40 to 60 inch pumice, 15 to 40 percent slopes

Map Unit Components	**Stonewell family, pumice (75 percent)**
Position, Slope, and Elevation	On sideslopes and toeslopes of volcanic mountain uplands with a deep deposit of recent pyroclastic pumice; 15 to 40 percent slopes; 5400 to 6400 feet.
Typical Vegetation and Precipitation (ppt)	Open mixed conifer stands of ponderosa pine, sugar pine, white fir and incense-cedar, and more dense stands of lodgepole pine above 5700 feet in some areas, plus greenleaf manzanita, bitterbrush, ceonothus, Ross's sedge, bunchgrasses; 25 to 40 inches ppt.
Surface Layer	1 to 0 inches; scattered ponderosa pine needles mixed with pumice gravels over, 0 to 4 inches; dark grayish brown very gravelly loamy sand (pumice) single grain structure, loose, pH 6.2.
Substratum	4 to 50 inches; light gray extremely gravelly coarse sand (pumice) grading to gravelly coarse sand at 44 to 50 inches over extremely cobbly sandy loam from 50 to 60 plus inches, single grain structure, loose, pH 6.2. to 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; pumice, cinders, basalt
Erosion Factor (K)	.15
Max. Erosion Hazard	Moderate
Soil Permeability	Rapid
Drainage Class	Somewhat excessively drained
Soil Manageability Class Group	 3eP III
Forest Site Class	6-7 (4 to non-commercial)
Range Site	Not placed in a range site.
Water Runoff Potential	Very Slow
Watershed Sensitivity	8 (Low)
Hydrologic Soil Group	A
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.4 inches
Susceptibility to Burning Damage	High
Slope Stability Hazard	Low
Allowable Soil Loss	3 tons/acre/year
Chance of Seedling Survival	Low to Moderate
Rating for Timber Site	Fair (6)
R-Value	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-4; Very gravelly loamy sand Unified: SW-SM, SM AASHTO: A-1-a 4-44; Extremely gravelly coarse sand Unified: GP AASHTO: A-1-a 44-50; Gravelly coarse sand Unified: SM AASHTO: A-1-a, A-1-b 50-60; Extremely cobbly sandy loam Unified: SM AASHTO: A-1-b, A-2-4
Included Areas:	Included with this soil in mapping and making up about 25 percent of the acreage are unnamed Cindery over Medial, and Cindery over Medial-Skeletal, frigid soils, Lithic Xerorthents frigid, Rock outcrop, areas of deeper pumice and steeper slopes.

261 STONEWELL-YALLANI FAMILIES ASSOCIATION, 6 to 20 inch pumice overburden, 5 to 30 percent slopes

Map Unit Components	**Stonewell family, pumice overburden phase (50 percent)**	**Yallani family, pumice overburden phase (30 percent)**
Position, Slope, and Elevation	On toeslopes and lower sideslopes of volcanic mountain uplands; 5 to 25 percent slopes; 5300 to 6300 feet.	On sideslopes and knolls of volcanic mountain uplands; 10 to 30 percent slopes; 5300 to 6300 feet.
Typical Vegetation and Precipitation (ppt)	Mixed conifer forest of ponderosa pine, white fir, sugar pine, incense-cedar, plus greenleaf manzanita, bitterbrush, Ross's sedge, bunchgrasses; 25 to 40 inches ppt.	Mixed conifer forest of ponderosa pine, white fir, sugar pine, incense-cedar, plus greenleaf manzanita, bitterbrush, Ross's sedge, bunchgrasses; 25 to 40 inches ppt.
Surface Layer	1 to 0 inches white fir needles and twigs; over 9 inches of pumice overburden consisting of light gray and yellowish brown gravelly and very gravelly loamy coarse sand; granular structure, soft, pH 6.6 (Thickness ranges from 6 to 20 inches) OVER 9 to 27 inches; brown gravelly and very gravelly sandy loam; granular and sub- angular blocky structure; soft; pH 6.4. *SUBSTRATUM: 27 to 60 inches; reddish yellow and brownish yellow very gravelly loamy coarse sand; massive; soft; pH 6.2.	1 to 0 inches; ponderosa pine and white fir needles and twigs, over 17 inches of pumice overburden consisting of 0 to 2 inches; gray extremely gravelly loamy coarse sand; 2 to 17 inches; white extremely gravelly coarse sand. (Thickness ranges from 6 to 20 inches) OVER 17 to 23 inches; yellowish brown gravelly coarse sandy loam, granular structure, soft, pH 6.2. *SUBSOIL: 23 to 60 inches; yellowish brown to dark yellowish brown extremely cobbly and stony coarse sandy loam, granular and blocky structure, soft, pH 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; cinders, basalt	40 plus; basalt, andesite
Erosion Factor (K)	.15	.15
Max. Erosion Hazard	Low to Moderate	Low to Moderate
Soil Permeability	Rapid in the pumice overburden to moderately rapid below.	Rapid in the pumice overburden to moderately rapid below.
Drainage Class	Somewhat excessively drained	Well drained
Soil Manageability Class	2ep	2ep
Group	II	
Forest Site Class	4 (2-3)	4-5 (2-4)
Range Site	Not placed in a range site.	Not placed in a range site
Water Runoff Potential	Very Slow	Slow
Watershed Sensitivity	9 (Low)	8
Hydrologic Soil Group	A	B
Available Water Capacity (AWC)	Moderate to High	Moderate
Upper 20 inches	2.6 inches	2.3 inches
Susceptibility to Burning Damage	High	High
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate	Moderate
Rating for Timber Site	Fair (5)	Fair (3,5)
R-Value	60+	60+

Soil horizons in inches, USDA, Unified, AASHTO

0-9; Gravelly loamy coarse sand, very gravelly loamy coarse sand
Unified: SW-SM, SM
AASHTO: A-1-a, A-1-b

9-27; Gravelly sandy loam, very gravelly sandy laom
Unified: SM
AASHTO: A-1-b

27-60; Very gravelly loamy coarse sand
Unified: SW-SM, SM
AASHTO: A-1-a, A-1-b

0-2; Extremely gravelly loamy coarse sand
Unified: SW-SM
AASHTO: A-1-a

2-17; Extremely gravelly coarse sand
Unified: GW-GM
AASHTO: A-1-a

17-60; Gravelly coarse sandy loam, extremely stony coarse sandy loam, extremely cobbly coarse sandy loam
Unified: SM
AASHTO: A-1-b, A-2-4

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Zynbar and Inville families, unnamed Cindery over Medial, and Cindery over Medial-Skeletal, frigid soils and Rock outcrop.

262 STONEWELL-YALLANI FAMILIES ASSOCIATION, 35 to 70 percent slopes

Map Unit Components	Stonewell family, (50 percent)	Yallani family, (25 percent)
Position, Slope, and Elevation	On smooth to concave sideslopes of volcanic cinder cones; 35 to 70 percent slopes; 4600 to 6000 feet.	On lower sideslopes of volcanic cinder cones; 35 to 60 percent slopes; 4600 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	Mixed conifer forest of ponderosa pine, white fir, incense-cedar, plus greenleaf manzanita, bitterbrush, Ross's sedge, squaw carpet; 25 to 40 inches ppt.	Mixed conifer forest of ponderosa pine, white fir, incense-cedar, plus greenleaf manzanita, bitterbrush, Ross's sedge, squaw carpet; 25 to 40 inches ppt.
Surface Layer	1 to 0 inches white fir and ponderosa pine needles and twigs, over 0 to 4 inches; dark grayish brown gravelly sandy loam, granular structure, soft, pH pH 6.4.	3 to 0 inches of mostly decomposed white fir twigs and needles over: 0 to 4 inches; brown gravelly sandy loam; granular and subangular blocky structure; soft; pH 6.4.
Rooting Depth (in.) to Underlying Material	30 plus inches, cinders, ash, vesicular basalt.	40 plus inches; basalt
Erosion Factor (K)	.20	.20
Max. Erosion Hazard	Moderate to high	Moderate to high
Soil Permeability	Moderately rapid	Moderately rapid
Drainage Class	Somewhat excessively drained	Well drained
Soil Manageability Class Group	3E III	3Ex
Forest Site Class	5-6 (3-5)	4-5 (2-4)
Range Site	Not placed in a range site.	Not placed in a range site
Water Runoff Potential	Moderate	Moderate
Watershed Sensitivity	7 (Moderate)	7
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.6 inches	Moderate to high 2.4 inches
Susceptibility to Burning Damage	Moderate to High	Moderate to High
Slope Stability Hazard	Low	Low
Allowable Soil Loss	2,3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate	Low to Moderate
Rating for Timber Site	Fair (8)	Fair (3,8)
R-Value	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-24; Gravelly sandy loam, very gravelly sandy loam Unified: SM AASHTO: A-1-b 24-42; Extremely gravelly loamy sand, extremely gravelly coarse sand Unified: GP AASHTO: A-1-a 42-51; Very fine sandy loam, silt loam, very gravelly coarse sand Unified: SM, ML AASHTO: A-1-a, A-4 51-60; Extremely gravelly coarse sand Unified: GP AASHTO: A-1-a	0-18; Gravelly sandy loam, extremely cobbly fine sandy loam Unified: SM, SM-SC AASHTO: A-2-4 18-60; Extremely cobbly loam Unified: SM, SM-SC AASHTO: A-2-4, A-4

Included Areas:

Included with these soils in mapping and making up about 25 percent of the acreage are the Lithic Xerorthents, frigid, Zynbar family, Rock outcrop, Stonewell family pumice and pumice overburden phases, and unnamed Medial over Cindery, frigid soils.

263 STONEWELL-YALLANI FAMILIES-LITHIC XERORTHENTS, FRIGID ASSOCIATION, 30 to 55 percent slopes

Map Unit Components	Stonewell family (40 percent)	Yallani family (30 percent)	Lithic Xerorthents, frigid (15 percent)
Position, Slope, and Elevation	On smooth sideslopes of volcanic mountain uplands; 30 to 50 percent slopes; 5600 to 6900 feet.	On sideslopes of volcanic mountain uplands; 30 to 55 percent slopes; 5600 to 6900 feet.	On upper sideslopes and ridges of volcanic mountain uplands; 35 to 55 percent slopes; 5600 to 6900 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest or mixed conifer forest of white fir, red fir, ponderosa pine plus snowbrush, greenleaf manzanita, Ross's sedge, mint., few grasses; 30 to 40 inches ppt.	White fir forest or mixed conifer forest of white fir, red fir, ponderosa pine plus snowbrush, greenleaf manzanita, Ross's sedge, mint., few grasses; 30 to 40 inches ppt.	
Surface Layer	1 to 0 inches; white fir and ponderosa pine needles and twigs, over 0 to 4 inches; dark grayish brown gravelly sandy loam, granular structure, soft, pH 6.4.	3 to 0 inches of mostly decomposed white fir twigs and needles over: 0 to 4 inches; brown gravelly sandy loam; granular and subangular blocky structure; soft; pH 6.4.	0 to 2 inches; yellowish brown very gravelly sandy loam; platy and granular structure; slightly hard, pH 6.6
Rooting Depth (in.) to Underlying Material	30 plus inches; cinders, basalt	40 plus inches; basalt	6 to 20; basalt
Erosion Factor (K)	.20	.20	Variable
Max. Erosion Hazard	Moderate to High	Moderate to High	High
Soil Permeability	Moderately rapid	Moderately rapid	Moderately rapid
Drainage Class	Somewhat excessively drained	Well drained	Somewhat excessively drained
Soil Manageability Class Group	3E III	3Ex	3Edx
Forest Site Class	5 (3-4)	4-5 (2-4)	7 (non-commercial)
Range Site	Not placed in a range site.	Not placed in a range site	9
Water Runoff Potential	Moderate	Moderate	Rapid
Watershed Sensitivity	7 (Moderate)	7	5
Hydrologic Soil Group	B	B	D
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.6 inches	Moderate to High 2.4 inches	Very Low to Low 0.6 to 2.5 inches
Susceptibility to Burning Damage	Moderate to High	High	High
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2,3 tons/acre/year	3 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Moderate	Low to Moderate	Not Rated
Rating for Timber Site	Fair (8)	Fair (3,7,8)	Not Rated
R-Value	60+	60+	Not Rated

Soil horizons in inches, USDA, Unified, AASHTO

0-24; Gravelly sandy loam, very gravelly sandy loam
Unified: SM
AASHTO: A-1-b

24-42; Extremely gravelly loamy sand, extremely gravelly coarse sand
Unified: GP
AASHTO: A-1-a

42-51; Very fine sandy loam, silt loam, very gravelly coarse sand
Unified: SM, ML
AASHTO: A-1-a, A-4

51-60; Extremely gravelly coarse sand
Unified: GP
AASHTO: A-1-a

0-18; Gravelly sandy loam, extremely cobbly fine sandy loam
Unified: SM, SM-SC
AASHTO: A-1-b, A-2-4

18-60; Extremely cobbly loam
Unified: SM, SM-SC
AASHTO: A-2-4, A-4

0-6; Variable
Unified: Not Rated
AASHTO: Not Rated

6+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are Zynbar and Kinzel families, Rock outcrop, and Yallani soils that are moderately deep.

264 STONEWELL-YALLANI-ZYNBAR FAMILIES ASSOCIATION, 2 to 20 percent slopes

Map Unit Components	Stonewell family (40 percent)	Yallani family (25 percent)	Zynbar family (20 percent)
Position, Slope, and Elevation	On sideslopes of cinder cones and volcanic mountain uplands; 2 to 15 percent slopes; 5500 to 6400 feet.	On upper sideslopes, ridges and knolls of volcanic mountain uplands and cinder cones; 5 to 20 percent slopes; 5500 to 6400 feet.	On sideslopes and toeslopes of cinder cones and volcanic mountain uplands; 2 to 15 percent slopes; 5500 to 6400 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar. plus Ribes spp., rabbitbrush, mint., Ross's sedge, Stipa spp.; 30 to 40 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar. plus Ribes spp., rabbitbrush, mint., Ross's sedge, Stipa spp.; 30 to 40 inches ppt.	
Surface Layer	1 to 0 inches; white fir and ponderosa pine needles and twigs, over 0 to 4 inches; dark grayish brown gravelly sandy loam, granular structure, soft, pH 6.4	3 to 0 inches of mostly decomposed white fir twigs and needles over: 0 to 4 inches; brown gravelly sandy loam granular and subangular blocky structure; soft; pH 6.4.	0 to 11 inches; brown and dark yellowish brown gravelly coarse sandy loam, granular structure, soft, pH 6.6 to 7.0.
Rooting Depth (in.) to Underlying Material	40 plus; cinders, basalt	40 plus; basalt, andesite	30 plus; basalt, cinders, andesite
Erosion Factor (K)	.20	.20	.20
Max. Erosion Hazard	Low	Low to moderate	Low
Soil Permeability	Moderately rapid	Moderately rapid	Moderately rapid
Drainage Class	Somewhat excessively drained	Well drained	Well drained
Soil Manageability Class Group	 1 I	 2e	 1
Forest Site Class	4 (2-3)	4-5 (2-4)	4 (1-3)
Range Site	Not placed in a range site.	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Very slow	Very slow	Very slow
Watershed Sensitivity	9 (Low)	9	9
Hydrologic Soil Group	B	B	B
Available Water Capacity (AWC) Upper 20 inches	 2.6 inches	 2.4 inches	 3.0 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year	2,3 tons/acre/year
Chance of Seedling Survival	Moderate	Low to Moderate	Moderate to High
Rating for Timber Site	Good	Fair (3)	Good
R-Value	60+	60+	60+

Soil horizons in inches, USDA, Unified, AASHTO

0-24; Gravelly sandy loam, very gravelly sandy loam
Unified: SM
AASHTO: A-1-b

24-42; Extremely gravelly loamy sand, extremely gravelly coarse sand
Unified: GP
AASHTO: A-1-a

42-51; Very fine sandy loam, silt loam, very gravelly coarse sand
Unified: SM, ML
AASHTO: A-1-a, A-4

51-60; Extremely gravelly coarse sand
Unified: GP
AASHTO: A-1-a

0-18; Gravelly sandy loam, extremely cobbly fine sandy loam
Unified: SM, SM-SC

18-60; Extremely cobbly loam
Unified: SM, SM-SC
AASHTO: A-2-4, A-4

0-34; Gravelly coarse sandy loam
Unified: SM
AASHTO: A-2-4

34+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Lithic Xerorthents, frigid, Sheld and Ahart families and Rock outcrop.

265 STONEWELL-ZYNBAR FAMILIES ASSOCIATION, 15 to 35 percent slopes

Map Unit Components	Stonewell family (45 percent)	Zynbar family (35 percent)
Position, Slope, and Elevation	Upper sideslopes of volcanic cinder cones; 20 to 35 percent slopes; 5800 to 6600 feet.	Lower sideslopes of volcanic cinder cones;15 to 35 percent slopes; 5800 to 6600 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, plus snowbrush, greenleaf manzanita, chinqupine, Ross's sedge, grasses; 30 to 40 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, plus snowbrush, Greenleaf manzanita, chinqupine, Ross's sedge, grasses; 30 to 40 inches ppt.
Surface Layer	1 to 0 inches; white fir and ponderosa pine needles and twigs, over 0 to 4 inches; dark grayish brown gravelly sandy loam, granular structure, soft, pH 6.4.	0 to 11 inches; brown and dark yellowish brown gravelly coarse sandy loam, granular structure, soft, pH 6.6 to 7.0.
Rooting Depth (in.) to Underlying Material	40 plus; cinders, basalt	30 plus; basalt, cinders, andesite
Erosion Factor (K)	.20	.20
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderately rapid	Moderately rapid
Drainage Class	Somewhat excessively drained	Well drained
Soil Manageability Class Group	2e II	2e
Forest Site Class	4 (2-3)	3 (1-3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	9 (Low)	8
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.6 inches	Moderate to High 3.0 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	2, 3 tons/acre/year
Chance of Seedling Survival	Moderate	Moderate to High
Rating for Timber Site	Good	Good
R-Value	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-24; Gravelly sandy loam, very gravelly sandy loam Unified: SM AASHTO: A-1-b 24-42; Extremely gravelly loamy sand, extremely gravelly coarse sand Unified: GP AASHTO: A-1-a 42-51; Very find sandy loam, silt loam, very gravelly coarse sand Unified: SM, ML AASHTO: A-1-a, A-4 51-60; Extremely gravelly coarse sand Unified: GP AASHTO: A-1-a	0-34; Gravelly coarse sandy loam Unified: SM AASHTO: A-2-4 34+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the Yallani, Sheld and Ahart families, Lithic Xerorthents, frigid and Rock outcrop.

266 STUKEL FAMILY-LAVA FLOW ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	Stukel family (55 percent)	Lava flow (20 percent)
Position, Slope, and Elevation	On nearly level to undulating basalt plateaus; 1 to 10 percent; 4200 to 4500 feet.	Hummocky disaggreagated lava flow rock and collapsed lava tubes with slope lengths of 10 to 40 feet on undulating basalt plateaus; 5 to 20 percent slopes; 4200 to 4500 feet.
Typical Vegetation and Precipitation (ppt)	Few western juniper, rabbitbrush, big sagebrush, low sagebrush, cheatgrass, Idaho fescue, bottlebrush; 10 to 14 inch ppt.	Barren; 10 to 14 inch ppt.
Surface Layer	0 to 11 inches; grayish brown to brown very cobbly loam to loam, granular and blocky structure, soft to slightly hard, pH 6.2 to 7.2.	NOT APPLICABLE: Fractured vesicular basalt flow rock with minor accumulations of aeolian soil deposition in some fractures.
Rooting Depth (in.) to Underlying Material	8 to 15; basalt	
Erosion Factor (K)	.37	
Max. Erosion Hazard	Moderate	
Soil Permeability	Moderate	
Drainage Class	Well drained	
Soil Manageability Class	2ed	
Group	II	
Forest Site Class	7 (non-commercial)	
Range Site	7, 1	
Water Runoff Potential	Slow	Moderate
Watershed Sensitivity	6 (Moderate)	6
Hydrologic Soil Group	D	
Available Water Capacity (AWC) Upper 20 inches	Very Low to Low 1.1 to 2.1 inches	
Susceptibility to Burning Damage	Low	
Slope Stability Hazard	Low	
Allowable Soil Loss	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	
Rating for Timber Site	Not Rated	
R-Value	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-3; Very cobbly loam Unified: SM, SM-SC, ML, ML-CL AASHTO: A-2-4, A-4 3-11; Loam Unified: ML, ML-CL AASHTO: A-4 11+; Unweathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 25 percent of the acreage are the Bakeoven, Searles, Gwin, Pass Canyon, Cowiche families and Lithic Xerorthents, mesic and lava flow rock with steeper slopes.	

267 STUKEL-LOS GATOS-PASS CANYON FAMILIES COMPLEX, 1 to 10 percent slopes

Map Unit Components	Stukel family (35 percent)	Los Gatos family (30 percent)	Pass Canyon family (20 percent)
Position, Slope, and Elevation	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4400 to 5200 feet.	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4400 to 5200 feet.	On nearly level to undulating basalt plateaus; 1 to 10 percent slopes; 4400 to 5200 feet.
Typical Vegetation and Precipitation (ppt)	Western juniper, low sagebrush, rabbitbrush, big sagebrush, cheatgrass, bottlebrush, Idaho fescue; 14 to 16 inches ppt.	Western juniper, big sagebrush, bitterbrush, Phlox spp., mustard, western yarrow, sandberg bluegrass, Idaho fescue, bottlebrush; 14 to 16 inches ppt.	
Surface Layer	0 to 11 inches; grayish brown to brown very cobbly loam to loam, granular and blocky structure, soft, pH 6.2 to 7.2.	0 to 19 inches; brown gravelly loam, granular and blocky structure, soft, pH 6.8 to 7.0.	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam, granular and platy structure, slightly hard, pH 6.8 to 6.6.
Rooting Depth (in.) to Underlying Material	10 to 20; basalt, tuff	20 to 40; basalt, tuff	14 to 20; basalt, tuff
Erosion Factor (K)	.37	.32	.32
Max. Erosion Hazard	Moderate	Low	Moderate
Soil Permeability	Moderate	Moderately Slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2ed II	1	2ed
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	4, 8	13	8, 4
Water Runoff Potential	Slow	Very Slow	Moderate
Watershed Sensitivity	6 (Moderate)	8	6
Hydrologic Soil Group	D	B	D
Available Water Capacity (AWC) Upper 20 inches	Low 1.5 to 2.8 inches	Low to Moderate 2.8 inches	Low 1.8 to 2.6 inches
Susceptibility to Burning Damage	Low	Moderate	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	1 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	30-60	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-3; Very cobbly loam Unified: SM, SM-SC, ML, ML-CL AASHTO: A-2-4, A-4 3-11; Loam Unified: ML, ML-CL AASHTO: A-4 11+; Unweathered bedrock	0-19; Gravelly loam Unified: ML, ML-CL AASHTO: A-4 19-38; Clay loam, gravelly clay loam Unified: CL, MH AASHTO: A-6, A-7 38+; Unweathered bedrock	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-4; Loam Unified: ML-CL, CL ASHTO: A-4, A-6 4-12; Clay loam, cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Bakeoven, Roval, Deven, Supan, Elmore and Lawyer families.		

268 SUPAN-SUPAN deep-PASS CANYON FAMILIES ASSOCIATION, 1 to 20 percent slopes

Map Unit Components	Supan family (40 percent)	Supan family, deep (25 percent)	Pass Canyon family (20 percent)
Position, Slope, and Elevation	On sideslopes of undulating basalt plateaus and mountain uplands; 1 to 20 percent slopes; 4300 to 6000 feet.	On lower sideslopes and depressions of undulating basalt plateaus and mountain uplands; 1 to 15 percent slopes; 4300 to 6000 feet.	On sideslopes ridges and knolls of undulating basalt plateaus and mountain uplands; 1 to 20 percent slopes; 4300 to 6000 feet.
Typical Vegetation and Precipitation (ppt)	May have dense western juniper and big sagebrush, with mountain mahogany, bitterbrush, rabbitbrush, Idaho fescue, wheatgrass, Ross's sedge, other grasses; 14 to 16 inches ppt.	May have dense western juniper and big sagebrush, with bitterbrush, rabbitbrush, mountain mahogany, Idaho fescue, wheatgrass, bluegrass, Ross's sesdge, other grasses; 14 to 16 inches ppt.	
Surface Layer	0 to 11 inches; brown loam, granular and blocky structure, slightly hard, pH 6.8.	0 to 23 inches; brown loam, granular and blocky structure, soft to slightly hard, pH 6.8 to 7.0.	0 to 4 inches; very dark grayish brown to dark brown very cobbly loam and loam, granular and platy structure, slightly hard, pH 6.6 to 6.8.
Rooting Depth (in.) to Underlying Material	20 to 40; soft to hard basalt, tuff	40 plus; soft to hard basalt, tuff	10 to 20; basalt, tuff
Erosion Factor (K)	.32	.32	.32
Max. Erosion Hazard	Low to moderate	Low	Moderate
Soil Permeability	Moderately slow	Moderately slow	Moderately slow
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2e II	1	2ed
Forest Site Class	7 (non-commercial)	7 (non-commercial)	7 (non-commercial)
Range Site	13	13	8, 4
Water Runoff Potential	Very Slow	Very Slow	Moderate
Watershed Sensitivity	8 (Low)	8	6
Hydrologic Soil Group	B	B	D
Available Water Capacity (AWC) Upper 20 inches	Moderate 3.3 inches	Moderate to High 3.4 inches	Very Low to Low 1.3 to 2.6 inches
Susceptibility to Burning Damage	Low to Moderate	Low	Low
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	3 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated	Not Rated
R-Value	30-60	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-11; Loam Unified: ML, ML-CL AASHTO: A-4 11-31; Cobbly clay loam Unified: CL, CH AASHTO: A-6, A-7 31+; Weathered bedrock	0-23; Loam Unified: ML, ML-CL AASHTO: A-4 23-60; Gravelly clay loam Very gravelly clay loam, extremely cobbly clay loam Unified: CL, CH AASHTO: A-6, A-7	0-2; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4 2-4; Loam Unified: ML-CL, CL AASHTO: A-4, A-6 4-12; Clay loam, cobbly clay loam Unified: CL, MH AASHTO: A-6, A-7 12+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Deven, Roval, Barnard, Ridd, Gwin, Alicel, Wrentham, Sutkel, Bieber, Los Gatos, Elmore and Fordice families, Rock outcrop and unnamed soils similar to Wrentham family but not Pachic, and soils similar to the Skalan family.

269 SUPERVISOR-CHEADLE FAMILIES-ROCK OUTCROP ASSOCIATION, 15 to 35 percent slopes

Map Unit Components	**Supervisor family (45 percent)**	**Cheadle family (20 percent)**	**Rock outcrop (20 percent)**
Position, Slope, and Elevation	On sideslopes and toeslopes of mountain uplands; 15 to 35 percent slopes; 7000 to 9700 feet.	On upper sideslopes and ridges of mountain uplands; 20 to 35 percent slopes; 7000 to 9700 feet.	On ridges and sideslopes of deeply incised drainages of mountain uplands; 20 to 35 percent slopes; 7000 to 9700 feet.
Typical Vegetation and Precipitation (ppt)	White bark pine, few lodgepole pine, mulesear, lupine, penstamin, Ross's sedge, few grasses; 30 to 35 inches ppt.	Big sagebrush, low sagebrush, mulesear, lupine, phlox spp., buckwheat, Idaho fescue, other grasses; 30 to 35 inches ppt.	
Surface Layer	1 to 0 inches; lodgepole pine needles, over 0 to 12 inches; dark grayish brown to brown gravelly fine sandy loam, granular and blocky structure, slightly hard, pH 6.0 to 6.2.	0 to 17 inches; dark grayish brown to brown very cobbly loam to very cobbly clay loam; granular and subangular blocky structure, slightly hard to hard, pH 6.6.	NOT APPLICABLE: Basalt, andesite or conglomerated tuff bedrock with minor accumulationa of aeolian soil deposition in some fractures.
Substratum	26 to 37 inches; weathering in place pale brown to reddish brown semi-soft tuff conglomerate.		
Rooting Depth (in.) to Underlying Material	20 to 40; andesite, tuff	10 to 20; andesite	
Erosion Factor (K)	.20	.37	
Max. Erosion Hazard	Moderate	Moderate to high	
Soil Permeability	Moderate	Moderate	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	 2ep II	 2ed	
Forest Site Class	6-7 (4-5 at 7000 to 8000 feet elevation, and non-commercial above 8000 feet elevation)	7 (non-commercial)	
Range Site	Not placed in a range site.	9	
Water Runoff Potential	Slow	Rapid	Very Rapid
Watershed Sensitivity	7 (Moderate)	4	2
Hydrologic Soil Group	B	D	
Available Water Capacity (AWC) Upper 20 inches	 2.2 inches	 1.2 to 2.4 inches	
Susceptibility to Burning Damage	Moderate	Low	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	
Chance of Seedling Survival	Low to Moderate (Not Rated above 8,000 feet elevation)	Not Rated	
Rating for Timber Site	Fair to Poor (7,12,13)	Not Rated	
R-Value	60+	30-60	

Soil horizons in inches, USDA, Unified, AASHTO

0-12;	Gravelly fine sandy loam Unified: SM AASHTO: A-2-4, A-4	0-12;	Very cobbly loam Unified: SM, SM-SC AASHTO: A-4, A-6
12-26;	Very gravelly sandy loam Unified: SM AASHTO: A-1-b	12-17;	Very cobbly clay loam Unified: SC AASHTO: A-6, A-7
26+;	Weathered bedrock	17+;	Unweathered bedrock

Included Areas:

Included with this unit in mapping and making up about 15 percent of the acreage are the Duncom, Gralic and Behanin families, Lithic Cryochrepts, and Rubble land.

270 SUPERVISOR-CHEADLE FAMILIES-ROCK OUTCROP ASSOCIATION, 35 to 60 percent slopes

Map Unit Components	**Supervisor family (40 percent)**	**Cheadle family (25 percent)**	**Rock outcrop (20 percent)**
Position, Slope, and Elevation	On sideslopes and toeslopes of mountain uplands; 35 to 60 percent slopes; 8000 to 9000 feet.	On upper sideslopes and ridges of mountain uplands; 35 to 60 percent slopes; 8000 to 9900 feet.	On ridges and sideslopes of deeply incised drainages of mountain uplands; 35 to 60 percent slopes; 8000 to 9900 feet.
Typical Vegetation and Precipitation (ppt)	Semi-dense and stunted white bark pine forest with few lodgepole pine, plus mules- ear, lupine, penstamin, Ross's sedge, few grasses; 30 to 35 inches ppt.	Big sagebrush, low sagebrush, mulesear, lupine, Phlox spp., buckwheat, Idaho fescue, other grasses; 30 to 35 inches ppt.	
Surface Layer	1 to 0 inches; lodgepole pine needles over 0 to 12 inches; dark grayish brown to brown gravelly fine sandy loam, granular and blocky structure, slightly hard, pH 6.0 to 6.2.	0 to 17 inches; dark grayish brown to brown very cobbly loam to very cobbly clay loam; granular and subangular blocky structure, slightly hard to hard, pH 6.6.	NOT APPLICABLE: Basalt, andesite or conglomerated tuff bedrock with minor accumulations of aeolian soil deposition in some fractures.
Substratum	26 to 37 inches; weathering in place pale brown to reddish brown semi-soft tuff conglomerate.		
Rooting Depth (in.) to Underlying Material	20 to 40; andesite, tuff	10 to 20; andesite	
Erosion Factor (K)	.20	.37	
Max. Erosion Hazard	High	High to very high	
Soil Permeability	Moderate	Moderate	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	 3Ep III	 3Ed	
Forest Site Class	7 (non-commercial)	7 (non-commercial)	
Range Site	Not placed in a range site.	9	
Water Runoff Potential	Moderate	Very Rapid	Very Rapid
Watershed Sensitivity	6 (High)	3	0
Hydrologic Soil Group	B	D	
Available Water Capacity (AWC) Upper 20 inches	 2.2 inches	 1.2 to 2.4 inches	
Susceptibility to Burning Damage	Moderate to High	Moderate	
Slope Stability Hazard	Low	Low	
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	Not Rated	
Rating for Timber Site	Poor (7, 8, 13)	Not Rated	
R-Value	60+	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-12; Gravelly fine sandy loam Unified: SM AASHTO: A-2-4, A-4 12-26; Very gravelly sandy loam Unified: SM AASHTO: A-1-b 26+; Weathered bedrock	0-12; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4, A-6 12-17; Very cobbly clay loam Unified: SC AASHTO: A-6, A-7 17+; Unweatheed bedrock	
Included Areas:	Included with this unit in mapping and making up about 15 percent of the acreage are the Duncom family, Lithic Cryochrepts, and Rubble land.		

271 SUPERVISOR-CHEADLE FAMILIES-ROCK OUTCROP ASSOCIATION, 60 to 90 percent slopes

Map Unit Components	**Supervisor family (30 percent)**	**Cheadle family (30 percent)**	**Rock outcrop (25 percent)**
Position, Slope, and Elevation	On sideslopes of mountain uplands; 60 to 80 percent slopes; 8000 to 9700 feet.	On upper sideslopes and ridges of mountian uplands; 60 to 90 percent slopes; 8000 to 9700 feet.	On ridges and sideslopes of deeply incised drainages; 60 to 90 percent slopes; 8000 to 9700 feet.
Typical Vegetation and Precipitation (ppt)	Semi-dense and stunted white bark pine forest with few lodgepole pine, plus mules- ear, lupine, penstamin, Ross's sedge, few grasses; 30 to 35 inches ppt.	Big sagebrush, low sagebrush, mulesear, lupine, Phlox spp., buckwheat, Idaho fescue, other grasses; 30 to 35 inches ppt.	
Surface Layer	1 to 0 inches; lodgepole pine needles, over 0 to 12 inches; dark grayish brown to brown gravelly fine sandy loam, granular and blocky structure, slightly hard, pH 6.0 to 6.2.	0 to 17 inches; dark grayish brown to brown very cobbly loam to very cobbly clay loam; granular and subangular blocky stucture, slightly hard to hard, pH 6.6.	NOT APPLICABLE: Basalt, andesite or conglomerated tuff bedrock with minor accumulations of aeolian soil deposition in some fractures.
Substratum	26 to 37 inches; weathering in place pale brown to reddish brown semi-soft tuff conglomerate.		
Rooting Depth (in.) to Underlying Material	20 to 40; andesite,	10 to 20; andesite	
Erosion Factor (K)	.20	.37	
Max. Erosion Hazard	Very high	Very high	
Soil Permeability	Moderate	Moderate	
Drainage Class	Well drained	Well drained	
Soil Manageability Class Group	 4Gp IV	 4Gd	
Forest Site Class	7 (non-commercial)	7 (non-commercial)	
Range Site	Not placed in a range site.	9	
Water Runoff Potential	Rapid	Very Rapid	Very Rapid
Watershed Sensitivity	4 (Very High)	2	0
Hydrologic Soil Group	B	D	
Available Water Capacity (AWC) Upper 20 inches	 2.2 inches	 1.2 to 2.4 inches	
Susceptibility to Burning Damage	High	Moderate	
Slope Stability Hazard	Moderate	Moderate	
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year	
Chance of Seedling Survival	Not Rated	Not Rated	
Rating for Timber Site	Poor (7, 9, 13)	Not Rated	
R-Value	60+	30-60	
Soil horizons in inches, USDA, Unified, AASHTO	0-12; Gravelly fine sandy loam Unified: SM AASHTO: A-2-4, A-4 12-26; Very gravelly sandy loam Unified: SM AASHTO: A-1-b 26+; Weathered bedrock	0-12; Very cobbly loam Unified: SM, SM-SC AASHTO: A-4, A-6 12-17; Very cobbly clay loam Unified: SC AASHTO: A-6, A-7 17+; Unweathered bedrock	
Included Areas:	Included with this unit in mapping and making up about 15 percent of the acreage are the Duncom family, Lithic Cryochrepts, and Rubble land.		

272 ROCK OUTCROP, tuff-LITHIC XERORTHENTS, FRIGID COMPLEX, 60 to 100 percent slopes

Map Unit Components	**Rock outcrop, tuff (45 percent)**	**Lithic Xerorthents, frigid (40 percent)**
Position, Slope, and Elevation	On ridges, knolls and deeply incised drainages of mountain uplands; 60 to 100 percent slopes; 5000 to 8000 feet.	On sideslopes and ridges of mountain uplands; 60 to 100 percent slopes; 5000 to 8000 feet.
Typical Vegetation and Precipitation (ppt)	Barren; 16 to 30 inches ppt.	Very sparse vegetation consisting of Buckwheat, Phlox spp., low sagebrush, Idaho fescue, trace of western juniper; 16 to 30 inches ppt.
Surface Layer	NOT APPLICABLE: Platy and massive paralithic volcanic tuff which rubs to a sandy loam, loam, or clay loam texture.	0 to 2 inches; yellowish brown very gravelly sandy loam; platy and granular structure; slightly hard, pH 6.6.
Rooting Depth (in.) to Underlying Material		4 to 10; andesite, conglomerated tuff, sandstone
Erosion Factor (K)		Variable
Max. Erosion Hazard		Very high
Soil Permeability		Moderate
Drainage Class		Somewhat excessively drained
Soil Manageability Class Group	 Not rated IV	 4GD
Forest Site Class		7 (non-commercial)
Range Site		1
Water Runoff Potential	Very Rapid	Very Rapid
Watershed Sensitivity	0 (Very High)	0
Hydrologic Soil Group		D
Available Water Capacity (AWC) Upper 20 inches		Very low 0.6 to 1.5 inches
Susceptibility to Burning Damage		Low
Slope Stability Hazard		Moderate
Allowable Soil Loss		1 tons/acre/year
Chance of Seedling Survival		Not Rated
Rating for Timber Site		Not Rated
R-Value		0-6; Variable
Soil horizons in inches, USDA, Unified, AASHTO		0-6; Variable Unified: Not Rated AASHTO: Not Rated 6+; Weathered bedrock

Included Areas: Included with this unit in mapping and making up about 15 percent of the acreage are the Cheadle, Anatone, Patio and Smarts families, Lithic Cryochrepts, Rubble land, and areas of lesser and greater slopes.

273 VIPONT-GINSER-ANATONE FAMILIES ASSOCIATION, 15 to 40 percent slopes

Map Unit Components	Vipont family (40 percent)	Ginser family (25 percent)	Anatone family (20 percent)
Position, Slope, and Elevation	On southeast to westerly aspects of lower sideslopes and toeslopes of mountain uplands 15 to 35 percent slopes; 5500 to 7000 feet.	On southeast to westerly aspects of sideslopes of mountain uplands; 20 to 40 percent slopes; 5500 to 7000 feet.	On southeast to westerly aspects of upper sideslopes, ridges, and knolls of mountain uplands; 20 to 40 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	Few ponderosa pine, white fir, western juniper, big sagebrush, mountain mahogany, bitterbrush, ceonothus, greenleaf manzanita, Carex spp., wheatgrass, Ross's sedge, Idaho fescue; 20 to 22 inches ppt.	Few ponderosa pine,white fir, western juniper big sagebrush, mountain mahogany, bitterbrush, ceonothus, greenleaf manzanita, Carex spp., wheatgrass, Idaho fescue; Ross's sedge, 20 to 22 inches ppt.	
Surface Layer	0 to 16 inches; brown very gravelly loam, granular and blocky structure, slightly hard, pH 6.8.	0 to 24 inches; dark brown to to dark yellowish brown cobbly loam, very cobbly loam and extremely cobbly loam, granular and blocky structure, slightly hard to hard, pH 6.4 to 6.8.	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.8 to 7.0.
Rooting Depth (in.) to Underlying Material	20 to 40; basalt	20 to 40; andesite, basalt	10 to 20; andesite, basalt
Erosion Factor (K)	.28	.32	.37
Max. Erosion Hazard	Moderate	Moderate	Moderate to high
Soil Permeability	Moderately slow	Moderate	Moderate
Drainage Class	Well drained	Well drained	Well drained
Soil Manageability Class Group	2e II	2ep	3Ed
Forest Site Class	5-6 (4-5)	6 (4-5)	7 (non-commercial)
Range Site	Not placed in a range site.	Not placed in a range site.	9
Water Runoff Potential	Slow	Slow	Rapid
Watershed Sensitivity	7 (Moderate)	7	4
Hydrologic Soil Group	B	B	D
Available Water Capacity (AWC) Upper 20 inches	Low to Moderate 2.8 inches	Low to Moderate 2.3 inches	Very Low to Low 1.2 to 2.5 inches
Susceptibility to Burning Damage	Moderate	Moderate	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	2 tons/acre/year	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Moderate	Low	Not Rated
Rating for Timber Site	Poor (1,7,11)	Poor (1,7,11)	Not Rated
R-Value	30-60	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-16; Very gravelly loam Unified: SM, SM-SC AASHTO: A-4 16-32; Very gravelly clay loam, very cobbly clay loam, extremely cobbly clay loam Unified: SC, CL AASHTO: A-6, A-7 32+; Weathered bedrock	0-24; Cobbly loam, very cobbly loam, extremely cobbly loam Unified: SM, SC, ML, CL AASHTO: A-4, A-6 24+: Weathered bedrock	0-8; Cobbly loam Unified: ML, ML-CL AASHTO: A-4 8-17; Very cobbly loam Unified: SM, SC AASHTO: A-4, A-6 17+; Unweathered bedrock

Included Areas:

Included with these soils in mapping and making up about 15 percent of the acreage are the Hades, Mascamp, Lamondi and Smarts families, and Rock outcrop.

274 AQUOLLS, 0 to 5 percent slopes

Map Unit Components	**Aquolls (70 percent)**
Position, Slope, and Elevation	On nearly level slightly concave alluvial basins and drainages; (subject to spring flooding); 0 to 5 percent slopes; 4800 to 6400 feet.
Typical Vegetation and Precipitation (ppt)	Kentucky bluegrass, other Poa spp., timothy, willows, forbes, sedges, other grasses; 14 to 25 inches ppt.
Surface Layer	0 to 4 inches very dark gray silty clay loam; platy and granular structure; hard; pH 7.4.
Substratum	27 to 60 inches; light gray and gray with yellowish brown and yellowish red mottles; silty clay loam and clay loam; massive and blocky structure; slightly hard and very hard; pH 6.4.
Rooting Depth (in.) to Underlying Material	40 plus; alluvium
Erosion Factor (K)	Variable
Max. Erosion Hazard	Moderate
Soil Permeability	Variable
Drainage Class	Poorly drained
Soil Manageability Class Group	 3W III
Forest Site Class	7 (non-commercial)
Range Site	25
Water Runoff Potential	Very Slow
Watershed Sensitivity	7 (Moderate)
Hydrologic Soil Group	D
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 3.3 inches
Susceptibility to Burning Damage	Low
Slope Stability Hazard	Low
Allowable Soil Loss	5 tons/acre/year
Chance of Seedling Survival	Not Rated
Rating for Timber Site	Not Rated
R-Value	Not Rated
Soil horizons in inches, USDA, Unified, AASHTO	0-60; Variable Unified: Not Rated AASHTO: Not Rated
Included Areas:	Included with this soil in mapping and making up about 30 percent of the acreage are the Jacknife, Aikman, Smarts and Los Gatos families and unnamed Fluvents, Saprists, and Fluvaquents.

275 WOODHURST-BEHANIN deep FAMILIES COMPLEX, 10 to 35 percent slopes

Map Unit Components	**Woodhurst family (45 percent)**	**Behanin family, deep (35 percent)**
Position, Slope, and Elevation	On sideslopes and toeslopes of mountain uplands; 10 to 30 percent slopes; 7000 to 8000 feet.	On sideslopes and ridges of mountain uplands; 10 to 35 percent slopes; 7000 to 8000 feet.
Typical Vegetation and Precipitation (ppt)	White fir, lodgepole pine, few quaking aspen, snowberry, forbes, Ross's sedge, few grasses; 25 to 35 inches ppt.	White fir, lodgepole pine, western white pine, few quaking aspen, snowberry, forbes, Ross's sedge, few grasses; 25 to 35 inches ppt.
Surface Layer	3 to 0 inches; white fir and lodgepole pine needles and twigs, over 0 to 25 inches; brown to yellowish brown cobbly fine sandy loam, very stony loam and extremely stony loam, granular and blocky structure, slightly hard, pH 6.4 to 6.8.	1-1/2 to 0 inches of white fir needles and twigs, over 0 to 60 inches; very dark grayish brown to brown very gravelly loam, very stony loam and extremely gravelly loam, granular to subangular blocky structure, slightly hard, pH 6.0 to 6.4.
Rooting Depth (in.) to Underlying Material	40 plus; basalt	40 plus; basalt, andesite
Erosion Factor (K)	.20	.28
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderate	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class	2ep	2e
Group	II	
Forest Site Class	5 (3-4)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	7 (Moderate)	7
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate	Moderate
	2.5 inches	2.4 inches
Susceptibility to Burning Damage	Low to Moderate	Low to Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate	Moderate
Rating for Timber Site	Fair (1,3,12)	Fair (1,12)
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-34; Cobbly fine sandy loam, very stony loam, extremely stony loam Unified: SM, SM-SC AASHTO: A-4 34-60; Very cobbly loam Unified: ML, CL AASHTO: A-4, A-6	0-34; Very gravelly loam, very stony loam Unified: SM, ML, ML-CL AASHTO: A-4 34-60; Extremely gravelly loam Unified: GM, GM-GC AASHTO: A-2-4, A-2-6
Included Areas:	Included with these soils in mapping and making up about 20 percent of the acreage are the Supervisor, Gallatin, Duncom and Cheadle families and Lithic Cryochrepts.	

276 WRENTHAM-BAKEOVEN FAMILIES ASSOCIATION, 10 to 40 percent slopes

Map Unit Components	Wrenthan family (65 percent)	Bakeoven family (20 percent)
Position, Slope, and Elevation	Mainly on sideslopes and toeslopes of mountain uplands; 10 to 35 percent slopes; 4600 to 5600 feet.	Mainly on upper sideslopes and ridges of Mountain uplands; 15 to 40 percent slopes; 4600 to 5600 feet.
Typical Vegetation and Precipitation (ppt)	Big sagebrush, rabbitbrush, bitterbrush, Ribes spp., lupine, arrowleaf balsam root, western yarrow, crested wheatgrass, bluebunch wheatgrass, sandberg bluegrass, thurbers needlegrass, Idaho fescue; 12 to 14 inches ppt.	Low sagebrush, big sagebrush, rabbitbrush, Phlox spp., Idaho fescue, sandberg bluegrass, cheatgrass; 12 to 14 inches ppt.
Surface Layer	0 to 23 inches; dark grayish brown, grayish brown and brown very gravelly loam, granular structure, slightly hard, pH 6.6 to 6.8.	0 to 11 inches; dark grayish brown and grayish brown very cobbly fine sandy loam, subangular blocky structure; slightly hard, pH 6.6.
Substratum	23 to 33 inches; pale brown very gravelly loam, massive, slightly hard, pH 6.4.	
Rooting Depth (in.) to Underlying Material	20 to 40; andesite	8 to 20; andesite, basalt
Erosion Factor (K)	.28	.24
Max. Erosion Hazard	Moderate	Moderate to high
Soil Permeability	Moderate	Moderately rapid
Drainage Class	Well drained	Well drained
Soil Manageability Class	2e	3Edx
Group	II	
Forest Site Class	7 (non-commercial)	7 (non-commercial)
Range Site	12	7, 1
Water Runoff Potential	Slow	Rapid
Watershed Sensitivity	7 (Moderate)	5
Hydrologic Soil Group	B	D
Available Water Capacity (AWC)	Low to Moderate	Very Low to Low
Upper 20 inches	2.5 inches	0.8 to 1.9 inches
Susceptibility to Burning Damage	Low	Low
Slope Stability Hazard	Low	Low
Allowable Soil Loss	2 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Not Rated	Not Rated
Rating for Timber Site	Not Rated	Not Rated
R-Value	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-33; Very gravelly loam Unified: GM, GM-GC, SM, SM-SC AASHTO: A-2-4, A-4 33+; Unweathered bedrock	0-11; Very cobbly fine sandy loam Unified: SM, SM-SC AASHTO: A-4 11+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Searles, Supan, Simpson, Pass Canyon and Alicel families, Rock outcrop, soils similar to Wrentham family but not Pachic, and areas of greater slope.	

277 YALLANI-SHELD FAMILIES COMPLEX, 5 to 30 percent slopes

Map Unit Components	Yallani family (60 percent)	Sheld family (25 percent)
Position, Slope, and Elevation	On sideslopes, toeslopes and alluvial fans of volcanic mountain uplands; 5 to 30 percent slopes; 5800 to 7000 feet.	On sideslopes, toeslopes and alluvial fans of volcanic mountain uplands; 5 to 30 percent slopes; 5800 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, some red fir, ponderosa pine, and lodgepole pine above 6500 feet, plus current spp., snowberry, Ross's sedge, bunchgrasses; 35 to 45 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, some red fir and lodgepole pine above 6500 feet, current spp., snowberry, Ross's sedge, bunchgrasses: 35 to 45 inches ppt.
Surface Layer	3 to 0 inches of mostly decomposed white fir twigs and needles over: 0 to 4 inches; brown gravelly sandy loam; granular and subangular blocky structure; soft; pH 6.4.	2 to 0 inches of white fir and ponderosa pine needles and twigs, over 0 to 25 inches; dark grayish brown and brown gravelly fine sandy loam and very cobbly loam, granular and subangular blocky structure, soft, pH 5.8 to 6.2.
Rooting Depth (in.) to Underlying Material	40 plus; basalt, andesite	40 plus inches, hard basalt
Erosion Factor (K)	.20	.20
Max. Erosion Hazard	Low to moderate	Low to moderate
Soil Permeability	Moderately rapid	Moderate
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	 2e II	 2e
Forest Site Class	4 (2-3)	4 (2-3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	8(Low)	8
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.4 inches	Moderate to High 3.1 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Low to Moderate	High
Rating for Timber Site	Fair (3)	Good
R-Value	60+;	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-18; Gravelly sandy loam, extremely cobbly fine sandy loam Unified: SM, SM-SC AASHTO: A-2-4, A-1-b 18-60; Extremely cobbly loam Unified: SM, SM-SC AASHTO: A-2-4, A-4	0-12; Gravelly fine sandy loam Unified: SM AASHTO: A-4 12-50; Very cobbly loam, Very gravelly loam,extremely cobbly loam Unified: SM, SM-SC AASHTO: A-4 50+; Unweathered bedrock

Included Areas: Included with these soils in mapping and making up about 15 percent of the acreage are the Lithic Xerumbrepts, Ahart, Stonewell, Kinzel and Divers families, rock outcrop, and soils similar to the Germany family but medial-skeletal.

278 YALLANI-INVILLE FAMILIES COMPLEX, 8 to 20 inch pumice overburden, 5 to 30 percent slopes

Map Unit Components	Yallani family, pumice overburden phase (60 percent)	Inville family (20 percent)
Position, Slope, and Elevation	On sideslopes of volcanic mountain uplands; 5 to 30 percent slopes; 5400 to 6500 feet.	On sideslopes of volcanic mountain uplands; 5 to 30 percent slopes; 5400 to 6500 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of ponderosa pine, white fir, red fir, plus greenleaf manzanita, bitterbrush, rabbit- brush, Ross's sedge, grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, red fir, plus greenleaf manzanita, bitterbrush, rabbitbrush, Ross's sedge, grasses; 20 to 30 inches ppt.
Surface Layer	1 to 0 inches; ponderosa pine and white fir needles and twigs, over 17 inches of pumice overburden consisting of 0 to 2 inches; gray extremely gravelly loamy coarse sand; 2 to 17 inches; white extremely gravelly coarse sand. (Thickness ranges from 8 to 20 inches) OVER 17 to 23 inches; yellowish brown gravelly coarse sandy loam, granular structure, soft, pH 6.2.	2 to 0 inches of undecomposed and decomposed ponderosa pine needles, over 12 inches of pumice consisting of 0 to 2 inches; pale brown and grayish brown gravelly loamy coarse sand and gravelly loamy fine sand. (Thickness ranges from 8 to 20 inches) OVER 12 to 15 inches; yellowish brown very gravelly sandy loam, granular structure, soft, pH 6.4
Rooting Depth (in.) to Underlying Material	40 plus; basalt, andesite	40 plus; basalt
Erosion Factor (K)	.15	.17
Max. Erosion Hazard	Low to moderate	Low to moderate
Soil Permeability	Rapid in the pumice overburden to moderately rapid below.	Rapid in the pumice overburden to moderate below.
Drainage Class	Well drained	Well drained
Soil Manageability Class Group	 2ep II	 2ep
Forest Site Class	5 (3-4)	4-5 (2-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	8 (Low)	8
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate 2.3 inches	Moderate to high 2.3 inches
Susceptibility to Burning Damage	High	High
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Moderate	Moderate
Rating for Timber Site	Fair (3,5)	Fair (5)
R-Value	60+	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-2; Extremely gravely loamy coarse sand Unified: SW-SM AASHTO: A-1-a 2-17; Extremely gravelly coarse sand Unified: GW-GM AASHTO: A-1-a 17-60; Gravelly coarse sandy loam, extremely stony coarse sandy loam, extremely cobbly coarse sandy loam Unified: SM AASHTO: A-1-b, A-2-4	0-6; Very gravelly loamy coarse sand Unified: SW-SM, SM AASHTO: A-1-a 6-12; Very gravelly loamy fine sand Unified: SM AASHTO: A-2-4 12-21; Very gravelly sandy loam Unified: SM AASHTO: A-1-b 21-60; Very gravelly loam Unified: SM, SM-SC AASHTO: A-2-4, A-2-6

Included Areas:

Included with these soils in mapping and making up about 20 percent of the acreage are the Stonewell family pumice phase, Kinzel family, unnamed cindery over medial-skeletal, frigid soils, and Rock outcrop.

279 YALLANI-STONEWELL FAMILIES ASSOCIATION, 15 to 35 percent slopes

Map Unit Components	Yallani family (50 percent)	Stonewell family (30 percent)
Position, Slope, and Elevation	On knolls, ridges and sideslopes of volcanic mountain uplands; 20 to 35 percent slopes; 5600 to 6800 feet.	On smooth sideslopes of volcanic mountain uplands; 15 to 30 percent slopes; 5600 to 6800 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, some red fir and incense-cedar, plus greenleaf manzanita, snowbrush, Ross's sedge, few grasses; 30 to 40 inches ppt.	White fir forest, or mixed conifer forest of white fir, some red fir, ponderosa pine, and incense-cedar, plus greenleaf manzanita, snowbrush, Ross's sedge, few grasses; 30 to 40 inches ppt.
Surface Layer	3 to 0 inches of mostly decomposed white fir twigs and needles over: 0 to 4 inches; brown gravelly sandy loam; granular and subangular blocky structure; soft, pH 6.4.	1 to 0 inches; white fir and ponderosa pine needles and twigs, over 0 to 4 inches; dark grayish brown gravelly sandy loam, granular structure, soft, pH 6.4.
Rooting Depth (in.) to Underlying Material	40 plus; basalt, andesite	40 plus; cinders, basalt
Erosion Factor (K)	.20	.20
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderately Rapid	Moderately rapid
Drainage Class	Well drained	Somewhat excessively drained
Soil Manageability Class Group	2e II	2e
Forest Site Class	4 (2-3)	4 (2-3)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	8 (Low)	9
Hydrologic Soil Group	B	B
Available Water Capacity (AWC) Upper 20 inches	Moderate to High 2.4 inches	Moderate 2.6 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Low to Moderate	Moderate
Rating for Timber Site	Fair (3)	Good
R-Value	60+	60+
Soil horizons in inches, USDA, Unified, AASHTO	0-18; Gravelly sandy loam, extremely cobbly fine sandy loam Unified: SM, SM-SC AASHTO: A-2-4, A-1-b 18-60; Extremely cobbly loam Unified: SM, SM-SC AASHTO: A-2-4, A-4	0-24; Gravelly sandy loam, very gravelly sandy loam Unified: SM AASHTO: A-1-b 24-42; Extremely gravelly loamy sand, extremely gravelly coarse sand Unified: GP AASHTO: A-1-a 42-51; Very fine sandy loam, silt loam, very gravelly coarse sand Unified: SM, ML AASHTO: A-4, A-1-a 51-60; Extremely gravelly coarse sand Unified: GP AASHTO: A-1-a

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the Zynbar, Sheld and Ahart families, Lithic Xerorthents, frigid, and rock outcrop.

280 WAPAL-ANATONE-PATIO deep FAMILIES ASSOCIATION, 60 to 90 percent slopes

Map Unit Components	**Wapal family (40 percent)**	**Anatone family (25 percent)**	**Patio faimily, deep (20 percent)**
Position, Slope, and Elevation	On sideslopes and deeply incised drainages of mountain uplands; 60 to 90 percent slopes; 5500 to 7000 feet.	On ridges, knolls and upper sideslopes of mountain uplands; 60 to 90 percent slopes; 5500 to 7000 feet.	On sideslopes and lower slopes of mountain uplands; 60 to 80 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus few western juniper, big sagebrush, ceonothus, rabbitbrush, Ross's sedge, few grasses; 20 to 30 inches ppt.	Western juniper, few ponderosa pine, mountain mahogany, low sagebrush, big sagebrush, bottlebrush, Idaho fescue, other grasses; 20 to 30 inches ppt.	
Surface Layer	1/2 to 0 inches; ponderosa pine needles and twigs, over 0 to 6 inches; gray to light yellowish brown gravelly fine sandy loam, granular structure, loose, pH 6.6.	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.8 to 7.0.	1 to 0 inches of white fir needles, over 0 to 18 inches; yellowish brown very gravelly loam, granular structure, slightly hard, pH 6.2 to 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; andesite tuff, obsidian	10 to 20; andesite, tuff, obsidian	40 plus; andesite, tuff, obsidian
Erosion Factor (K)	.20	.37	.28
Max. Erosion Hazard	High to very high	Very high	High to very high
Soil Permeability	Moderately rapid	Moderate	Moderate
Drainage Class	Somewhat excessively drained	Well drained	Well drained
Soil Manageability Class Group	4Gp IV	4Gd	4Gp
Forest Site Class	6 (4-5)	7 (Non-commercial)	5 (3-4)
Range Site	Not placed in a range site.	9	Not placed in a range site.
Water Runoff Potential	Rapid	Very Rapid	Rapid
Watershed Sensitivity	5 (High)	2	5
Hydrologic Soil Group	A	D	B
Available Water Capacity (AWC) Upper 20 inches	Low 1.5 inches	Very Low to Low 1.2 to 2.5 inches	Moderate 2.3 inches
Susceptibility to Burning Damage	High	Moderate	High
Slope Stability Hazard	Moderate	Moderate	Moderate
Allowable Soil Loss	3 tons/acre/year	1 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Low to Very Low	Not Rated	Low to Moderate
Rating for Timber Site	Poor (9)	Not Rated	Poor (9)
R-Value	60+	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Gravelly fine sandy loam Unified: SM AASHTO: A-4 6-60; Very gravelly loamy fine sand, very gravelly loamy sand Unified: SM AASHTO: A-1-b, A-2-4	0-8; Cobbly loam Unified: ML, ML-CL AASHTO: A-4 8-17; Very cobbly loam Unified: SM, SC AASHTO: A-4, A-6 17+; Unweathered bedrock	0-60; Very gravelly loam, extremely gravelly loam, extremely cobbly loam Unified: SM, SM-SC AASHTO: A-2-4, A-2-6
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Mascamp family, Lithic Xerorthents, frigid, rock outcrop and Rubble land.		

281 WAPAL-PATIO deep FAMILIES ASSOCIATION, 15 to 35 percent slopes

Map Unit Components	**Wapal family (55 percent)**	**Patio family, deep (25 percent)**
Position, Slope, and Elevation	On upper sideslopes, ridges and knolls of mountain uplands; 20 to 35 percent slopes; 5500 to 7000 feet.	On lower sideslopes and toeslopes of mountain uplands; 15 to 35 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, washoe pine, plus few western juniper, mountain mahogany, big sagebrush, ceonothus, rabbitbrush, Ross's sedge, few grasses 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, washoe pine plus big sagebrush, ceonothus, rabbitbrush, Ross's sedge, few grasses; 20 to 30 inches ppt.
Surface Layer	1/2 to 0 inches; ponderosa pine needles and twigs, over 0 to 6 inches; gray to light yellowish brown gravelly fine sandy loam, granular structure, loose, pH 6.6.	1 to 0 inches of white fir needles, over 0 to 18 inches; yellowish brown very gravelly loam, granular structure, slightly hard, pH 6.2 to 6.8.
Rooting Depth (in.) to Underlying Material	40 plus; andesite, tuff, obsidian	40 plus; andesite, tuff, obsidian
Erosion Factor (K)	.20	.28
Max. Erosion Hazard	Moderate	Moderate
Soil Permeability	Moderately rapid	Moderate
Drainage Class	Somewhat excessively drained	Well drained
Soil Manageability Class Group	2ep II	2ep
Forest Site Class	6 (4-5)	5 (3-4)
Range Site	Not placed in a range site.	Not placed in a range site.
Water Runoff Potential	Slow	Slow
Watershed Sensitivity	8 (Low)	7
Hydrologic Soil Group	A	B
Available Water Capacity (AWC) Upper 20 inches	Low 1.5 inches	Moderate 2.3 inches
Susceptibility to Burning Damage	Moderate	Moderate
Slope Stability Hazard	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year
Chance of Seedling Survival	Low to Very Low	Low to Moderate
Rating for Timber Site	Good	Good
R-Value	60+	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Gravelly fine sandy loam Unified: SM AASHTO: A-4 6-60: Very gravelly loamy fine sand, very gravelly loamy sand Unified: SM AASHTO: A-1-b, A-2-4	0-60; Very gravelly loam, extremely gravelly loam,extremely cobbly loam Unified: SM, SM-SC AASHTO: A-2-4, A-2-6

Included Areas: Included with these soils in mapping and making up about 20 percent of the acreage are the Anatone, Smarts, Gleason, Merkel, and Lamondi families, Rock outcrop, and unnamed soils similar to the Inville family.

282 WAPAL-PATIO deep-ANATONE FAMILIES ASSOCIATION, 35 to 60 percent slopes

Map Unit Components	**Wapal family (40 percent)**	**Patio family, deep (25 percent)**	**Anatone family (20 percent)**
Position, Slope, and Elevation	On sideslopes and deeply incised drainages of mountain uplands; 35 to 60 percent slopes; 5500 to 7000 feet.	On sideslopes and lower slopes of mountain uplands; 35 to 60 percent slopes; 5500 to 7000 feet.	On ridges, knolls and upper sideslopes of mountain uplands; 40 to 60 percent slopes; 5500 to 7000 feet.
Typical Vegetation and Precipitation (ppt)	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, plus washoe pine few western juniper, big sage- brush ceonothus, rabbitbrush, Ross's sedge, few grasses; 20 to 30 inches ppt.	White fir forest, or mixed conifer forest of white fir, ponderosa pine, incense-cedar, washoe pine, plus few western juniper, big sagebrush, ceonothus, rabbitbrush, Ross's sedge, few grasses; 20 to 30 inches ppt.	
Surface Layer	1/2 to 0 inches; ponderosa pine needles and twigs, over 0 to 6 inches; gray to light yellowish brown gravelly fine sandy loam, granular structure, loose, pH 6.6.	1 to 0 inches of white fir needles, over 0 to 18 inches; yellowish brown very gravelly loam, granular structure, slightly hard, pH 5.8 to 6.0.	0 to 17 inches; brown cobbly loam to very cobbly loam, granular and blocky structure, slightly hard, pH 6.8 to 7.0.
Rooting Depth (in.) to Underlying Material	40 plus; andesite, tuff, obsidian	40 plus; andesite, tuff, obsidian	10 to 20; andesite, tuff, obsidian
Erosion Factor (K)	.20	.28	.37
Max. Erosion Hazard	High	High	High to very high
Soil Permeability	Moderately rapid	Moderate	Moderate
Drainage Class	Somewhat excessively drained	Well drained	Well drained
Soil Manageability Class Group	3Ep III	3Ep	3Ed
Forest Site Class	6 (4-5)	5 (3-4)	7 (non-commercial)
Range Site	Not placed in a range site.	Not placed in a range site.	9
Water Runoff Potential	Moderate	Moderate	Rapid
Watershed Sensitivity	7 (Moderate)	6	3
Hydrologic Soil Group	A	B	D
Available Water Capacity (AWC)	Low	Moderate	Very Low to Low
Upper 20 inches	1.5 inches	2.3 inches	1.2 to 2.5 inches
Susceptibility to Burning Damage	High	Moderate to High	Moderate
Slope Stability Hazard	Low	Low	Low
Allowable Soil Loss	3 tons/acre/year	3 tons/acre/year	1 tons/acre/year
Chance of Seedling Survival	Low to Very Low	Low to Moderate	Not Rated
Rating for Timber Site	Fair (8)	(Fair 8)	Not Rated
R-Value	60+	30-60	30-60
Soil horizons in inches, USDA, Unified, AASHTO	0-6; Gravelly fine sandy loam Unified: SM AASHTO: A-4 6-60; Very gravelly loamy fine sand, very gravelly loamy sand Unified: SM AASHTO: A-1-b, A-2-4	0-60; Very gravelly loam, extremely gravelly loam, extremely cobbly loam Unified: SM, SM-SC AASHTO: A-2-4, A-2-6	0-8; Cobbly loam Unified: ML, ML-CL AASHTO: A-4 8-17; Very cobbly loam Unified: SM, SC AASHTO: A-4, A-6 17+; Unweathered bedrock
Included Areas:	Included with these soils in mapping and making up about 15 percent of the acreage are the Mascamp, Gleason, Merkel, Smarts families, Lithic Xerorthents, frigid, Rock outcrop, Rubble land and unnamed soils similar to the Inville family.		

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land use allocations to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in the land use.

Information in this section can provide a basis for assigning management priorities to land areas that have few or less severe limitations and for determining areas where more detailed or site-specific soil information is needed. Additional information about each soil and its use and management is given under "Detailed Soil Map Unit Descriptions." In that section, individual soils are evaluated for their productivity, their manageability limitations, and their potential for production of forage and timber.

Watershed

Water is used on the Forest for livestock, dust abatement on roads during timber hauling, human consumption, maintenance of instreams flows, and wildlife needs, including wetland habitat. Outside Forest boundaries, water is used primarily for agricultural irrigation, hydroelectric power generation, livestock, recreation and wildlife. Tremendous amount of fracturing occurs throughout the rock mass. Therefore, the capacity for reception and temporary storage of water in the rock mass is considerable. The fracturing and the associated deep weathering in the underlying rock mantles are important factors in determining the hydrologic response of these watersheds.

Twenty watersheds on the Forest produce a cumulative annual yield of 565,800 acre-feet of water per year, not including water yield on private lands within the Forest Boundary. Most of this water percolates through the thin soil mantle and enters the ground-water system. At the beginning of the rainy season when the shallow soils are dry and undisturbed, they normally have a high infiltration rate. Because of the degree of fracturing and deep weathering in the underlying bedrock, these soils have a more permeable substratum then other shallow soils. For watershed planning purposes, these soils were assigned a hydrologic soil group rating of moderately high runoff rather that high runoff potential.

Soils in the forest are managed for watershed protection by preventing soil erosion and maintaining productivity. Overland flow or runoff on shallow forest soils can increase tremendously when wildfires induce the formation of water-repellent soil layers. Prevention of large wildfires through more intensive vegetative management is an important objective of soil management. The use of prescribed burning to develop age-class mosaics, along with fuelbreak construction, is an important tool for reducing soil erosion and sedimentation.

Timber production is of major importance in this survey area. About 29 percent or about 510,000 acres of the survey area is capable of supporting commercial timber at 20 cubic feet or more per acre per year at culmination of mean annual increment. Most of this acreage (about 85 to 90 percent) is on the Modoc National Forest. The rest is privately owned.

The largest areas of woodland are in map units 1, 2, 10, 11, 12, 13, 14, 15, 16, 18, and 19 described in the section "General soil map units". In the past ten years the Modoc National Forest has harvested about 60 million board feet of commercial timber per year. The most common commercial trees in the survey area are ponderosa pine and white fir. Other commercial timber present in less amounts are incense-cedar, sugar pine, Jeffrey pine, red fir, lodgepole pine and western white pine. The survey area has large areas of somewhat open pine stands which are typical of the eastside ponderosa pine climax community.

Most of the timber producing land in the survey area is limited in productivity due to one or more of the following factors: (a) marginal precipitation, (b) short growing season, (c) warm, dry southerly exposures, (d) low available soil water holding capacity, (e) low available nutrient supply. Recent nutrient analysis have shown nitrogen, phosphorus and/or sulfur to be deficient on many of the timber stands tested on the Modoc National Forest.

The major concerns with managing the soil resource to maintain or improve timber productivity are: accelerated soil erosion, soil compaction, areas of low regeneration potential, cumulative watershed impacts, low soil fertility, and soils with a high potential for slope failure. Timber management based on soil survey information and other timber inventory information is the basis for maintaining or improving timber production.

About 64 percent or about 1,130,000 acres of the survey area is rangeland. Modoc County has more resident beef cows than any other County in the state (Summary of Agricultural Commissioner's Reports in California 1981 and 1982). Eighty-eight grazing allotments are administered on the Modoc National Forest and vary in size from 100 acres to over 84,000 acres. The Modoc National Forest is by far, the leading Forest in the Region in total permitted domestic grazing with over 128,000 Animal Unit Months (AUM's) per year. These range allotments are normally utilized by livestock during the late spring, summer and early fall months.

The livestock normally remain off the allotments for the rest of the year. This helps maintain plant vigor and allows the plants to grow and set seed in the spring. It also helps alleviate compaction caused by trampling during this period when the soils are normally wet. Range has other land uses including watershed, wildlife habitat and recreation.

Over the past 60 years or so, western juniper and brush have become more prominent on some of our rangelands causing those areas to produce less grass. This is due to a combination of things such as better wildfire control, and overgrazing by either domestic or wild animals. In addition, improper or excessive road developments and/or overgrazing have resulted in excessive soil erosion in some areas.

Wildlife [1]

A diversity of wildlife and fish species habit the survey area. Those which contribute to recreational hunting and fishing are the most popular, such as mule deer, pronghorn antelope, trout, largemouth bass, channel catfish, and various waterfowl species like Canada geese, mallards, pintails, and gadwalls. Threatened, endangered, and sensitive species also use various habitats on the Forest. They include the bald eagle, Modoc sucker, California bighorn sheep, goshawk, and redband trout. In total, there are over 350 fish and wildlife species that rely in part, or totally, on the variety of habitats found within the Forest.

Soil directly affects the kind and amount of habitat that is available to fish and wildlife by their influence on the vegetation to provide food and cover. For example, on forested lands soils are important for determining the site's potential to produce large diameter trees and dense canopied stands for habitat used by dependent species such as goshawks and marten. Soils help to differentiate between those lands capable of providing these conditions and those lands which are not capable. Soils information is also important in determining the suitability of habitat improvement projects. Prescribe burning, seedings, and mechanical manipulation all require knowledge of soils to ensure meeting management objectives.

The soil survey can be used to help determine areas of potential habitat for various kinds of wildlife and their suitability for habitat improvement. Refer to the soil maps, the detailed map unit descriptions, and the applicable range site descriptions for this information.

Recreation

The Modoc National Forest is best known for its remote location and uncrowded recreation opportunities. In 1981, total recreation use on the Forest was 377,400 recreation visitor days (RVDs) and wildlife and fish user days (WFUDs). Most visitors enjoy hunting, fishing, and camping, while others delight in touring, hiking, horseback riding, swimming, picnicking, and gathering firewood. These activities are enhanced by the abundance of wildlife variety of landscape settings, and uncrowded conditions.

Increased use of the forest by recreational off-highway vehicles (trail bikes, 4-wheel jeeps, etc.) can cause major impact on soil resources. Overuse and heavy foot traffic can cause such severe soil compaction and reduced infiltration that it becomes necessary to close campgrounds for restoration.

Soils in the survey area are not rated in the map unit descriptions for their manageability. The rating system considers soil properties useful in recreation planning. For site-specific planning, more detailed soil investigation and interpretations may be required. The following is a general discussion of soil characteristics important for some kinds of recreational sites.

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

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

[1] This section prepared by Karen Shimamoto, Forest Ecologist, Modoc National Forest.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock should be considered.

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In Table 2, the soils of the survey area are listed alphabetically and are classified according to the system. In Table 3, the soils are listed by the categories. The categories are defined in the following paragraphs.

ORDER. Ten (prior to 1992) soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in "sols". An example is Alfisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Xeralfs "Xer", meaning dry, plus "alfs", from Alfisols.

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name or a suborder and by a prefix that indicates a property of the soil. For example, Haploxeralfs ("Haplo", meaning minimal horizonation, plus "xeralfs", the suborder of the Alfisols that have a xeric moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typical is the central concept; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceeding the name of the great group. The adjective "Lithic" identifies the subgroup that has hard parent rock within 20 inches of the surface. An example is Lithic Haploxeralfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is loamy, mixed, mesic Lithic Hapoloxeralfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer and the substratum can differ to some extent within a series.

In this survey soil series names were not used. Instead common family names were used. A common family name is a short name which can be substituted for the family which is explained in the family paragraph above. In other words instead of writing out "loamy, mixed, mesic Lithic Haploxerolls" we can simply call it the "Stukel family". There were several reasons for going only to the family level and common family name instead of to the series level and using the series name. These include:

- A soil inventory designed for forestwide planning and reconnaissance level project purposes does not warrant mapping to the series level of specificity.

- If this survey had been mapped at the series level this would have necessitated the development of about 30 to 40 new state soil series. This is due to significant differences in existing series already established. This would have taken a lot of additional soil scientist time to do this adequately. The relative short time period that was left to finish this inventory combined with the limited amount of soil scientist availability did not allow for this to be done.

- This also implies that perhaps 40 to 50 of the soils recognized in this survey may already fit established series or they could fit if minor changes were made to the established series and these changes approved through the SCS. This is true. However, to avoid confusion with using both series names and common family names together in this survey, it was decided that only common family names would be used.

- Using only the common family name instead of a series name helps to eliminate the bias that can be associated with attempting to "bend" the range in characteristics, etc., to fit an established series.

Table 2 - Classification by Soil Name

Soil Name	Family or Higher Taxonomic Class
Ahart family	Medial, frigid, Andic Xerumbrepts
Aikman family	Fine, montmorillonitic, mesic, Typic Chromoxererts
Alcot family	Cindery, mesic, Typic Xerorthents
Alicel family	Fine-loamy, mixed, mesic, Pachic Haploxerolls
Anatone family	Loamy-skeletal, mixed, frigid, Lithic Haploxerolls
Aquolls	Aquolls
Bakeoven family	Loamy-skeletal, mixed, mesic, Lithic Haploxerolls
Barnard family	Fine, montmorillonitic, mesic, Aridic Durixerolls
Bearskin family	Loamy, mixed, frigid, Lithic Argixerolls
Behanin family	Loamy-skeletal, mixed, Pachic Cryoborolls
Bertag family	Fine, montmorillonitic, frigid, Pachic Ultic Argixerolls
Bieber family	Clayey, montmorillonitic, mesic, shallow, Aridic Durixerolls
Cardon family	Fine, montmorillonitic, mesic, Chromic Pelloxererts
Castlevale family	Loamy, mixed, mesic, Lithic Xerollic Haplargids
Casuse family	Loamy, mixed, mesic, shallow, Xeralfic Haplargids
Cavanaugh family	Clayey-skeletal, montmorillonitic, frigid, Ultic Argixerolls
Cheadle family	Loamy-skeletal, mixed, Lithic Cryoborolls
Cowiche family	Fine-loamy, mixed, mesic, Aridic Argixerolls
Cryoborolls, wet	Cryoborolls, wet
DeMasters family	Fine-loamy, mixed, frigid, Pachic Ultic Argixerolls
Deven family	Clayey, montmorillonitic, mesic, Lithic Argixerolls
Dishner family	Clayey, montmorillonitic, mesic, Lithic Xerollic Haplargids

Soil Name	Family or Higher Taxonomic Class
Ditchcamp family	Fine-loamy, mixed, mesic, Xerollic Durargids
Divers family	Medial-skeletal, Andic Cryochrepts
Duncom family	Loamy, mixed, Lithic Cryoborolls
Elmore family	Fine-loamy, mixed, mesic, Pachic Ultic Argixerolls
Fordice family	Loamy-skeletal, mixed, mesic, Ultic Argixerolls
Friana family	Fine, montmorillonitic, Argic Pachic Cryoborolls
Gallatin family	Fine-loamy, mixed, Pachic Cryoborolls
Germany family	Medial, mesic, Andic Xerumbrepts
Ginser family	Loamy-skeletal, mixed, frigid, Pachic Haploxerolls
Gleason family	Coarse-loamy, mixed, mesic, Entic Haploxerolls
Gralic family	Loamy-skeletal, mixed, non-acid, Typic Cryorthents
Gwin family	Loamy-skeletal, mixed, mesic, Lithic Argixerolls
Hades family	Fine-loamy, mixed, frigid, Pachic Argixerolls
Hiibner family	Clayey-skeletal, montmorillonitic, mesic, Typic Argixerolls
Holland family	Fine-loamy, mixed, mesic, Ultic Haploxeralfs
Indian Creek family	Clayey, montmorillonitic, mesic, shallow, Xerollic Durargids
Inville family	Loamy-skeletal, mixed, frigid, Ultic Haploxeralfs
Jacket family	Fine, montmorillonitic, mesic, Pachic Ultic Argixerolls
Jacknife family	Fine, montmorillonitic, mesic, Pachic Argixerolls
Keating family	Fine, montmorillonitic, mesic, Typic Argixerolls
Kinzel family	Medial-skeletal, Andic Cryumbrepts
Lamondi family	Loamy-skeletal, mixed, frigid, Pachic Ultic Haploxerolls
Lapine family	Cindery, Typic Cryorthents
Lawyer family	Loamy-skeletal, mixed, mesic, Pachic Ultic Argixerolls
Lithic Cryochrepts	Lithic Cryochrepts

Soil Name	Family or Higher Taxonomic Class
Lithic Xerorthents	Lithic Xerorthents
Lithic Xerumbrepts	Lithic Xerumbrepts
Loberg family	Clayey-skeletal, mixed, Typic Cryoboralfs
Los Gatos family	Fine-loamy, mixed, mesic, Typic Argixerolls
Manila family	Fine, montmorillonitic, frigid, Typic Argixerolls
Mascamp family	Loamy-skeletal, mixed, frigid, Lithic Argixerolls
Menzel family	Coarse-loamy, mixed, mesic, Andic Xerochrepts
Merkel family	Loamy-skeletal, mixed, frigid, Typic Xerochrepts
Merlin family	Clayey, montmorillonitic, frigid, Lithic Argixerolls
Neer family	Medial-skeletal, mesic, Andic Xerochrepts
Packwood family	Loamy, mixed, mesic, shallow, Xerollic Durargids
Pass Canyon family	Loamy, mixed, mesic, Lithic Argixerolls
Patio family	Loamy-skeletal, mixed, frigid, Ultic Haploxerolls
Puls family	Clayey, montmorillonitic, mesic, shallow, Abruptic Xerollic Durargids
Ridd family	Loamy-skeletal, mixed, mesic, Typic Argixerolls
Roval family	Loamy, mixed, mesic, shallow, Aridic Durixerolls
Ruckles family	Clayey-skeletal, montmorillonitic, mesic, Lithic Argixerolls
Sadie family	Medial, mesic, Andic Xerochrepts
Saprists	Saprists
Searles family	Loamy-skeletal, mixed, mesic, Aridic Argixerolls
Sheld family	Medial-skeletal, frigid, Andic Xerumbrepts
Simpson family	Fine, montmorillonitic, mesic, Aridic Argixerolls
Skalan family	Loamy-skeletal, mixed, mesic, Ultic Haploxeralfs
Smarts family	Loamy-skeletal, mixed, frigid, Pachic Ultic Argixerolls
Stonewell family	Cindery, frigid, Dystric Xerorthents
Stukel family	Loamy, mixed, mesic, Lithic Haploxerolls

Soil Name	Family or Higher Taxonomic Class
Supan family	Fine-loamy, mixed, mesic, Pachic Argixerolls
Supervisor family	Loamy-skeletal, mixed, Typic Cryoborolls
Vipont family	Loamy-skeletal, mixed, frigid, Pachic Argixerolls
Wapal family	Sandy-skeletal, mixed, frigid, Typic Xerorthents
Wenatchee family	Fine-loamy, mixed, mesic, Xerollic Haplargids
Woodhurst family	Loamy-skeletal, mixed, Argic Pachic Cryoborolls
Wretham family	Loamy-skeletal, mixed, mesic, Pachic Haploxerolls
Wuksi family	Ashy-skeletal, Typic Cryorthents
Xerofluvents	Xerofluvents
Yallani family	Medial-skeletal, frigid, Andic Xerochrepts
Zynbar family	Medial, frigid, Entic Dystrandepts

Seven soil orders are represented in the Modoc survey area: Alfisols, Aridisols, Entisols, Histosols, Inceptisol, Mollisols, and Vertisols.

The soils in the survey area have a xeric moisture regime. The xeric moisture regime is typical in Mediterranean climates, where winters are moist and cool and summers are warm and dry. Therefore, unless the soil is irrigated, its moisture control section is dry in all parts for 45 consecutive days or more from July until October in 6 out of 10 years. The moisture control section is moist in all parts for 45 consecutive days or more from December until May.

The soils have a mesic, cryic or frigid temperature regime. In a mesic temperature regime, the soil temperature at a depth of 20 inches ranges from 47 to 59 degrees F. In a frigid temperature regime, which occurs at the highest elevations, particularly on north-facing aspects, the soil temperature at a depth of 20 inches ranges from 32 to 47 degrees F. Soils in a cryic temperature regime have a mean annual temperature higher than 32 degrees F but lower than 47 degrees F. A soil with a cryic regime is colder in summer than a soil with a frigid regime.

Alfisols are soils that can have a massive and hard A horizon and an argillic B horizon. They have high base saturation, and water is held at less that 15 bar tension during at least 3 months of each year when the soil is warm enough for plants to grow. Alfisols in this area have been placed in the Xeralf suborder. They have a xeric moisture regime; winters are moist and cool, and summers are warm and dry.

Aridisols are the soils that have formed in aridic moisture regime. The Aridisols in the survey area are in the Argids suborder and Durargids great group. They have a silica hard pan.

Entisols are soils that have little or no evidence of development of pedogenic horizons.

The Entisols in this area are in the Orthent and Psamment suborders. The soils do not have a B horizon and generally have less than 1 percent organic matter.

Orthents have a particle-size class that is loamy or finer in texture in some horizon below the Ap horizon and have slope of more then 25 percent or have an organic carbon content that decreases regularly with increasing depth. The organic carbon reaches a level of 0.2 percent or less within a depth of 1.25 meters. Psamments are loamy fine sand or coarser in the textural control section. These soils are on alluvial fans and are deep to very deep. The Orthents and Psamments have been placed in the Xerorthent and Xeropsamment great groups since they have a xeric moisture regime.

Inceptisols are soils in which altered horizons have lost bases of iron and aluminum but have retained some weatherable minerals. These soils do not have an illuvial horizon enriched either with silicate clay that contains aluminum or with an amorphous mixture of aluminum and organic carbon.

The Inceptisols in the survey area are in the Ochrept suborder. They have an ochric epipedon and a cambic horizon. They do not have a mollic epipedon because either the dark color, organic matter, or structure is lacking. The cambic horizon increases in clay content by 1 or 2 percent and has structure. The texture is coarse sandy loam or finer. These soils have a xeric moisture regime and thus have been placed in the Xerochrept great group.

Mollisols typically have a dark colored surface layer which is more than 25 cm thick, is more than 1 percent organic matter, and is not both hard and massive. Base saturation of this layer is more than 50 percent.

In this survey area, the Mollisols are in the Xeroll suborder. These soils formed in a warm, subhumid climate or in a semiarid climate where a natural, supplemental source of water extends the growing season. Winters are cool and moist, and summers are hot and dry. Unless irrigated, these soils are dry throughout the root zone for more than 60 consecutive days during the 3-month period following the summer solstice.

Xerolls are divided into two great groups: Argixerolls and Haploxerolls, Soils that do not have clay-enriched B horizon or layers strong in calcium carbonates are classified in the Hapolxeroll great group. Soils that have a clay-enriched B horizon and a clear to gradual boundary between the A and B horizons and do not have strongly calcareous layers have been placed in the Argixeroll great group.

Vertisols are the soils that have clay fraction of greater than 30 percent. These are easily recognized from cracks that open and close periodically and from slickensides.

Table 3 - Classification by Taxonomic Category

(An asterisk in the columns below indicate the soil was not classified to that level.)

ORDER	SUBORDER	GREAT GROUP	SUBGROUP	FAMILY	SOIL NAME
Alfisols	Boralfs	Cryoboralfs	Typic Cryoboralfs	Clayey-skeletal, mixed	Loberg family
	Xeralfs	Haploxeralfs	Ultic Haploxeralfs	Loamy-skeletal, mixed, frigid	Inville family
				Loamy-skeletal, mixed, mesic	Skalan family
				Fine-Loamy, mixed, mesic	Holland family
Aridisols	Argids	Durargids	Abruptic Xerollic Durargids	Clayey, montmorillonitic, mesic, shallow	Puls family
			Xerollic Durargids	Clayey, montmorillonitic, mesic, shallow	Indian Creek family
				Fine-loamy, mixed, mesic	Ditchcamp family
				Loamy, mixed, mesic, shallow	Packwood family
		Haplargids	Lithic Xerollic Haplargids	Clayey, montmorillonitic, mesic	Dishner family
				Loamy, mixed, mesic	Castlevale family
			Xerollic Haplargids	Loamy, mixed, mesic, shallow	Casuse family
			Xerollic Haplargids	Fine-loamy, mixed, mesic	Wenatchee family
Entisols	Fluvents	Xerofluvents	*	*	*
	Orthents	Cryorthents	Typic Cryorthents	Ashy-skelatal	Wuksi family
				Cindery	Lapine family
				Loamy-skeletal, mixed, non-acid	Gralic family
		Xerorthents	Typic Xerorthents	Cindery, mesic	Alcot family
				Sandy-skeletal, mixed, frigid	Wapal family
			Dystric Xerorthents	Cindery, frigid	Stonewell family
			Lithic Xerorthents	*	*
Histosols	Saprists	*	*	*	*
Inceptisols	Andepts	Dystrandepts	Entic Dystrandepts	Medial, frigid	Zynbar family
	Ochrepts	Cryochrepts	Andic Cryochrepts	Medial-skeletal	Divers family
			Lithic Cryochrepts	*	*

ORDER	SUBORDER	GREAT GROUP	SUBGROUP	FAMILY	SOIL NAME
		Xerochrepts	Typic Xerochrepts	Loamy-skeletal, mixed, frigid	Merkel family
			Andic Xerochrepts	Coarse-loamy, mixed, mesic	Menzel family
				Medial-skeletal, frigid	Yallani family
				Medial-skeletal, mesic	Neer family
				Medial, mesic	Sadie family
	Umbrepts	Xerumbrepts	Andic Xerumbrepts	Medial-skeletal, frigid	Sheld family
				Medial, frigid	Ahart family
				Medial, mesic	Germany family
			Lithic Xerumbrepts	*	*
Mollisols	Aquolls	*	*	*	*
	Borolls	Cryoborolls	Typic Cryoborolls	Loamy-skeletal, mixed	Supervisor family
			Argic Pachic Cryoborolls	Fine, montmorillonitic	Friana family
				Loamy-skeletal, mixed	Woodhurst family
			Lithic Cryoborolls	Loamy, mixed	Duncom family
			Loamy-skeletal, mixed	Cheadle family	
			Pachic Cryoborolls	Fine-loamy, mixed	Gallatin family
				Loamy-skeletal, mixed	Behanin family
	Xerolls	Durixerolls	Aridic Durixerolls	Clayey, montmorillonitic, mesic, shallow	Bieber family
				Fine, montmorillonitic, mesic	Barnard family
				Loamy, mixed, mesic, shallow	Roval family
		Argixerolls	Typic Argixerolls	Fine, montmorillonitic, frigid	Manila family
				Clayey-skeletal, montmorillonitic, mesic	Hiibner family
				Fine, montmorillonitic, mesic	Keating family
				Fine-loamy, mixed, mesic	Los Gatos family
				Loamy-skeletal, mixed, mesic	Ridd family
			Aridic Agrixerolls	Fine, montmorillonitic, mesic	Simpson family
				Fine-loamy, mixed, mesic	Cowiche family
				Loamy-skeletal, mixed, mesic	Searles family

ORDER	SUBORDER	GREAT GROUP	SUBGROUP	FAMILY	SOIL NAME
			Lithic Argixerolls	Clayey, montmorillonitic, mesic	Deven family
				Clayey-skeletal, montmorillonitic, mesic	Ruckles family
				Loamy, mixed, mesic	Pass Canyon family
				Loamy-skeletal, mixed, mesic	Gwin family
				Clayey, montmorillonitic, frigid	Merlin family
				Loamy, mixed, frigid	Bearskin family
				Loamy-skeletal, mixed, frigid	Mascamp family
			Pachic Argixerolls	Fine-loamy, mixed, frigid	Hades family
				Loamy-skeletal, mixed, frigid	Vipont family
				Fine, montmorillonitic, mesic	Jacknife family
				Fine-loamy, mixed, mesic	Supan family
			Pachic Ultic Argixerolls	Fine, montmorillonitic, frigid	Bertag family
				Fine-loamy, mixed, frigid	DeMasters family
				Loamy-skiletal, mixed, frigid	Smarts family
				Fine, montmorillonitic, mesic	Jacket family
				Fine-loamy, mixed, mesic	Elmore family
				Loamy-skeletal, mixed, mesic	Lawyer family
			Ultic Argixerolls	Clayey-skeletal, montmorillonitic, frigid	Cavanaugh family
				Loamy-skeletal, mixed, mesic	Fordice family
		Haploxerolls	Entic Haploxerolls	Coarse-loamy, mixed, mesic	Gleason family
			Lithic Haploxerolls	Loamy-skeletal, mixed, frigid	Anatone family
				Loamy-skeletal, mixed, mesic	Bakeoven family
				Loamy, mixed, mesic	Stukel family
			Pachic Haploxerolls	Loamy-skeletal, mixed, frigid	Ginser family
				Loamy-skeletal, mixed, mesic	Wrentham family
				Fine-loamy, mixed, mesic	Alicel family
			Pachic Ultic Haploxerolls	Loamy-skeletal, mixed, frigid	Lamondi family
			Ultic Haploxerolls	Loamy-skeletal, mixed, frigid	Patio family
Vertisols	Xererts	Chromoxererts	Typic Chromoxererts	Fine, montmorillonitic, mesic	Aikman family
		Pelloxererts	Chromic Pelloxererts	Fine, montmorillonitic, mesic	Cardon family

Taxonomic Unit Descriptions

In this section, each soil family or higher category recognized in the survey area is described. The descriptions are arranged in alphabetic order by either their common family name or higher taxonomic classification.

Characteristics of the soil and the material in which it formed are identified. A pedon, a small three-dimensional area of soil, that is typical of the soil in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual. Preceeding each pedon description is a brief paragraph describing the soils drainage class and permeability, its parent material, its range in physiographic position, slope, elevation, and climatic conditions as it was mapped in this survey area. Following the pedon description is the range of important characteristics of the soil.

Table 4 lists the approximate acreage of each soil map unit, and identifies its proportionate extent of the survey area. The approximate acreage of each soil type mapped within the survey area can be determined by multiplying the percent of that soil in each detailed map unit description it is named in by the total acreage of that mapping unit, then adding those acreages together.

Table 5 lists the mapping unit numbers in which that soil component (soil family or higher category) is found.

Table 4. - Map Unit Legend, Acreage and Proportionate Extent of the Soils

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
101	**Aikman family,** 0 to 2 percent slopes	19,220	1.09
102	**Aikman-Cardon families complex,** 0 to 2 percent slopes	4,920	0.28
103	**Aikman-Barnard families association,** 0 to 2 percent slopes	18,230	1.03
104	**Alcot family, 20 to 40 inch pumice overburden,** 1 to 10 percent slopes	3,890	0.22
105	**Alcot family, 40 to 60 inch pumice,** 5 to 35 percent slopes	4,340	0.24
106	**Alcot-Neer families association, 10 to 20 inch pumice overburden,** 5 to 30 percent slopes	6,760	0.38
107	**Alcot-Sadie families complex,** 1 to 20 percent slopes	9,260	0.52
108	**Alcot-Menzel families complex, 10 to 20 inch pumice overburden,** 1 to 10 percent slopes	3,020	0.17
109	**Alicel family,** 5 to 25 percent slopes	1,370	0.08
110	**Anatone-Bearskin families-Rock outcrop association,** 40 to 70 percent slopes	12,930	0.73
111	**Anatone-Bearskin-Smarts families association,** 2 to 20 percent slopes	6,230	0.35
112	**Anatone-Bearskin-Smarts families association,** 20 to 40 percent slopes	8,760	0.50
113	**Anatone-Merlin families-Rock outcrop association,** 40 to 90 percent slopes	1,450	0.08
114	**Anatone-Patio families-Rubble land association,** 60 to 90 percent slopes	640	0.04
115	**Anatone-Smarts families association,** 5 to 20 percent slopes	4,760	0.27
116	**Anatone-Smarts families association,** 20 to 40 percent slopes	7,410	0.42
117	**Anatone-Smarts families-Rock outcrop association,** 40 to 70 percent slopes	16,880	0.96
118	**Bakeoven family-Lava flow-Lithic Xerorthents, mesic association,** 1 to 15 percent slopes	39,890	2.25
120	**Bakeoven family-Rock outcrop association,** 20 to 60 percent slopes	4,280	0.24
121	**Bakeoven family-Rock outcrop-Wenatchee family association,** 1 to 20 percent slopes	2,420	0.14
122	**Bakeoven-Stukel families-Lava flow association,** 1 to 15 percent slopes	4,350	0.25
123	**Behanin-Cheadle families association,** 10 to 35 percent slopes	3,530	0.20

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
124	**Behanin-Cheadle families association,** 35 to 60 percent slopes	2,630	0.15
125	**Behanin deep-Gallatin families complex,** 10 to 35 percent slopes	810	0.05
126	**Behanin deep-Supervisor families complex,** 15 to 40 percent slopes	1,550	0.09
127	**Bertag deep-Cavanaugh-Mascamp families association,** 35 to 60 percent slopes	3,720	0.21
128	**Bertag-Smarts families association,** 10 to 40 percent slopes	2,510	0.14
129	**Bertag-Smarts, deep-Cavanaugh families complex,** 35 to 60 percent slopes	1,540	0.09
130	**Bieber-Barnard families complex,** 1 to 20 percent slopes	21,380	1.21
131	**Bieber-Barnard-Simpson families complex,** 1 to 10 percent slopes	3,750	0.21
132	**Bieber-Deven-Roval families complex,** 1 to 10 percent slopes	46,940	2.65
133	**Bieber-Roval families complex,** 1 to 15 percent slopes	21,130	1.20
134	**Bieber-Roval-Barnard families complex,** 1 to 10 percent slopes	3,800	0.22
135	**Bieber-Roval-Puls families complex,** 1 to 15 percent slopes	11,490	0.65
136	**Cardon family,** 0 to 2 percent slopes	5,780	0.33
137	**Cardon-Jacket-Deven families association,** 5 to 25 percent slopes	550	0.03
138	**Saprists,** 0 to 2 percent slopes	870	0.05
139	**Castlevale-Bakeoven families complex, 2 to 8 inch pumice overburden,** 1 to 10 percent slopes	2,080	0.12
140	**Castlevale-Wenatchee-Searles families complex, 2 to 12 inch pumice overburden,** 1 to 10 percent slopes	3,600	0.20
141	**Cavanaugh-Patio deep families association,** 35 to 65 percent slopes	1,110	0.06
142	**Cheadle-Gallatin families-Rock outcrop association,** 10 to 60 percent slopes	3,220	0.18
144	**Cowiche family,** 1 to 10 percent slopes	3,070	0.17
145	**Cowiche-Casuse families-Rock outcrop, tuff association,** 2 to 30 percent slopes	900	0.05
146	**Cowiche-Simpson families complex,** 1 to 15 percent slopes	8,200	0.46
147	**DeMasters-Merlin-DeMasters deep families association,** 1 to 20 percent slopes	13,980	0.79
148	**DeMasters-Smarts families, deep complex,** 1 to 20 percent slopes	11,300	0.64

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
149	**DeMasters-Smarts families, deep complex,** 20 to 40 percent slopes	4,070	0.23
150	**Deven family,** 1 to 10 percent slopes	2,770	0.16
151	**Deven-Bieber-Barnard families complex,** 0 to 5 percent slopes	53,520	3.02
152	**Deven-Bieber-Lawyer families association,** 1 to 10 percent slopes	4,070	0.23
153	**Deven-Bieber-Pass Canyon families association,** 1 to 15 percent slopes	47,960	2.72
154	**Deven-Pass Canyon families complex,** 1 to 10 percent slopes	50,060	2.83
155	**Deven-Pass Canyon-Keating families complex,** 1 to 15 percent slopes	6,500	0.37
156	**Deven-Pass Canyon-Keating families complex,** 15 to 35 percent slopes	16,920	0.96
157	**Deven-Pass Canyon-Keating families complex,** 35 to 60 percent slopes	9,040	0.51
158	**Deven-Puls families association,** 1 to 15 percent slopes	16,200	0.92
159	**Deven family-Rock outcrop association,** 1 to 20 percent slopes	8,580	0.49
161	**Divers-Lapine-Kinzel families association, 2 to 15 inch pumice overburden,** 2 to 30 percent slopes	6,820	0.39
162	**Divers-Lapine-Kinzel families association,** 30 to 55 percent slopes	4,340	0.25
163	**Divers-Lapine families-Rock outcrop association, 5 to 15 inch pumice overburden,** 2 to 30 percent slopes	1,250	0.07
164	**Elmore deep family,** 1 to 15 percent slopes	24,710	1.40
165	**Elmore deep family,** 15 to 40 percent slopes	3,120	0.18
166	**Elmore-Deven-Elmore deep families association,** 1 to 20 percent slopes	14,250	0.81
167	**Elmore-Jacket, deep-Lawyer families association,** 1 to 20 percent slopes	2,300	0.13
168	**Elmore-Jacket, deep-Lawyer families association,** 20 to 40 percent slopes	7,490	0.42
169	**Elmore deep-Elmore family-Lava flow association,** 5 to 30 percent slopes	1,510	0.09
170	**Gallatin-Behanin deep-Duncom families complex,** 5 to 30 percent slopes	3,290	0.19
171	**Gallatin-Cheadle families-Cryoborolls, wet association,** 15 to 40 percent slopes	2,410	0.14
173	**Germany deep-Sadie families complex,** 1 to 5 percent slopes	2,760	0.16
174	**Germany family-Lithic Xerumbrepts-Lava flow association,** 1 to 20 percent slopes	48,340	2.74

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
175	**Gwin-Pass Canyon families-Lithic Xerorthents, mesic complex**, 1 to 20 percent slopes	2,110	0.12
176	**Gwin-Pass Canyon families-Lithic Xerorthents, mesic complex**, 20 to 40 percent slopes	6,210	0.35
177	**Gwin-Pass Canyon families-Lithic Xerorthents, mesic complex**, 40 to 70 percent slopes	5,280	0.30
178	**Gwin-Ruckles families-Rock outcrop association**, 40 to 70 percent slopes	2,910	0.16
179	**Hades-Vipont-Anatone families association**, 10 to 30 percent slopes	4,410	0.25
180	**Hiibner-Deven-Keating families complex**, 20 to 60 percent slopes	10,070	0.57
181	**Hiibner-Ruckles families complex**, 15 to 35 percent slopes	3,800	0.22
182	**Holland family, 4 to 15 inch pumice overburden**, 1 to 10 percent slopes	4,050	0.23
183	**Holland deep-Skalan families complex, 8 to 20 inch pumice overburden**, 1 to 10 percent slopes	5,900	0.33
184	**Indian Creek family**, 1 to 5 percent slopes	21,820	1.24
185	**Indian Creek-Puls-Barnard families complex**, 0 to 2 percent slopes	14,720	0.83
186	**Inville-Yallani families complex, 10 to 20 inch pumice overburden**, 2 to 20 percent slopes	4,920	0.28
187	**Jacket-Deven-Hiibner families association**, 1 to 15 percent slopes	3,450	0.19
188	**Jacket-Deven-Hiibner families association**, 15 to 35 percent slopes	21,720	1.23
189	**Jacket-Deven-Hiibner families association**, 35 to 60 percent slopes	4,370	0.25
190	**Jacknife-Aikman families association**, 0 to 5 percent slopes	4,040	0.23
191	**Keating-Deven families association**, 1 to 20 percent slopes	22,050	1.25
192	**Keating-Deven families association**, 20 to 40 percent slopes	4,390	0.25
193	**Kinzel-Lapine-Divers families association, 2 to 12 inch pumice overburden**, 1 to 15 percent slopes	5,030	0.28
194	**Lamondi-Smarts deep families complex**, 2 to 20 percent slopes	4,460	0.25
195	**Lamondi-Smarts deep families complex**, 20 to 40 percent slopes	11,560	0.65
196	**Lamondi-Smarts deep families complex**, 40 to 60 percent slopes	4,870	0.28
197	**Lapine-Divers families association, 10 to 24 inch pumice overburden**, 20 to 40 percent slopes	900	0.05
198	**Lapine-Divers families association, 10 to 24 inch pumice overburden**, 40 to 60 percent slopes	1,500	0.08

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
199	**Lapine-Wuksi-Divers families association, 2 to 8 inch pumice overburden,** 5 to 30 percent slopes	2,430	0.14
200	**Lawyer deep-Lawyer family complex,** 1 to 20 percent slopes	6,060	0.34
201	**Lawyer-Elmore families, deep association,** 1 to 20 percent slopes	67,190	3.81
202	**Lawyer-Elmore families, deep association,** 20 to 40 percent slopes	20,240	1.15
203	**Lawyer-Elmore families, deep association,** 40 to 60 percent slopes	4,330	0.25
204	**Lawyer-Elmore-Gwin families association,** 1 to 20 percent slopes	48,740	2.76
205	**Lawyer-Elmore-Gwin families association,** 20 to 40 percent slopes	20,230	1.15
206	**Lawyer-Elmore-Gwin families association,** 40 to 60 percent slopes	3,750	0.21
207	**Lithic Cryochrepts-Cheadle family association,** 10 to 40 percent slopes	820	0.05
208	**Lithic Xerorthents, mesic-Deven family complex,** 1 to 15 percent slopes	1,820	0.10
209	**Lithic Xerorthents, mesic-Lava flow complex,** 1 to 20 percent slopes	1,210	0.07
210	**Lithic Xerorthents, mesic-Xerofluvents, mesic-Aquolls association,** to 20 percent slopes	8,050	0.46
211	**Loberg-Friana-Cheadle families association,** 30 to 65 percent slopes	1,940	0.11
212	**Manila-Merlin-Mascamp families association,** 10 to 35 percent slopes	10,210	0.58
213	**Manila-Merlin-Mascamp families association,** 35 to 60 percent slopes	4,350	0.25
214	**Merlin family,** 1 to 10 percent slopes	780	0.04
215	**Gralic-Loberg families-Rubble land association,** 35 to 80 percent slopes	1,580	0.09
216	**Gralic-Supervisor families complex,** 10 to 35 percent slopes	1,450	0.08
217	**Gralic-Supervisor families complex,** 35 to 60 percent slopes	1,370	0.08
218	**Packwood-Bieber families complex,** 1 to 10 percent slopes	7,390	0.42
219	**Packwood-Ditchcamp families-Rock outcrop complex,** 1 to 10 percent slopes	25,560	1.45
220	**Packwood-Puls families complex,** 1 to 5 percent slopes	12,790	0.72
221	**Pass Canyon-Dishner-Deven families association,** 1 to 20 percent slopes	1,870	0.11
222	**Pass Canyon-Elmore families-Lava flow association,** 1 to 20 percent slopes	35,920	2.04

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
223	**Pass Canyon-Elmore-Packwood families association,** 1 to 10 percent slopes	10,960	0.62
224	**Pass Canyon-Fordice-Gwin families association,** 1 to 20 percent slopes	26,000	1.47
225	**Pass Canyon-Fordice-Gwin families association,** 20 to 40 percent slopes	25,730	1.46
226	**Pass Canyon-Gwin-Fordice families association,** 40 to 70 percent slopes	7,340	0.42
227	**Pass Canyon family-Lithic Xerorthents, mesic complex,** 1 to 15 percent slopes	3,310	0.19
228	**Pass Canyon-Los Gatos families complex,** 1 to 20 percent slopes	31,770	1.80
229	**Pass Canyon-Roval families complex,** 1 to 15 percent slopes	6,540	0.37
230	**Patio deep-Gleason-Merkel families complex,** 10 to 40 percent slopes	6,220	0.35
231	**Patio deep-Merkel families complex,** 15 to 35 percent slopes	4,720	0.27
232	**Patio deep-Merkel families complex,** 35 to 60 percent slopes	4,130	0.23
233	**Patio-Smarts-Anatone families association,** 15 to 35 percent slopes	1,470	0.08
235	**Puls-Packwood-Ditchcamp families complex,** 1 to 10 percent slopes	5,320	0.30
236	**Puls-Roval-Dishner families complex,** 0 to 5 percent slopes	47,190	2.67
237	**Ridd-Los Gatos-Gwin families association,** 5 to 35 percent slopes	9,920	0.56
238	**Ridd-Ruckles-Keating families complex,** 1 to 20 percent slopes	1,770	0.10
239	**Rock outcrop-Bakeoven-Wenatchee families association,** 20 to 60 percent slopes	5,460	0.31
240	**Rock outcrop-Rubble land-Bakeoven family association,** 40 to 90 percent slopes	4,880	0.28
241	**Rock outcrop-Rubble land-Cheadle family association,** 60 to 100 percent slopes	7,670	0.43
242	**Roval-Deven families association,** 1 to 10 percent slopes	5,360	0.30
243	**Roval-Pass Canyon families complex,** 1 to 15 percent slopes	35,610	2.02
244	**Ruckles-Bieber families complex,** 2 to 30 percent slopes	2,340	0.13
245	**Ruckles-Gwin families-Rock outcrop association,** 20 to 40 percent slopes	6,480	0.37
246	**Menzel-Holland families, 4 to 15 inch pumice overburden-Rock outcrop association** 15 to 40 percent slopes	1,680	0.10
247	**Searles-Gwin families-Lava flow complex,** 1 to 10 percent slopes	8,780	0.50

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
249	**Sheld-Ahart families association,** 2 to 20 percent slopes	2,970	0.17
250	**Simpson family,** 1 to 10 percent slopes	2,810	0.16
251	**Simpson-Deven families association,** 1 to 20 percent slopes	23,420	1.33
252	**Smarts deep-Smarts family complex,** 2 to 20 percent slopes	30,220	1.71
253	**Smarts deep-Smarts family complex,** 20 to 40 percent slopes	5,770	0.33
254	**Smarts-Bertag-DeMasters families, deep association,** 10 to 35 percent slopes	6,600	0.37
255	**Smarts deep-Cavanaugh families complex,** 10 to 35 percent slopes	1,150	0.07
256	**Smarts deep-Cavanaugh families complex,** 35 to 60 percent slopes	2,100	0.12
257	**Smarts-Mascamp families association,** 40 to 60 percent slopes	6,650	0.37
258	**Smarts-Mascamp-DeMasters deep families association,** 2 to 20 percent slopes	11,050	0.63
259	**Smarts-Mascamp-DeMasters deep families association,** 20 to 40 percent slopes	11,720	0.66
260	**Stonewell family, 40 to 60 inch pumice,** 15 to 40 percent slopes	7,870	0.45
261	**Stonewell-Yallani families association, 6 to 20 inch pumice overburden,** 5 to 30 percent slopes	5,060	0.29
262	**Stonewell-Yallani families association,** 35 to 70 percent slopes	4,920	0.28
263	**Stonewell-Yallani families-Lithic Xerorthents, frigid association,** 30 to 55 percent slopes	4,020	0.23
264	**Stonewell-Yallani-Zynbar families association,** 2 to 20 percent slopes	3,010	0.17
265	**Stonewell-Zynbar families association,** 15 to 35 percent slopes	2,230	0.13
266	**Stukel family-Lava flow association,** 1 to 20 percent slopes	4,860	0.28
267	**Stukel-Los Gatos-Pass Canyon families complex,** 1 to 10 percent slopes	11,100	0.63
268	**Supan-Supan deep-Pass Canyon families association,** 1 to 20 percent slopes	47,650	2.70
269	**Supervisor-Cheadle families-Rock outcrop association,** 15 to 35 percent slopes	7,250	0.41
270	**Supervisor-Cheadle families-Rock outcrop association,** 35 to 60 percent slopes	5,180	0.29
271	**Supervisor-Cheadle families-Rock outcrop association,** 60 to 90 percent slopes	1,240	0.07
272	**Rock outcrop, tuff-Lithic Xerorthents, frigid complex,** 60 to 100 percent slopes	11,110	0.63

Map Symbol	Mapping Unit Name	Approx. Acreage	Approx. Survey Area %
273	**Vipont-Ginser-Anatone families association,** 15 to 40 percent slopes	3,560	0.20
274	**Aquolls,** 0 to 5 percent slopes	5,010	0.28
275	**Woodhurst-Behanin deep families complex,** 10 to 35 percent slopes	2,950	0.17
276	**Wrentham-Bakeoven families association,** 10 to 40 percent slopes	5,270	0.30
277	**Yallani-Sheld families complex,** 5 to 30 percent slopes	3,330	0.19
278	**Yallani-Inville families complex, 8 to 20 inch pumice overburden,** 5 to 30 percent slopes	3,900	0.22
279	**Yallani-Stonewell families association,** 15 to 35 percent slopes	1,720	0.10
280	**Wapal-Anatone-Patio deep families association,** 60 to 90 percent slopes	940	0.05
281	**Wapal-Patio deep families association,** 15 to 35 percent slopes	2,610	0.15
282	**Wapal-Patio deep-Anatone families association,** 35 to 60 percent slopes	7,050	0.40
V	**Lava flow rock**	32,390	1.83
W	**Water**	38,270	2.17
	Total	1,764,960	100.00

Table 5. - Soil Components in Map Units

(Miscellaneous areas and minor components are not included)

Soil Name	Map Unit
Ahart family	249
Aikman family	101,102,103,190,
Alcot family	104,105,106,107, 108
Alicel family	109,
Anatone family	110,111,112,113, 114,115,116,117, 233,273,280,282
Aquolls	210,274,
Bakeoven family	118,120,121,122, 139,239,240,276,
Barnard family	103,130,131,134, 151,185
Bearskin family	110,111,112,
Behanin family	123,124,125,126 170,275,
Bertag family	127,128,129,
Bieber family	130,131,132,133, 134,135,151,152, 218,
Cardon family	102,136,137,
Castlevale family	139,140,
Casuse family	145,
Cavanaugh family	127,129,141,
Cheadle family	123,124,142,171, 207,211,241,269, 270,271,
Cowiche family	144,145,146
Cryoborolls, wet	171,
DeMasters family	147,148,149,
Deven family	132,137,150,151, 152,153,154,155, 156,157,158,166, 180,187,188,189, 191,192,208,221
Dishner family	221,236,
Ditchcamp family	219,235,
Divers family	161,162,163,193, 197,198,199,
Duncom family	170,
Elmore family	164,165,166,167, 168,169,201,202, 203,204,205,206, 222,223,
Fordice family	224,225,226,
Friana family	211,
Gallatin family	125,142,170,171,
Germany family	173,174,
Ginser family	273,
Gleason family	230,
Gralic family	215,216,217,
Gwin family	175,176,177,178, 204,205,206,224, 225,226.237,
Hades family	179,

Soil Name	Map Unit
Hiibner family	180,187,188,189,
Holland family	182,183,
Indian Creek family	184,185,
Inville family	186,278,
Jacket family	137,167,168,187, 188,189,
Jacknife family	190,
Keating family	155,156,157,180, 181,191,192,238,
Kinzel family	161,162,193,
Lamondi family	194,195,196,
Lapine family	161,162,163,193, 197,198,199,
Lawyer family	152,167,168,200, 201,202,203,204, 205,206,
Lithic Cryochrepts	207,
Lithic Xerorthents	118,175,176,177, 208,209,210,227, 272,
Lithic Xerumbrepts	174,
Loberg family	211,215,
Los Gatos family	228,237,
Manila family	212,213,
Mascamp family	127,212,213,
Menzel family	108,
Merkel family	230,231,232,

Soil Name	Map Unit
Merlin family	113,147,212,213, 214,
Neer family	106
Packwood family	218,219,220,223, 235,
Pass Canyon family	153,154,155,156, 157,175,176,177, 221,222,223,224, 225,226,227,228, 229,
Patio family	114,141,230,231, 232,233,280,281, 282,
Puls family	135,158,185,220, 235,236,
Ridd family	237,238,
Roval family	132,133,134,135, 229,236,
Ruckles family	178,181,238,
Sadie family	107,173,
Saprists	138,
Searles family	140,
Sheld family	277,
Simpson family	131,146,
Skalan family	183,
Smarts family	111,112,115,116, 117,128,129,148, 149,194,195,196, 233,

Soil Name	Map Unit
Stonewell family	279,
Stukel family	122,
Supan family	268
Supervisor family	126,216,217,269, 270,271,
Vipont family	179,273,
Wapal family	280,281,282,
Wenatchee family	121,140,239,
Woodhurst family	275,
Wrentham family	276,
Wuksi family	199,
Xerofluvents	210,
Yallani family	186,277,278,279,
Zynbar family	

AHART FAMILY

The Ahart family consists of deep, well drained soils formed from alluvium and in material weathered from ash and basalt. Permeability is moderate. These soils are on 2 to 10 percent slopes and occur on toeslopes and draws of volcanic mountain uplands at 5600 to 6200 feet elevation. The climate is cool with 40 to 44°F mean annual air temperature and 30 to 40 inches annual precipitation which falls mostly as snow during winter. The frost free season is 70 to 100 days.

Taxonomic Class: Medial, frigid, Andic Xerumbrepts.

Reference Pedon: Ahart family gravelly fine sandy loam on a southwest facing 4 percent mountain toeslope at 5770 feet elevation under an open white fir forest with rabbitbrush, snowbrush, Ross's sedge and bunch grass understory. Soil was dry in the upper 3 inches when described on 7/10/80. (Colors are for dry soil unless otherwise stated.)

01–1/2 to 0 inches; white fir needles and grass duff.

A11–0 to 3 inches; brown (10YR 5/3) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and very fine granular structure; soft, very friable, non-sticky and non-plastic; 20 to 25 percent cinder and pumice gravel by volume; many very fine and fine, and few medium roots; slightly acid (pH 6.2); weakly smeary; gradual wavy boundary.

A12–3 to 12 inches; brown (10YR 5/3) gravelly fine sandy loam, dark brown (10YR 3/3) moist; very weak fine and medium subangular blocky structure which parts into weak fine granular; soft, very friable, non-sticky and non-plastic; 15 percent cinder and basalt gravel by volume; many very fine and fine, common medium and few coarse roots; slightly acid (pH 6.2); weakly smeary; gradual wavy boundary.

B2–12 to 28 inches; brown (10YR 5/3) gravelly fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 15 percent cinder and basalt gravel by volume; common very fine, fine and medium and few coarse roots; medium acid (pH 6.0); weak to moderately smeary; gradual wavy boundary.

C1–28 to 60 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, non-sticky and non-plastic; 30 to 35 percent gravel of weathered cinder and pumice by volume; few to common very fine and fine and few medium and coarse roots; medium acid (pH 6.0); moderately smeary.

Reference Pedon Location: Siskiyou County, California, about 1800 feet east and 1500 feet north of the southwest corner of Section 1, T.42N., R.3E.

Range of Characteristics: The Ahart family soils are deeper than 40 inches to basalt or unweathered ash. The mean annual soil temperature at a depth of 20 inches is 42 to 47°F. The 4 to 12 inch soil moisture control section is moist in all parts from about November 15 through May 30. It is dry in all parts from about August 1 through October 20. The soil temperature exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The average content of coarse fragments in the 10 to 40 inch control section is 15 to 35 percent by volume. The bulk density of the soil fine earth fraction is estimated to be between 0.80 and 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally in all parts of the upper 30 inches of soil. The estimated base saturation in the A horizon is between 30 and 50 percent by the ammonium acetate method. The soil has weak to moderate smeary consistence throughout and the soil pH is slightly to medium acid.

The A horizon is 8 to 24 inches thick. Soil colors are 10YR 4/4, 5/3, 5/4; 7.5YR 4/4, 4/6; 5YR 4/4 dry and 10YR 3/2, 3/3; 7.5YR 3/2; 5YR 3/3 moist. Texture is sandy loam or fine sandy loam and normally contains between 15 and 30 percent gravel and cobbles. It has weak granular and subangular blocky structure and soil pH is slightly acid to medium acid.

The B horizon has dry color of 10YR 5/3, 5/4, 5/6, 6/4; 7.5YR 3/4 and 10YR 4/3, 3/4, 4/4, 4/6; or 5YR 3/4 moist. Texture is loam, sandy loam or fine sandy loam and contain between 15 and 35 percent by volume gravel and cobbles. It has weak to moderate subangular blocky structure and soil pH is slightly acid to medium acid.

The C horizon is sandy loam or fine sandy loam and contains between 25-45 percent by volume gravel and cobbles. Soil colors are 10YR 6/4, 6/6, 7/4 dry and 10 YR 4/4, 4/6, 5/4, 5/6 moist. It is massive and soil pH is slightly acid to medium acid.

AIKMAN FAMILY

The Aikman family consists of deep and moderately deep, moderately well drained soils formed in clayey alluvium derived from basalt. Permeability is very slow. These soils are on slopes of 0 to 2 percent and occur on alluvial flood plans and drainages at elevations of 4300 to 6000 feet. The climate is cool with annual precipitation of 12 to 20 inches which falls mostly as snow during the winter. Mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Typic Chromoxererts.

Reference Pedon: Aikman family silty clay on a nearly level alluvial drainageway at 5100 feet elevation under silver sagebrush, timothy and various wet meadow grasses. Soil was moist below 14 inches when described on 9/6/79. (Colors are for dry soil unless otherwise stated.)

A1–0 to 1 inch; dark gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) moist; moderate to strong fine and medium granular structure; very hard, firm, very sticky and very plastic; many fine, very fine and few medium roots; cracks are 2 inches wide and 10 to 24 inches between cracks; non-effervescent; neutral (pH 6.6); clear smooth boundary.

AC–1 to 4 inches; dark grayish brown (10YR 4/2), silty clay, very dark grayish brown (10YR 3/2) moist; moderate to strong, fine and medium platy structure parting to moderate to strong fine and medium granular; very hard, firm, very sticky and very platic; many fine, very fine and few medium roots; common fine and few medium tubular pores; cracks are 2 inches wide; non-effervescent; neutral (pH 7.0); clear smooth boundary.

C1–4 to 14 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong coarse and very coarse prismatic structure parting to strong medium angular blocks; slickensides on ped faces; very hard, firm, very sticky and very plastic; common to many fine and very fine and few medium roots; common fine and few medium tubular pores; cracks are 1 to 2 inches wide; non-effervescent; neutral (ph 7.0); clear wavy boundary.

C2–14 to 42 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate to strong, medium and fine angular blocky structure; slickensides on ped faces; very hard, firm, very sticky and very plastic; common very fine and fine roots; common fine and few medium tubular pores; cracks are less than 1/2 inch to 1 inch wide; non-effervescent; mildly alkaline (ph 7.4); clear wavy boundary.

C3–42 to 60 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; massive, extremely hard, very firm, very sticky and very plastic; few fine and very fine roots, few very fine tubular pores; non-effervescent; neutral (pH 7.0).

Reference Pedon Location: Modoc County, California, about 1200 feet east and 400 feet north of the southwest corner of Section 25, T.47N., R.11E.

Range of Characteristics: Depth to bedrock is typically greater than 40 inches with some pedons in the 20-40 inch depth normally found along the parameter of units. Clay content in the control section ranges from 40-60 percent. The Aikman soils have surface cracks of about 1/2 inch to 2-1/2 inches wide and extend to depths of greater than 20 inches which open and close at least once each year and remain open during the period of mid-July through mid-October and remain closed for the rest of the year. Intersecting slickinsides or pressure faces are common between the 4 to 42 inch soil depth. The annual soil temperature at the 20 inch depth is estimated to range between 48 to 52°F. The soil between depths of 4 to 12 inches is usually dry in all parts from July 15 through October 15 and is moist in some or all parts all the rest of the year. Rock fragments can make up to 20 percent of the surface horizon and are mostly rounded basalt cobbles and stones.

The A horizon is 1 to 5 inches thick and has dry color of 10YR 5/4, 5/3, 5/2, 4/3, 4/2, 4/1 and moist color of 10YR 4/2, 4/1, 3/2, 3/3, or 3/4. Texture is silty clay or clay. Structure is moderate to strong granular and soil pH is neutral to slightly alkaline.

The C horizon has dry color of 10YR 5/4, 5/3, 5/2, 4/3, 4/2 and moist color of 10YR 4/3, 4/2, 3/3, or 3/2. The moist value is 2 or 3 within the top 12 inches of the soil surface. Texture is silty clay or clay. Some pedons have a clay loam or gravelly clay loam IIC horizon below 30 inches.

Structure is platy, prismatic, angular blocky or massive and soil pH ranges from neutral to mildly alkaline. Calcium carbonate accumulations may be present below 30 inches in some pedons.

ALCOT FAMILY

The Alcot soils consist of deep, somewhat excessively drained soils that formed in alluvium derived from volcanic ash, cinders and geologically recent pyroclastic pumice. Permeability is rapid in the pumice material, if present, and moderately rapid below. These soils are found on old alluvial fans on basalt plateaus and sideslopes of volcanic mountain uplands and have slopes of 1 to 35 percent. Elevation is 4200 to 5500 feet. The annual precipitation is 16 to 30 inches most of which falls in winter as snow. The frost free season is 80 to 110 days. Mean annual air temperature is 44-48°F.

Taxonomic Class: Cindery, mesic, Typic, Xerorthents.

Reference Pedon: Alcot family gravelly loamy coarse sand (pumice overburden phase) on a nearly level basalt plateau with a geologically recent pumice deposit at 4200 feet elevation under an open ponderosa pine forest with a bitterbrush understory. Soil was dry throughout when described on 10/11/78. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; Ponderosa pine needles and twigs.

A1–0 to 6 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand pumice material; very dark grayish brown (10YR 3/2) moist; single grained loose; non-sticky and non-plastic; common fine and very fine and few to common medium and coarse roots; 30 percent by volume pumice gravel less than 3/4 inch in diameter; non-effervescent; neutral (pH 6.6); clear smooth boundary.

C1–6 to 20 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand very pale brown (10YR 7/3) moist; single grained; loose; non-sticky and non-plastic; few to common fine and very fine and few medium and coarse roots; 85 percent by volume pumice gravel less than 3/4 inch in diameter; non-effervescent; neutral (pH 6.7); abrupt smooth boundary.

IIA1b–20 to 22 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure parting to moderate fine and very fine granular; soft; very friable; slightly sticky and non-plastic; common fine and very fine and few medium and coarse roots; 40 percent by volume pumice and ash gravel less than 3/4 inch in diameter; common to many fine and very fine tubular pores; non-effervescent; neutral (pH 6.8); clear smooth boundary.

IIAC–22 to 33 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft; very friable; slightly sticky and non-plastic; common fine and very fine roots and few to common medium and coarse; gravel 40 percent by volume of ash material less than 3/4 inch in diameter; common fine and very fine tubular pores; non-effervescent; neutral (pH 6.8); gradual wavy boundary.

IIC1–33 to 53 inches; brownish yellow (10YR 6/6) very gravelly sandy loam, dark yellowish brown (10YR 4/6) moist; massive; soft; very friable; slightly sticky and non-plastic; few to common fine and very fine and few medium and coarse roots; 45 percent gravel by volume of ash material less than 3/4 inch in diameter; non-effervescent; slightly acid (pH 6.4); gradual wavy boundary.

IIIC2–53 to 64 inches; light yellowish brown (10YR 6/4) very gravelly loamy sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable; non-sticky and non-plastic; few fine, very fine and medium roots; 40 percent gravel by volume of ash material mostly less than 3/4 inch in diameter; non-effervescent; slightly acid (pH 6.5).

IVC3–64 to 88 inches; light yellowish brown (10YR 6/4) very gravelly sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, non-sticky and non-plastic; 50 percent gravel by volume of ash material mostly less than 3/4 inches in diameter; few fine and very fine roots; non-effervescent; neutral (pH 6.7).

VC4 sim. 88+ inches.

Reference Pedon Location: Modoc County, California, about 2200 feet east and 500 feet south of the northeast corner of Section 22, T.44N., R.5E.

Range in Characteristics: Depth to a lithic contact of fractured basalt is greater than 40 inches. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The soil in the moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30. The control section averages 35 to 95 percent 2-25 mm. gravel size pumice and/or cinders by volume. The bulk density of

the soil fine earth fraction is estimated to be less than 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 in all parts of the soil. It is estimated that more than 60 percent of the whole soil by weight is volcanic ash, cinders and/or pumice throughout the soil.

There are three Alcot family soil phases recognized in this survey. They consist of Alcot family pumice phase; Alcot family pumice overburden phase; and Alcot family without pumice.

The Alcot family, pumice phase consists of a geologically recent pumice deposition of 40 to over 60 inches in depth. This pumice material is over a loamy textured cindery material or is directly over basalt flow rock. The A horizon is 2 to 6 inches thick and ranges in colors from 10YR 5/4, 5/3, 5/2, or 4/2 dry, over 10YR 3/4, 3/3, 3/2, or 2/2 moist. It is loamy sand or sand with 35 to 60 percent pumice gravel. The C horizon has colors of 10YR 8/3, 7/2, 6/3, or 6/2 dry, and 10YR 7/3, 6/3, 6/2, 5/3, 5/2, 4/3 moist. Texture in the pumice C material is coarse sand and contains from 70 to 95 percent pumice gravel mainly of the less than 3/4 inch size. A IIC horizon may be present below the pumice material with textures of very gravelly coarse sandy loam or very gravelly sandy loam.

The Alcot family, pumice overburden phase consists of a geologically recent pumice deposition 10 to 40 inches in depth over a loamy textured cindery material below this pumice overburden. The pumice overburden consists of an A horizon 4 to 8 inches in depth and is coarse loamy sand with 15 to 35 percent gravel mainly of the less than 0.4 inch size. Colors are 10YR 5/4, 5/3, 5/2 dry, and 10YR 4/3, 4/2, 3/3 or 3/2 moist. The C horizon is extremely coarse sand with 60 to 90 percent gravel mainly of the 0.2 to 1.0 inch size. Colors are 10YR 8/3, 7/3, or 7/2 dry, and 10YR 7.3 or 6/3 moist. The burried IIAb horizon below the pumice mantle is 2 to 6 inches thick and is sandy loam in texture with 35 to 50 percent gravel mainly of the less than 0.6 inch size. Color is 10YR 6/4 or 5/4 dry, 10YR 4/4 or 3/4 moist. The IIC horizon is sandy loam, and grade to a loamy sand or sand with depth. Gravel content ranges from 35 to 60 percent and is mainly less than 3/4 inch in size and consist of older weathered pumice and cinder material. Colors are 10YR 7/4, 6/6, 6/4, 6/3 dry, and 10YR 4/6, 4/4, 5/4, 5/6 moist.

The Alcot family without the recent pumice deposition has an A horizon 3 to 9 inches in depth. Texture is sandy loam. Gravel content is 20 to 50 percent by volume and mainly of the less than 0.4 inch size. Colors are 10YR 5/4, 5/3, 4/3, 4/2 dry, and 10YR 3/4, 3/3, 3/2 or 2/2 moist. The C horizon has texture of sandy loam or coarse sandy loam and grades to loamy coarse sand and coarse sand with depth. Gravel content is 40 to 85 percent by volume and mainly of the less than 1 inch size. The gravels consist of older weathering cinders and pumice. Color is 10YR 6/3, 6/4, 6/6, 5/4, 5/6 dry and 10YR 3/4, 3/6, 4/4, 4/6, 5/4; 7.5YR 3/4, 4/4, 4/6 moist.

ALICEL FAMILY

The Alicel family consists of moderately deep to deep well drained soils formed in alluvium and aeolian deposits derived mainly from basalt and andesite. Permeability is moderate. These soils are found on rolling foothills with slopes of 5 to 25 percent and occur at elevations of 4200 to 5000 feet. The annual air temperature is 46 to 49°F. The frost free season is 90 to 110 days. The annual precipitation ranges from 10 to 14 inches most of which falls during the winter as snow.

Taxonomic Class: Fine-loamy, mixed, mesic, Pachic Haploxerolls.

Reference Pedon: Alicel family gravelly loam on a southeast facing 12 percent sideslope of a rolling foothill at 4700 feet elevation under big sagebrush and rabbitbrush rangeland with various bunch grasses. Soil was dry when described on 8/16/79. (Colors are for dry soil unless otherwise noted.)

A11–0 to 4 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine platy structure which parts into weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; 20 percent gravel by volume; slightly acid (pH 6.4); clear, smooth boundary.

A12–4 to 9 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine granular structure; slightly hard, friable, slightly sticky and non-plastic; 15 percent gravel by volume; common very fine and fine roots, few very fine and fine pores; neutral (pH 6.8); clear, smooth boundary.

A13–9 to 17 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, non-sticky and slightly plastic; few thin clay films on ped faces; 10 percent gravel by volume; few very fine and fine roots; few very fine and fine pores; neutral (pH 6.8); clear, smooth boundary.

A14–17 to 38 inches; brown (7.5YR 5/4) loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable; non-sticky and slightly plastic; few thin clay films on ped faces; 10 percent gravel by volume; few very fine and fine roots; few very fine and fine pores; neutral (pH 7.0); clear, smooth boundary.

IIC1–38 to 45 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, non-sticky and non-plastic; 15 percent gravel by volume; neutral (pH 7.0).

R–45 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 100 feet north of road and 1050 feet west and 400 feet north of the SE corner of Section 24, T.46N., R.6E.

Range in Characteristics: Depth to a lithic contact of fractured basalt is greater than 30 inches. The mean annual soil temperature at a depth of 20 inches is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 of most years. The soils 4 to 12 inch moisture control section is usually moist in all parts from December 15 through May 1 and dry in all parts from June 15 through November 15. The average coarse fragment content in the 10 to 40 inch control section is 10 to 35 percent by volume, and also averages 18 to 24 percent in clay content.

The A horizon is 20 to more than 40 inches thick and may make up the whole soil with dry color of 10YR 5/4, 5/3, 5/2 and moist color of 10YR 2/2, 3/2, 3/3, or 7.5YR 3/2. Texture is loam or sandy loam and contains from 10 to 30 percent by volume gravel. Structure is massive or granular and soil pH is slightly acid to neutral.

The B horizon, if present, has dry color of 10YR 6/3, 5/4 or 7.5YR 5/4 and moist color of 10YR 3/4, 4/3 or 7.5YR 3/4 or 4/4. Texture is loam or sandy loam with 15 to 35 percent by volume gravel. Structure is weak to moderate subangular blocky and soil pH is neutral.

The C horizon may or may not be present. If present, it is fine sandy loam or sandy loam with 20 to 40 percent by volume coarse fragments. Dry color is 10YR 6/3, 6/4 and moist color is 10YR 4/4, 4/3 or 7.5YR 4/4. It is massive and soil pH is neutral.

ANATONE FAMILY

The Anatone family consists of shallow, well drained soils that formed in material weathered from hard volcanic tuff, andesite, basalt or obsidian. Permeability is moderate. They are found on mountain sideslopes, ridges, and knolls with slopes of 5 to 90 percent and occur at elevations of 5500 to 7500 feet. The annual precipitation is 20 to 30 inches, most of which falls during the winter as snow. The mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Lithic Haploxerolls

Reference Pedon: Anatone family cobbly loam on a west facing 23 percent sideslope at 6520 feet elevation under big sagebrush, mule ears, arrowleaf balsam root and Idaho fescue rangeland with scattered montaine shrubs. Soil was dry when described on 11/4/81. (Colors are for dry soil unless otherwise noted.)

A11–0 to 8 inches; brown (7.5YR 4/2) cobbly loam, very dark brown (7.5YR 2/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 10 percent cobbles and 10 percent gravel by volume; many very fine, fine and medium, and few coarse roots; neutral (pH 7.0); gradual wavy boundary.

A12–8 to 17 inches; brown (7.5YR 4/2) very cobbly loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; 25 percent cobbles and 30 percent gravel by volume; common to many very fine and fine, common medium, and few coarse roots; neutral (pH 6.8); abrupt wavy boundary.

R–17 plus inches; hard fractured vasicular basalt.

Reference Pedon Location: Lassen County, California, about 750 feet west and 1400 feet south of the northeast corner of Section 10, T.38N., R.11E.

Range in Characteristics: Depth to a lithic contact of fractured basalt, andesite, obsidian, or volcanic tuff is 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The soils 5 to 15 inch moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average rock fragment content of the control section is 35 to 70 percent by volume, and also averages 16 to 24 percent clay.

The A horizon normally occupies the whole soil depth and have dry color of 7.5YR 4/2, 4/3; 10YR 4/3, 5/3, 5/4 and moist color of 7.5YR 2/2, 3/2; 10YR 2/1, 2/2, 3/2 or 3/3. Texture is loam or sandy loam and contains from 35 to 70 percent by volume rock fragments consisting mainly of gravel, cobbles and stones. Structure is granular and subangular blocky and soil pH is slightly acid to neutral.

AQUOLLS

Aquolls consist of moderately deep to very deep, poorly drained soils that formed in alluvium from mixed rock sources. Permeability is moderately slow to very slow. They are in drainageways on 0 to 5 percent slopes and are subject to flooding. Elevation ranges from 4400 to 6400 feet and annual precipitation ranges from 14 to 25 inches most of which falls during the winter as snow. The mean annual air temperature is 44 to 49°F. The frost free season is 60 to 110 days.

Taxonomic Class: Aquolls

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Aquoll silty clay loam on a nearly level drainageway at 5300 feet elevation under sedges, poa sp., and other grasses. Soil was moist throughout and saturated below 26 inches when described on 6/22/78. (Colors are for dry soil unless otherwise stated.)

A1–0 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam, black (10YR 2/1) moist; strong fine granular structure; hard, friable, sticky and plastic; many fine, very fine and common medium roots; neutral (pH 6.6); abrupt smooth boundary.

B2t–4 to 17 inches; dark grayish brown (10YR 4/2) clay, very dark brown (10YR 2/2) moist strong medium prismatic structure parting to strong medium angular blocky; very hard, very firm, very sticky and very plastic; many fine, very fine and few medium roots; common to many very fine and fine pores; many distinct clay films on ped faces and pores; neutral (pH 6.8); clear smooth boundary.

B3tg–17 to 26 inches; grayish brown (2.5YR 5/2) clay, dark grayish brown, (2.5YR 4/2) moist; 20 percent prominent medium yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure which parts to moderate fine and medium angular blocks; very hard, very firm, very sticky and very plastic; many very fine and common fine roots; few to common fine and very fine pores; many distinct clay films on ped faces and pores; neutral (pH 7.0); clear wavy boundary.

C1g–26 to 33 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; 50 percent distinct medium yellowish brown (10YR 5/8) mottles; massive; very hard, firm, very sticky and very plastic; few fine and common very fine roots; neutral (pH 6.6); abrupt smooth boundary.

IIC2g–33 to 60 inches; dark gray (5Y 4/1) 2 to 6 inch stratified lenses of very gravelly clay, clay and very gravelly clay loam, dark grayish brown (2.5Y 4/2) moist; 50 to 60 percent distinct medium yellowish brown (10YR 5/8) mottles; massive; hard, firm, very sticky and plastic; few fine and very fine roots; slightly acid (pH 6.4).

Reference Pedon Location: Modoc County, California, about 600 feet west and 1100 feet south of the NE corner of Section 18, T.40N., R.6E.

Range in Characteristics: Depth to bedrock is greater than 20 inches. fluctuating apparent water table exists within 10 to 40 inches of the surface with a capillary fringe at or near the surface. These soils are normally saturated with water during most of the year except where artifically drained. The soil temperature at the 20 inch depth is above 41°F. from about May 1 through November 30 in most years and the mean annual soil temperature at that depth is about 47 to 52°F. Clay content in the control section averages 30 to 70 percent and coarse fragments average 0 to 45 percent by volume.

The A horizon is 2 to 16 inches thick with dry color of 10YR 3/1, 4/1, 4/2, 4/3, 5/2, 5/3; 2.5Y 4/2, 3/2 and moist color of 10YR 2/1, 2/2, 3/1, 3/2; 2.5Y 3/2. Texture is loam, silt loam, clay loam, silty clay loam or clay and contains from 0 to 40 percent by volume coarse fragments. Structure is platy, granular or subangular blocky and soil pH is slightly acid to mildly alkaline.

The B horizon has dry color of 10YR 4/1, 4/2, 4/3, 4/4, 5/1, 5/2, 5/3, 5/3; 2.5Y 4/2, 4/4, 5/2 and moist color of 10YR 2/1, 2/2, 3/1, 3/2, 3/3, 3/4,4/2, 4/3; 7.5YR 3/2; 2.5Y 3/2, 4/2. The upper 7 inches of soil has mollic colors and may include the whole B horizon. Texture is clay loam, silty clay loam, sandy clay loam, silty clay or clay and contains from 0 to 60 percent by volume coarse fragments. Structure is prismatic or blocky and soil pH is slightly acid to mildly alkaline.

The C horizon has dry color of 10YR 5/1, 5/2, 6/2; 2.5Y 5/2,6/2, 6/4; 5Y 4/1, 5/1, 5/2, 6/2 and moist color of 10YR 4/2, 5/2; 2.5Y 4/2, 5/2; 5Y 4/1, 4/2, 5/1, 5/2. Common to many distinct yellowish brown to yellowish red mottles are evident throughout the C horizon. Texture is loam, clay loam, silty clay loam, silty clay or clay and may contain up to 60 percent by volume coarse fragments. It is massive or is in stratified lenses and soil pH is slightly acid to neutral.

BAKEOVEN FAMILY

The Bakeoven family consists of shallow, well drained soils that formed in material weathered from basalt. Permeability is moderately rapid. These soils are found on basalt plateaus and mountain uplands at elevations of 4200 to 7000 feet. Slopes range from 1 to 70 percent. The annual precipitation is 10 to 20 inches most of which falls during the winter as snow. The mean annual air temperature is 44 to 50°F. The frost free season is 60 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Lithic Haploxerolls.

Reference Pedon: Bakeoven family very cobbly fine sandy loam on a 4 percent north sloping basalt plateau interspersed with lava flow rock at 4500 feet elevation under rabbitbrush and cheatgrass rangeland. Soil was dry when described on 11/6/81. (Colors are for dry soil unless otherwise stated.)

A11–0 to 5 inches; dark grayish brown (10YR 4/2) very cobbly fine sandy loam, very dark brown (10YR 2/2) moist, moderate fine and medium subangular blocky structure which parts into fine and medium granular structure; slightly hard, very friable, slightly sticky and non-plastic; 30 to 40 percent cobbles, and 5 to 10 percent gravel by volume; many very fine and fine, common medium roots; few to common very fine and fine pores; neutral (pH 6.6); clear smooth boundary.

A12–5 to 11 inches; grayish brown (10YR 5/2) very cobbly fine sandy loam, very dark brown (10YR 2/2) moist; weak to moderate fine and medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, very friable, slightly sticky and non-plastic; 45 percent cobbles and 5 to 10 percent gravel by volume; common very fine, fine and medium roots; few to common very fine and fine pores; neutral (pH 6.6) abrupt wavy boundary.

R–11 plus inches; hard vesicular basalt, irregularly fractured.

Reference Pedon Location: Siskiyou County, California, about 1800 feet west and 700 feet south of the NE corner of Section 7, T.45N., R.4E.

Range in Characteristics: Depth to the lithic contact ranges from 7 to 20 inches. The mean annual soil temperature at the lithic contact is about 47 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1. Where this soil is mapped in map units 118, 119, 120, 121, 122, 139, 239, and 276 the soil between depths of about 5 to 15 inches, or lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped in map unit 240 the soil at the 5 to 15 inch depth, or lithic contact if shallower, is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1. The average rock fragment content of the control section is 35 to 75 percent by volume and clay content averages 10 to 24 percent.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 4/2, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, or 3/3. A thin 1 to 8 inch pumice ash and gravel overburden is present in some pedons. Texture is loam, sandy loam, fine sandy loam, or coarse sandy loam and contains from 35 to 75 percent by volume rock fragments consisting mainly of gravels, cobbles and stones. Structure is granular to subangular blocky and soil pH is neutral.

BARNARD FAMILY

The Barnard family consists of moderately deep, well drained soils that formed in material weathered from basalt and tuff. Permeability is slow. These soils are on basalt plateaus on 0 to 20 percent slopes and occur at elevations of 4300 to 6000 feet. The climate is cool. The annual precipitation is 10 to 16 inches, most of which falls during the winter as snow. The mean annual air temperature is 44 to 49°F. and the frost free season is 80 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Aridic Durixerolls.

Reference Pedon: Barnard family cobbly loam on an east facing 16 percent basalt plateau sideslope at 5140 feet elevation under western juniper, big sagebrush, rabbitbrush and bluegrass rangeland. Soil was dry when described on 9/15/75. (Colors are for dry soil unless otherwise noted.)

A1–0 to 3 inches; grayish brown (10YR 5/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and very coarse platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine interstitial pores, few very fine tubular pores; 30 percent by volume mixed cobbles and gravel; slightly acid (pH 6.5); gradual smooth boundary.

A3–3 to 8 inches; dark grayish brown (10YR 4/2) gravelly light clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and very coarse subangular blocky structure; slightly hard, very friable, slightly sticky and plastic; common very fine and fine roots; common very fine and fine tubular pores; 30 percent by volume mixed gravel; neutral (pH 7.0); clear smooth boundary.

B21t–8 to 17 inches; dark brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; strong fine subangular blocky structure; hard, firm, sticky and plastic; common fine, and few medium roots; common very fine and fine tubular pores; common pressure faces on ped faces, few moderately thick clay films on face of peds, and clay bridges between mineral grains; 10 to 15 percent by volume mixed gravel; neutral (pH 7.0); gradual wavy boundary.

B22t–17 to 32 inches; brown (7.5YR 5/4) gravelly silty clay, dark brown (7.5YR 3/4) moist; strong very fine and fine subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; few very fine tubular pores; many moderately thick clay films on face of peds, and clay bridges between mineral grains; many pressure faces in lower 3 inches; 20 percent by volume mixed gravel, 10 percent cobbles; mildly alkaline (pH 7.5); abrupt wavy boundary.

Csim–32 to 42 inches; very pale brown (10YR 7/4) silica duripan, dark yellowish brown (10YR 4/4) moist; strong fine and medium platy structure; weakly to strongly cemented; moderately alkaline (pH 8.0).

R–42 plus inches; slightly weathered hard basalt.

Reference Pedon Location: Modoc County, California, about 50 feet east of dirt road to cinder pit just past major curve in road and about 250 feet north and 1650 feet west of the southeast corner of Section 14, T.39N., R.14E.

Range in Characteristics: Depth to silica duripan ranges from 20 to 40 inches and is generally underlain by hard fractured basalt or tuff. The silica duripan normally ranges in thickness from 5 to 20 inches. The mean annual soil temperature is 20 inches is about 47°F. to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 in most years. The 4 to 12 inch moisture control section is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1. The average coarse fragment content of the control section is 5 to 30 percent by volume, and clay content averages 35 to 50 percent.

The A horizon is 4 to 8 inches thick with dry colors of 10YR 4/2, 5/2, 5/3 and moist colors of 10YR 3/1, 3/2, 3/3 or 7.5YR 3/2. Texture is loam or clay loam and normally contain between 5 to 40 percent gravel and cobbles. It has platy granular or subangular blocky structure and soil pH is slightly acid to neutral.

The B horizon has dry colors of 10YR 4/2, 4/3, 5/4, 6/4 or 7.5YR 4/2, 4/4, or 5/4 and moist colors of 10YR 3/2, 3/3, 3/4, 4/2, 4/3 or 7.5YR 3/2, 3/4, 4/4. The upper part of the argillic B horizon normally has the darker mollic colors. Texture is clay loam, silty clay or clay and normally contain between 5 and 30 percent by volume coarse fragments. Structure is blocky and soil pH is neutral to mildly alkaline.

The C horizon normally consists entirely of the silica duripan which is weakly to strongly cemented.

BEARSKIN FAMILY

The Bearskin family consists of shallow, well drained soils that formed from hard volcanic tuff or basalt. Permeability is moderately slow. These soils are on mountain sideslopes of 2 to 60 percent. Elevation ranges from 5500 to 7000 feet. The annual precipitation is 20 to 25 inches, most of which falls during the winter as snow. Mean annual air temperature is 42 to 46°F. The frost free season is 60-90 days.

Taxonomic Class: Loamy, mixed, frigid, Lithic Agrixerolls.

Reference Pedon: Bearskin family cobbly loam on a south facing 15 percent slope at 5700 feet elevation under low sagebrush, western juniper, bottlebrush and wheatgrass rangeland. Soil was dry when described on 8/23/79. (Colors are for dry soil unless otherwise noted.)

A11–0 to 4 inches; brown (10YR 5/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium platy structure which parts into moderate very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; 30 percent gravel and cobbles by volume; many very fine and fine, few medium and coarse roots; neutral (pH 6.8); clear smooth boundary.

A12–4 to 8 inches; brown (10YR 4/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine and medium platy structure which parts into moderate to strong very fine or fine subangular blocks; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on ped faces; 30 percent basalt gravel and cobbles by volume; many very fine and fine, few medium roots; neutral (pH 6.8); clear wavy boundary.

B21t–8 to 14 inches; brown (10YR 4/3) cobbly silty clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular and angular blocky structure which parts into moderate to strong medium and coarse granular; slightly hard, friable, sticky and plastic; few moderately thick clay films on ped faces; 20 percent basalt gravel and cobbles by volume; common very fine, fine, medium and coarse roots; many very fine and fine, few medium; neutral (pH 6.6); clear wavy boundary.

B22t–14 to 18 inches; dark yellowish brown (10YR 4/4) cobbly silty clay loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common moderately thick clay films on ped faces; 30 to 35 percent tuff gravel and cobbles by volume; common very fine, fine, medium and coarse roots; neutral (pH 6.6); clear wavy boundary.

R–18 inches; hard congolmerated volcanic tuff.

Reference Pedon Location: Modoc County, California, about 30 feet above the road and about 1400 feet east and 1850 feet south of the northwest corner of Section 24, T.40N., R.14E.

Range in Characteristics: Depth to hard conglomerated tuff, or basalt is 10 to 20 inches. The control section averages 24 to 35 percent clay and coarse fragments average 10 to 35 percent by volume. The mean annual soil temperature at the lithic contact is about 43 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from June 15 through October 15 in most years. The soils 4 to 12 inch moisture control section, or to the lithic contact is shallower, is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20.

The A horizon is 4 to 8 inches thick with dry colors of 10YR 4/2, 4/3, 5/2, 5/3 or 7.5YR 4/2 or 4/4 and moist colors of 10YR 2/2, 3/2, 3/3 or 7.5YR 3/2. Texture is loam or light clay loam with normally 15 to 35 percent by volume coarse fragments. Structure is granular, platy or blocky and soil pH is neutral.

The B horizon makes up the remainder of the soil with dry colors of 10YR 4/3, 4/4, 5/3, 5/4 or 7.5YR 4/4, 5/2 or 5/4 and moist colors of 10YR 3/2, 3/3 or 7.5YR 3/2. Texture is clay loam or silty clay loam with 10 to 35 percent by volume rock fragments. Structure is blocky or prismatic and soil pH is neutral to slightly acid.

BEHANIN FAMILY

The Behanin family consists of moderately deep and deep well drained soils that formed in material weathered from andesite, basalt, or conglomerated tuff. Permeability is moderate. These soils are found on mountain sideslopes. The slopes ranges from 5 to 55 percent and elevations range from 7000 to 9700 feet. The annual precipitation is 25 to 35 inches which falls mainly as snow during the winter and the mean annual air temperature is 34 to 40°F. The frost free season is less than 30 days to 70 days.

Taxonomic Class: Loamy-skeletal, mixed, Pachic Cryoborolls.

Reference Pedon: Behanin family very gravelly loam on a northwest facing 29 percent mountain sideslope at 7100 feet elevation under a white fir forest with a sparse understory of snowberry, lupine and bottlebrush. Soil was moist below 17 inches when described on 9/13/80. (Colors are for dry soil unless otherwise stated.)

01–1-1/2 to 0 inches; white fir needles and twigs.

A11–0 to 7 inches; very dark grayish brown (10YR 3/2) very gravelly loam, black (10YR 2/1) moist; weak medium subangular blocky structure which parts to weak to moderate fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent stones, 10 percent cobbles and 25 percent gravel by volume; many very fine, fine and medium and common coarse roots; few to common very fine and fine pores; medium acid (pH 6.0); gradual wavy boundary.

A12–7 to 17 inches; very dark grayish brown (10YR 3/2) very stony loam, black (10YR 2/1) moist; weak to moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 20 percent stones, 15 percent cobbles and 15 percent gravel by volume; many very fine, fine and medium and common coarse roots; common very fine and fine pores; slightly acid (pH 6.2); gradual wavy boundary.

A13–17 to 34 inches; dark brown (10YR 3/3) very stony loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 20 percent stones, 20 percent cobbles, and 15 percent gravel by volume; many very fine and fine, common medium and coarse roots; few very fine and fine pores; slightly acid (pH 6.2); gradual wavy boundary.

IIA14–34 to 60 plus inches; brown (10YR 4/3) extremely gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; 60 percent weathered basalt gravel by volume; common very fine, fine and medium and few coarse roots; few very fine and fine pores; slightly acid (pH 6.4).

Reference Pedon Location: Modoc County, California, about 50 feet east of road and 2100 feet west and 250 feet south of the northeast corner of Section 13, T.44N., R.14E.

Range in Characteristics: Depth to a lithic contact ranges from 20 to 40 inches in map units 123 and 124 to greater than 40 inches in map units 125, 126, 170 and 275. The mean annual soil temperature at the 20 inch depth is about 36 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The soils 5 to 15 inch moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10. The rock fragment content of the control section averages 35 to 65 percent by volume and the clay content averages 18 to 24 percent.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 3/2, 3/3, 4/2, 4/3, 5/3, or 5/4 and moist color of 10YR 2/1, 2/2, 3/2, or 3/3. Texture is loam or sandy loam with 30 to 70 percent by volume rock fragments consisting mainly of gravel size with normally lessor amounts of cobbles and stones. Structure is granular and subangular blocky and soil pH is medium acid to neutral.

BERTAG FAMILY

The Bertag family consists of deep and moderately deep, well drained soils weathered from volcanic tuff and basalt. Permeability is slow. These soils are on mountain sideslopes with 10 to 60 percent slopes and elevations of 5500 to 7500 feet. The climate is cool with an annual precipitation of 20 to 30 inches most of which falls in the winter as snow. The mean annual air temperature is 40 to 46°F. and the frost free season is 60 to 90 days.

Taxonomic Class: Fine, montmorillonitic, frigid, Pachic Ultic Argixerolls.

Reference Pedon: Bertag family loam on a west facing 13 percent mountain sideslope at 6550 feet elevation under a predominately white fir forest with a few Jeffrey pine and ponderosa pine and a sparce understory of mountaine shrubs. Soil was moist below 13 inches when described on 8/12/80. (Colors are for dry soil unless otherwise stated.)

0–1-1/2 to 0 inches; litter of white fir and ponderosa pine needles and twigs.

A1–0 to 13 inches; dark brown (10YR 3/3) loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure which parts to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; 5 to 10 percent gravel and 5 percent by volume basalt cobbles; common very fine and fine pores; slightly acid (pH 6.4) clear smooth boundary.

B1t–13 to 20 inches; dark brown (10YR 4/3) cobbly clay loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular and subangular blocky structure; hard, friable, sticky and plastic; few to common thin clay films on ped faces and interstitial pores; 10 to 15 percent gravel and 10 percent by volume basalt cobbles; common very fine and fine pores; slightly acid (pH 6.4); clear wavy boundary.

B21t–20 to 30 inches; dark brown (7.5YR 4/4) gravelly clay, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and interstitial pores; 15 to 20 percent by volume basalt gravel; common very fine and fine pores; slightly acid (pH 6.2); gradual wavy boundary.

B22t–30 to 38 inches; brown (7.5YR 5/4) gravelly clay, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and interstitial pores; 25 percent by volume basalt gravel; common very fine and fine pores; slightly acid (pH 6.4); gradual wavy boundary.

B23t–38 to 60 plus inches; brown (10YR 4/3) gravelly clay, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; very hard, firm, very sticky and plastic; common moderately thick clay film on ped faces and interstitial pores; 30 to 35 percent by volume basalt gravel; few to common very fine and fine pores; neutral (pH 6.8).

Reference Pedon Location: Modoc County, California, about 50 feet east of road and 2100 feet east and 1550 feet north of the southwest corner of Section 5, T.40N., R.15E.

Range in Characteristics: Depth to a lithic contact is 20 to 40 inches in map unit 128 and greater than 40 inches in map units 127, 129 and 254. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The soils 4 to 12 inch moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20. The coarse fragment content of the control section averages 5 to 35 percent by volume and the clay content averages 35 to 50 percent. Base saturation averages 60 to 75 percent in the A horizon and increases with depth.

The A horizon is 8 to 18 inches thick with dry colors of 10YR 3/3, 3/4, 4/3, 4/4, 5/3 or 7.5YR 4/2, or 4/4 and moist colors for 10YR 2/1, 2/2, 3/2, 3/3 or 7.5YR 3/2. Texture is loam or clay loam and normally contain from 5 to 25 percent by volume coarse fragments. Structure is granular or blocky and soil pH is medium acid to neutral.

The B horizon normally occupies the remaining soil depth with dry colors of 10YR 4/2, 4/3, 5/3, 5/4 or 7.5YR 4/2, 4/4 or 5/4 and moist colors 10YR 2/2, 3/2, 3/3, 3/4 or 7.5YR 3/2 or 3/4. The upper parts of the argillic B horizon has mollic colors. Texture is clay loam or clay and ranges from 5 to 35 percent by volume in coarse fragment content. Structure is normally blocky or prismatic and soil pH is medium acid to neutral.

BIEBER FAMILY

The Bieber family consists of shallow, well drained soils that formed mainly over hard fractured basalt or volcanic tuff. Permeability is very slow. These soils have a silica duripan at depths of 7 to 20 inches. They are on basalt plateaus and alluvial fans and toeslopes of mountain uplands with 1 to 20 percent slopes at elevations of 4300 to 6000 feet. Annual precipitation is 12 to 18 inches, most of which falls in winter as snow. Mean annual air temperature is 44 to 49°F. The frost-free season is 80 to 110 days.

Taxonomic Class: Clayey, montmorillonitic, mesic, shallow, Aridic Durixerolls.

Reference Pedon: Bieber family very cobbly loam on a 2 percent south facing undulating basalt plateau at 5000 feet elevation under low sagebrush, scattered western juniper and Idaho fescue, cheatgrass and Sandberg bluegrass rangeland. Soil was moist when described on 4/11/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 4 inches; brown (10YR 5/3) very cobbly heavy loam; dark brown (10YR 3/3) moist; weak to moderate fine subangular blocky structure parting to moderate fine granular; hard, friable, sticky and plastic; 55 percent by volume cobbles, gravel and stones of basalt on surface; many fine, very fine and few medium and coarse roots; common fine, very fine and few medium tubular pores; neutral (pH 6.8); clear smooth boundary.

B21t–4 to 8 inches; brown (7.5YR 5/4) light clay; dark reddish brown (5YR 3/3) moist; moderate fine subangular blocky structure parting to moderate to strong fine and medium granular; very hard, firm, very sticky and plastic; 5 percent cobbles and gravel of basalt by volume; common to many thin faint clay films on ped faces; common to many very fine, fine and medium and few coarse roots; common very fine and fine tubular pores; neutral (pH 6.8); abrupt smooth boundary.

B22t–8 to 15 inches; brown (7.5YR 4/4) clay; dark brown (7.5YR 3/4) moist; strong medium and coarse prismatic structure parting to strong fine and medium angular blocks; extremely hard, firm, very sticky and very plastic; about 5 percent by volume basalt gravel and cobbles; many faint and distinct clay skins on ped faces and in pores; common very fine, fine, medium and coarse roots; common very fine tubular pores; neutral (pH 6.8) clear smooth boundary.

B3tsi–15 to 18 inches; strong brown (7.5YR 5/6) clay; strong brown (7.5YR 4/6) moist; strong fine and medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; about 10 percent by volume basalt cobbles and gravel; many distinct thick clay skins on ped faces; few fine, very fine, medium and coarse roots; common very fine and few fine tubular pores; common distinct thin masses of silica deposits; neutral (pH 7.0); abrupt smooth boundary.

Csim–18 to 23 inches; medium and coarse platy silica duripan with 1 mm to 5 mm thick laminar plates coated with silica or opal.

R–23 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 400 feet west and 1100 feet south of NE corner Section 22, T.45N., R.11E.

Range in Characteristics: Depth to silica duripan ranges from 7 to 20 inches. The silica duripan is generally only a few millimeters to a feet in thickness and is underlain by basalt or volcanic tuff. The control section averages 35 to 60 percent clay. The mean annual soil temperature at the contact is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the duripan contact exceeds 41°F. from April 1 through December 1. The 4 to 12 inch moisture control section, or to the duripan contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizon is 2 to 6 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 or 7.5YR 4/2, 5/2 and moist color of 10YR 2/2, 3/2, 3/3 or 7.5YR 3/2. Texture is loam or clay loam and normally contain between 20 to 80 percent surface basalt rock fragments of cobbles, gravel and stones. Structure is granular or blocky and soil pH is neutral.

The B horizon has dry color of 10YR 4/3, 4/4, 5/3, 5/4, 6/3, 6/4; 7.5YR 4/4, 5/4, 5/6, 6/4 and moist colors of 10YR 3/2, 3/3, 3/4, 4/3; 7.5YR 3/2, 3/4, 4/4, 4/6; 5YR 3/2 or 3/3. The upper part of the agrillic B horizon has mollic colors. Texture is clay loam or clay. Structure is blocky or prismatic and soil pH is neutral.

The Csim horizon is platy or massive and strongly cemented or indurated and may have opal coated laminar plates cemented in a mosaic.

CARDON FAMILY

The Cardon family consists of deep, somewhat poorly drained soils formed in clayey alluvium derived from basalt, andesite or tuff. This soil is found on flood plains and alluvial basins and drainages and on lower sideslopes of mountain uplands and basalt plateaus. Permeability is very slow. The slopes are generally nearly level but range from 0 to 15 percent. Elevations range from 4600 to 6200 feet. The annual precipitation is 14 to 20 inches which falls mostly during the winter as snow and the mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Chromic Pelloxererts.

Reference Pedon: Cardon family clay on a 6 percent west sloping alluvial drainageway at 6000 feet elevation under mosses, timothy, Kentucky blue grass and other meadow grasses. Soil was dry to 36 inches when described on 9/10/80. (Colors are for dry soil unless otherwise noted.)

A1–0 to 4 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak to moderate fine and medium platy structure which parts into moderate fine angular and subangular blocky; hard, very firm, sticky and plastic; less than 5 percent gravel by volume; many very fine, fine and medium roots; cracks are 2-1/2 inches wide and 10 to 24 inches between cracks; neutral (pH 6.8); clear smooth boundary.

C1–4 to 10 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong medium angular blocky structure and strong medium and coarse prismatic; extremely hard, very firm, very sticky and very plastic; slicken sides on ped faces; less than 5 percent gravel by volume; common to many very fine and fine, common medium roots; cracks 2 inches wide; neutral (pH 6.8); gradual wavy boundary.

C2–10 to 36 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong medium and coarse prismatic and angular blocky structure; extemely hard, very firm, very sticky and very plastic; slickensides on ped faces; less than 1 percent gravel by volume; few to common very fine, fine and few medium roots; cracks 0.4 to 1.2 inches wide; neutral (pH 6.8); clear smooth boundary.

C3g–36 to 46 inches; grayish brown (2.5Y 5/2) 1 to 3 inch stratified lenses of clay and clay loam with many medium and coarse distinct olive yellow (2.5Y 6/6) mottles, dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, very sticky and plastic; 5 percent gravel by volume; few very fine roots; neutral (pH 7.0); gradual wavy boundary.

C4g–46 to 60 inches; light brownish gray (2.5Y 6/2) clay, light brownish gray (2.5Y 6/2) moist, with many medium and coarse distinct olive yellow (2.5Y 6/6) mottles; massive; extremely hard, very firm, very sticky and very plastic; less than 1 percent gravel by volume; neutral (pH 7.2).

Reference Pedon Location: Modoc County, California, about 2200 feet east and 2000 feet south of the NW corner Section 36, T.42N., R.14E.

Range in Characteristics: Depth to bedrock is greater than 40 inches. Clay content in the control section ranges from 45 to 60 percent. The Cardon soils have surface cracks of 1 to 3 inches wide and extend to depths of greater than 20 inches which open and close at least once each year and remain open during the period of July 15 through October 15 and remain closed for the rest of the year. Intersecting slickensides or pressure faces are common between the 4 and 36 inch depth. The annual soil temperature at the 20 inch depth is estimated to range between 47 to 53°F. The soil between depths of 4 to 12 inches is usually dry in all parts from July 15 through October 15 and is moist in some or all parts all the rest of the year.

The A horizon is 1 to 5 inches thick and has dry color of 10YR 3/1, 4/1, 5/1, and moist color of 10YR 2/1 or 2/1. Texture is silty clay or clay. Structure is platy or blocky and soil pH is neutral.

The C horizon has dry color of 10YR 4/1, 4/2, 5/1, 6/2, 6/3; 2.5Y 5/2, 5/4, 6/2 and moist color of 10YR 3/1, 4/1, 4/2; 2.5Y 4/2, 5/2, 6/2. Dry and moist chromes of 2, 3 or 4 occur within 1 meter of the surface. Texture is silty clay or clay and often grade to clay loam with depth or is encountered in stratified lenses below about 30 to 40 inches.

CASTLEVALE FAMILY

The Castlevale family consists of shallow, well drained soils that have weathered from basalt. The top layer of soil generally consists of 50 to 100 percent pumice materials. Permeability is moderate. These soils are found generally on basalt plateaus with slopes of 1 to 10 percent. The elevation is 4200 to 4600 feet. The annual precipitation is 10 to 14 inches most of which falls during winter as snow. The mean annual air temperature is 48 to 50°F. The frost free season is 90 to 110 days.

Taxonomic Class: Loamy, mixed, mesic, Lithic Xerollic Haplargids.

Reference Pedon: Castlevale family very gravelly coarse sandy loam on a nearly level basalt plateau at 4200 feet elevation under big sagebrush, rabbitbrush and bunchgrass rangeland. Soil was dry when described on 8/14/78. (Colors are for dry soil unless otherwise stated).

A1–0 to 4 inches; grayish brown (10YR 5/2) very gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, non-sticky and non-plastic; 55 percent pumice gravel by volume; many fine and very fine roots; neutral (pH 6.6); clear smooth boundary.

C1–4 to 8 inches; pale brown (10YR 6/3) extremely gravelly coarse sandy loam, brown (10YR 5/3) moist; weak medium granular structure; soft, very friable, non-sticky and non-plastic; 60 percent pumice gravel by volume; common to many fine and very fine roots; neutral (pH 6.8); clear smooth boundary.

IIA1b–8 to 13 inches; yellowish brown (10YR 5/4) gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 30 percent basalt gravel by volume; few to common fine and very fine roots; neutral (pH 6.8); clear wavy boundary.

IIB2tb–13 to 18 inches; light yellowish brown (10YR 6/4) gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on ped faces; gravel 25-30 percent basalt by volume; few and common fine and very fine roots; neutral (pH 7.0); clear smooth boundary.

R–18 inches; fractured hard basalt.

Reference Pedon Location: Modoc County, California, about 2600 feet east and 800 feet south of NW corner of Section 1, T.44N., R.5E.

Range in Characteristics: Depth to bedrock is 8 to 20 inches. Clay content increases with depth and the control section averages 22 to 28 percent clay. Coarse fragments range from 10 to 35 percent by volume in the control section. The mean annual soil temperature at the lithic contact is about 50 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from April 1 through December 1. The soils 4 to 12 inch moisture control section, or to the lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The pumice overburden consists of an approximate 900 year old pumice deposit of 2 to 12 inches and normally has an A and sometimes an A-C horizon development in the deeper deposits. The A horizon is 2 to 8 inches thick and has dry color of 10YR 5/2, 6/2, 6/3, 6/4 and moist color of 10YR 3/2, 4/2, 4/3, 5/2, or 5/3. Texture is sandy loam, coarse sandy loam or coarse loamy sand and contains 40 to 65 percent by volume pumice gravel mainly of the less than 0.6 inch size. The pumice overburden C horizon, if present, has dry color of 10YR 6/3, 6/4, 7/2, 7/.3, 8/2 or 8/3 and moist color of 10YR 5/3, 5/4, 6/3, 7/2, or 7/3. Texture is coarse sand, coarse loamy sand or coarse sandy loam and contains 60 to 90 percent by volume pumice gravel mainly of the 0.2 to 1.0 inch size. The shallower pumice overburden areas are usually mixed with the older buried soil material. The pumice overburden pH is neutral to slightly acid.

The loamy textured mixed minerology soil beneath the pumice overburden has an A-B horizon development.

The A horizon is 3 to 6 inches thick and has dry color of 10YR 5/4, 6/3, 6/4; 7.5YR 5/4, 5/6 and moist color of 10YR 3/4, 4/2, 4/3; 7.5YR 3/4, 4/2. Texture is loam or sandy loam and contains 10 to 30 percent by volume basalt gravel. Structure is subangular blocky and soil pH is neutral.

The B horizon has dry color of 10YR 6/2, 6/3, 6/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4. Texture is loam or clay loam and contains from 10 to 35 percent by volume coarse fragments of basalt. Structure is subangular blocky and soil pH is neutral.

CASUSE FAMILY

The Casuse family consists of shallow, well drained soils which formed over volcanic tuff. Permeability is moderate. These soils are on volcanic plateaus and mountain sideslopes with slopes of 5 to 30 percent. They occur at elevations of 4500 to 5300 feet. The annual precipitation is 14 to 16 inches which mostly falls during the winter as snow. The mean annual air temperature is 46 to 49°F. The frost free season is 80 to100 days.

Taxonomic Class: Loamy, mixed, mesic, shallow, Xeralfic Haplargids.

Reference Pedon: Casuse family loam on an east facing 5 percent sideslope of an undulating volcanic plateau at 5050 feet elevation under western juniper, low sagebrush, big sagebrush, rabbitbrush and bunchgrass rangeland. Soil was dry when described on 8/21/79. (Colors are for dry soil unless otherwise noted.)

A11–0 to 2 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak to moderate fine and medium subangular blocky structure which parts into moderate very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and medium and few coarse vesicular pores; neutral (pH 6.8); gradual wavy boundary.

A12–2 to 5 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, friable, sticky and plastic; common very fine and fine and few medium roots; many very fine and fine, common medium pores; neutral (pH 6.8); clear smooth boundary.

B21t–5 to 10 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; weak to moderate subangular blocky structure which parts into moderate medium granular; slightly hard, friable, sticky and plastic; few thin clay films on ped faces; 5 percent gravel by volume; many very fine and fine, common medium and few coarse roots; many very fine and fine, few medium and coarse pores; neutral (pH 7.0); clear smooth boundary.

B22t–10 to 14 inches; pale brown (10YR 6/3) very gravelly clay loam, brown (10YR 4/3) moist; moderate to strong fine and medium subangular and angular blocky structure; hard, friable, sticky and plastic; common thin clay films on ped faces; 40 percent tuff gravel by volume; common very fine, fine and medium roots; common to many fine and very fine tubular pores; neutral (pH 7.2); abrupt smooth boundary.

Cr–14 plus inches; moderately to slightly weathered platy tuff.

Reference Pedon Location: Modoc County, California, about 30 feet east of road and about 1700 feet west and 300 feet south of the NE corner in Section 20, T.39N., R.14E.

Range in Characteristics: Depth to paralithic tuff ranges from 7 to 20 inches. The control section averages 22 to 35 percent clay. Coarse fragments range from 5 to 35 percent by volume in the control section. The mean annual soil temperature at the paralithic contact is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from April 1 through December 1. The soils 4 to 12 inch moisture control section, or to the paralithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizon is 2 to 6 inches thick with dry color of 10YR 5/2, 5/4, 6/2, 6/3, 7/2; 7.5YR 6/2, 6/4, 7/2; 2.5Y 5/2 or 6/2, and moist color of 10YR 3/4, 4/2, 4/3, 6/2; 7.5YR 4/2, 4/4, 5/2; 2.5Y 4/2. Texture is loam or fine sandy loam and may contain 0 to 20 percent by volume coarse fragments. Structure is granular, platy, or subangular blocky and soil pH is slightly acid to neutral.

The B horizon has dry color of 10YR 5/4, 6/2, 6/3; 7.5YR 6/2, 6/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4, 5/2; 7.5YR 4/2. Texture is loam or clay loam and contains 5 to 35 percent by volume coarse fragments mainly of gravel size.

The Cr paralithic contact consists of volcanic tuff which is usually platy in the upper parts and becomes massive with depth. It can be cut with a spade.

CAVANAUGH FAMILY

The Cavanaugh family consists of deep and moderately deep, well drained soils which weathered from andesite, basalt and volcanic tuff. Permeability is slow. These soils are on 10 to 65 percent slopes and occur on toeslopes, smooth and hummocky sideslopes or incized drainages of volcanic plateaus and mountain uplands at 5500 and 7200 feet elevation. The climate is cool with 40 to 46°F. mean annual air temperature and 20 to 30 inches annual precipitation which mostly falls as snow during the winter. The frost free season is 60 to 90 days.

Taxonomic Class: Clayey-skeletal, montmorillonitic, frigid, Ultic Argixerolls.

Reference Pedon: Cavanaugh family cobbly loam on an east facing 20 percent smooth mountain sideslope at 6450 feet elevation under a closed canopy of white fir and ponderosa pine with a sparce understory of current spp., snowberry, oregon grape, vetch and lupine. Soil was moist below 19 inches when described on 9/8/80. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; white fir and ponderosa pine needles and twigs.

A11–0 to 7 inches; dark brown (10YR 4/3) cobbly loam, very dark brown (10YR 2/2) moist; weak to moderate fine and medium platy structure which parts into moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; 15 percent cobbles and gravel by volume; common very fine and fine, few medium and coarse roots; slightly acid (pH 6.4); clear smooth boundary.

A12–7 to 13 inches; brown (10YR 4/3) very cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard; friable, slightly sticky and slightly plastic; few clay films on ped faces; 25 percent gravel and 15 percent cobbles by volume; common very fine and fine and few medium and coarse roots; common very fine and fine pores; slightly acid (pH 6.4); gradual wavy boundary.

B21t–13 to 18 inches; brown (10YR 5/3) very cobbly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium angular and subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces and pores; 25 percent gravel and 20 percent cobbles by volume; common very fine, fine, medium and coarse roots; many very fine, and fine, and common medium pores; neutral (pH 6.6); clear wavy boundary.

B22t–18 to 27 inches; yellowish brown (10YR 5/4) very gravelly clay, dark yellowish brown (10YR 3/4) moist; moderate to strong fine and medium angular and subangular blocky structure; hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and pores; 40 percent gravel and 15 percent cobbles by volume; few to common very fine, fine and coarse and common medium roots; common very fine and fine and few medium pores; neutral (pH 6.6); gradual wavy boundary.

B3t–27 to 60 inches; yellowish brown (10YR 5/4) extremely gravelly clay loam, dark yellowish brown (10YR 3/4) moist; moderate to strong fine and medium angular and subangular blocky structure; hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and pores; 45 percent gravel and 15 percent cobbles by volume; few very fine, fine, and medium roots; common very fine and fine and few medium pores; neutral (pH 6.8).

Reference Pedon Location: Modoc County, California, about 50 feet north of road and about 300 feet east and 2100 feet south of NW corner of Section 5, T.41N., R.15E.

Range in Characteristics: Depth to bedrock is greater than 30 inches. ay content in the control section averages 35 to 50 percent. Base saturation by the ammonium acetate method is estimated to be 60 to 75 percent in the A horizon and at least the upper part of the B horizon. The mean annual soil temperature at a depth of 20 inches is 42 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch moisture control section is moist in all parts from about November 15 through May 30. It is dry in all parts from about August 1 through October 20 in most years.

The A horizon is 6 to 13 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3 and moist color of 10YR 2/2, 3/2, 3/3 or 7.5YR 3/2. Texture is loam or clay loam and contains between 15 to 50 percent by volume gravel, cobbles and some stones. Structure is platy, granular, or subangular blocky and soil pH is moderately acid to neutral.

The B horizon normally makes up the remainder of the soil and have dry color of 10YR 4/3, 5/3, 5/4, 6/3; 7.5YR 5/4, and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3, 4/4; 7.5YR 3/2 or 3/4. The upper part of the argillic B horizon is normally mollic in color. Texture is

clay loam, silty clay or clay and contains from 35 to 60 percent by volume rock fragments mainly of cobble and gravel size with some stones normally present. Structure is subangular and angular blocky and soil pH is slightly acid to neutral.

CHEADLE FAMILY

The Cheadle family consists of shallow, well drained soils that weathered from andesite or hard volcanic tuff. Permeability is moderate. These soils are on 10 to 90 percent slopes and occur mainly on convex sideslopes, knolls and ridges of mountain uplands at elevations of 7000 to 9900 feet. The climate is cold with a mean annual air temperature of 34 to 40°F. Annual precipitation is 25 to 35 inches most of which falls as snow in witner. The frost free season is less than 30 days to 70 days.

Taxonomic Class: Loamy-skeletal, mixed, Lithic Cryoborolls.

Reference Pedon: Cheadle family very cobbly loam on a southwest facing, 11 percent upper sideslope at 7280 feet elevation under Idaho fescue with big sagebrush, rabbitbrush, mule ears, arrowleaf balsom root and various forbs. Soil was moist to 12 inches when described on 11/4/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 6 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, very friable, sticky and slightly plastic; 35 percent cobbles and gravel by volume; many very fine and fine roots; neutral (pH 6.6); clear wavy boundary.

A12–6 to 12 inches; dark grayish brown (10YR 4/2) very cobbly loam; very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure which parts into moderate fine granular; slightly hard, very friable, sticky and slightly plastic; 20 percent cobbles and 30 percent gravel by volume; many very fine and fine roots; common very fine and fine pores; neutral (pH 6.6); clear smooth boundary.

A13–12 to 17 inches; brown (10YR 5/3) very cobbly clay loam; dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; few thin clay films on ped faces and pores; 20 percent cobbles and 35 percent gravel by volume; common very fine and fine roots; many very fine and fine pores; neutral (pH 6.6); abrupt smooth boundary.

R–17 plus inches; hard fractured andesite.

Reference Pedon Location: Modoc County, California, on Bald Mountain, about 400 feet west and 800 feet north of the SE corner of Section 24, T.44N., R.14E.

Range in Characteristics: Depth to the lithic contact is 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 36 to 42°F. and the mean summer temperature at the contact is about 50 to 59°F. The soil temperature at the lithic contact exceeds 41°F. from June 1 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The soils 5 to 15 inch moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 1 through June 15 and dry in all parts from August 10 through October 10. Clay content in the control section averages 20 to 28 percent.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3; 7.5YR 4/2, 4/4 or 5/4 and have moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or light clay loam and contains from 35 and 60 percent by volume rock fragments normally of the cobble and gravel size with some stones. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

COWICHE FAMILY

The Cowiche family consists of moderately deep, well drained soils that formed in material derived from basalt or volcanic tuff. Permeability is moderate. These soils are found on basalt plateaus and toeslopes of mountain uplands of 1 to 20 percent slope. Elevation ranges from 4300 to 5300 feet and the annual precipitation is 10 to 16 inches most of which falls as snow in winter. The annual air temperature is 46 to 49°F. and the frost free season is 80 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Aridic Argixerolls.

Reference Pedon: Cowiche loam on a 15 percent southeast facing sideslope at 4900 feet elevation under western juniper, big sagebrush, mule ears, Idaho fescue and cheatgrass rangeland. Soil was moist below 6 inches when described on 6/8/79. (Colors are for dry soil unless otherwise stated.)

A11–0 to 2 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine platy structure which parts into weak fine granular; soft, friable, slightly sticky and non-plastic; many fine and very fine roots; many fine and very fine tubular continuous pores; slightly acid (pH 6.2); clear, smooth boundary.

A12–2 to 6 inches; grayish brown (10YR 5/2) loam, dark brown (7.5YR 3/2) moist; moderate fine and medium platy structure which parts to moderate fine granular; slightly hard, friable, sticky and slightly plastic; common fine and very fine roots; many fine, very fine and common medium tubular continuous pores; 5 percent gravel and cobbles by volume; slightly acid (pH 6.4); clear, smooth boundary.

B21t–6 to 11 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few faint clay skins on ped faces; common very fine, fine and medium roots; common fine and very fine tubular continuous pores; 5 percent gravel and cobbles by volume; slightly acid (pH 6.4); gradual, wavy boundary.

B22t–11 to 16 inches; dark yellowish brown (10YR 4/4) clay loam, dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common distinct clay skins on ped faces and pores; common fine, very fine and medium roots; common very fine and fine tubular continuous pores; slightly acid (pH 6.4) clear, smooth boundary.

B3t–16 to 25 inches; brownish yellow (10YR 6/6) gravelly clay loam, strong brown (7.5YR 4/6) moist; moderate medium angular blocky structure; hard, friable, sticky and plastic; many distinct clay skins on ped faces and in pores; 30 percent by volume highly weathered cinder and tuff gravel; few to common very fine and fine roots; common fine and very fine tubular continuous pores; slightly acid (pH 6.4) abrupt, smooth boundary.

Cr–25 plus inches; moderately weathered in place fractured volcanic tuff with clay skins on fractured faces. Tuff can be dug with a spade.

Reference Pedon Location: Modoc County, California, about 300 feet east and 2400 feet south of the NW corner of Section 24, T.48N., R.6E.

Range in Characteristics: Depth to bedrock of volcanic tuff or basalt is 20 to 40 inches. The mean annual soil temperature at 20 inches is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 in most years. The 4 to 12 inch soil moisture control section is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1. The average clay content in the control section is 24 to 35 percent.

The A horizon is 4 to 9 inches thick and have dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2. Texture is loam or sandy loam and normally contains less than 15 percent coarse fragments; structure is platy or granular and soil pH is slightly acid to neutral.

The B horizon normally makes up the rest of the soil and has dry color of 10YR 5/2, 5/3, 5/4, 4/3, 4/4, 6/3, 6/4, 6/6; 7.5YR 5/4, 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/2, 4/4 or 4/6. The upper part of the argillic B horizon is mollic in color. Texture is loam and clay loam and contain less than 35 percent by volume coarse fragments. Structure is subangular and angular blocky and soil pH is slightly acid to neutral.

CRYOBOROLLS, Wet

The Cryoborolls, wet phase soils consist of moderately deep to very deep, poorly drained soils that formed in alluvial and colluvial material derived from basalt, andesite or volcanic tuff rock sources. Permeability is moderate to slow. These soils are on broad toeslopes and drainageways and lower sideslopes of mountain uplands at 7,000 to 8,500 feet elevation and on 10 to 30 percent slopes. Annual precipitation is 25 to 35 inches most of which falls as snow during winter. Mean annual air temperature is 34 to 40°F. and the frost free growing season is 30 to 70 days.

Taxonomic Class: Cryoborolls (wet phase)

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Cryoborolls, wet gravelly loam on a 10 percent southwest facing toeslope adjacent to a narrow drainageway at 7,800 feet elevation under quaking aspen, montaine shrubs, skunk cabbage, sedges and grass. Soil was moist throughout and saturated below 23 inches when described on 8/21/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 8 inches; very dark gray (10YR 3/1) gravelly loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and non-plastic; 25 percent by volume andesite gravel; many fine, very fine and common medium roots; neutral (pH 6.6); clean smooth boundary.

A12–8 to 14 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure which parts to moderate fine granular; slightly hard, very friable, slightly sticky and slightly plastic; 45 percent by volume andesite gravel; many fine, very fine and common medium roots; common fine and medium pores; slightly acid (pH 6.2) clear smooth boundary.

A13g–14 to 23 inches; brown (10YR 4/3) very gravelly loam, very dark grayish brown (10YR 3/2) moist; few distinct fine yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 40 percent gravel and 5 to 10 percent cobbles by volume; common fine, very fine and medium roots; common fine and very fine pores; medium acid (pH 6.0); abrupt smooth boundary.

Cg–23 to 35 inches; grayish brown (2.5Y 5/2) extremely cobbly loam, dark grayish brown (2.5Y 4/2) moist; few distinct fine and medium light olive brown (2.5Y 5/6) to yellowish brown (10YR 5/8) mottles; massive, slightly hard, very friable, slightly sticky and slightly plastic; 30 percent cobbles and 35 percent gravel by volume; few fine, very fine and medium roots; medium acid (pH 6.0); abrupt wavy boundary.

R–35 plus inches hard fractured andesite bedrock.

Reference Pedon Location: Modoc County, California, about 1300 feet west and 1500 feet south of the NE corner of Section 7, T.39N., R.16E.

Range in Characteristics: Depth to bedrock is greater than 20 inches. year round fluctuating apparent water table exists within 10 to 30 inches of the soil surface with a capillary fringe at or near the surface. The soil temperature at the 20 inch depth is above 41°F. from about July 1 through October 30 in most years and the mean annual soil temperature at that depth is about 36 to 42°F. The mean summer soil temperature at 20 inches is less than 55°F. Clay content in the control section averages 20 to 45 percent and rock fragments average 15 to 60 percent by volume.

The A horizon is 14 to 30 inches thick and have dry color of 10YR 3/2, 4/1, 4/2, 4/3, 5/2; 2.5Y 4/2 and moist color of 10YR 2/1, 2/2, 3/2, 3/3; 2.5Y 3/2. Texture is sandy loam, loam, clay loam and contain 0 to 50 percent by volume coarse fragments. Structure is platy, granular or subangular blocky and soil pH is medium acid to neutral.

The B horizon, if present, has dry color of 10YR 4/3, 4/4, 5/3, 5/4; 2.5Y 4/4, 5/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 2.5Y 3/2, 4/2, 4/4. Texture is loam, clay loam or clay and contains from 15 to 50 percent by volume rock fragments. Structure is subangular or angular blocky or prismatic and soil pH is medium acid to neutral.

The C horizon has dry color of 10YR 5/1, 5/2, 6/2; 2.5Y 5/j2, 6/2 and moist color of 10YR 4/2, 5/2, 5/3; 2.5Y 4/2, 4/4. Few to common to many distinct light olive brown to yellowish brown mottles are evident throughout the C horizon. Texture is sandy loam, loam or clay loam and contain 25 to 70 percent by volume rock fragments. It is massive and soil pH is medium acid to slightly acid.

DEMASTERS FAMILY

The DeMasters family soils consist of deep and a limited amount of moderately deep, well drained soils that formed in material weathered mainly from basalt. Permeability is moderately slow. These soils are on sideslopes and toeslopes of mountain uplands with slopes ranging from 1 to 35 percent. Elevation ranges from 5400 to 7500 feet. The annual precipitation is 20 to 30 inches most of which falls during the winter as snow. Mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxanomic Class: Fine-loamy, mixed, frigid, Pachic Ultic Argixerolls.

Reference Pedon: DeMasters family loam on a 10 percent southeast facing mountain sideslope at 6200 feet elevation under a white fir forest with some ponderosa pine and a sparce understory of snowbrush, vetch and various grasses. Soil was dry when described on 8/24/79. (Colors are for dry soil unless otherwise stated).

01–1-1/2 to 0 inches; Ponderosa pine and white fir needles and twigs.

A11–0 to 10 inches; brown (7.5YR 4/2) loam, dark reddish brown (5YR 2.5/2) moist; weak medium subangular blocky structure parting to moderate fine and very fine granular; soft, very friable, sticky and slightly plastic; 10-15 percent basalt gravel; many fine very fine and common medium and coarse roots; slightly acid (pH 6.4); gradual wavy boundary.

A12–10 to 14 inches; brown (7.5YR 4/2) loam, dark reddish brown (5YR 2.5/2) moist; weak medium subangular blocky structure parting to moderate fine and medium granular; soft, very friable, sticky and slightly plastic; about 5 percent by volume basalt gravel; many fine, very fine, common medium and few coarse roots; medium acid (pH 5.6); clear smooth boundary.

B21t–14 to 24 inches; brown (7.5YR 4/2) gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure parting to moderate medium granular; slightly hard, friable, sticky and plastic; few thin clay skins on ped faces; 15 percent gravel by volume of basalt and ash; common to many fine, very fine medium and coarse roots; many very fine and fine and few medium tubular pores; neutral (pH 6.8); clear wavy boundary.

B22t–24 to 37 inches, brown (10YR 4/3) gravelly clay loam; dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure parting to strong fine and medium granular; hard, friable, sticky and plastic; few thin clay skins on ped faces; 5 percent cobbles and 25 percent gravel by volume of basalt; common very fine, fine, medium and coarse roots; many fine and very fine tubular pores; neutral (pH 6.8); gradual wavy boundary.

IIB3t–37 to 60 inches; dark yellowish brown (10YR 4/4) extremely cobbly clay loam; dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few thin clay skins on ped faces; 60 percent cobbles and 15 percent gravel by volume of basalt; few very fine, fine, medium and coarse roots, many very fine and fine tubular pores; neutral (pH 6.8).

Reference Pedon Location: Modoc County, California, about 500 feet east and 1800 feet north of SW corner of Section 17, T.40N., R.15E.

Range in Characteristics: Depth to bedrock is generally greater than 40 inches but ranges from 20 to 40 inches in some pedons in map unit 147. The control section averages 20 to 35 percent clay content and coarse fragments range from 5 to 35 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 50 and 75 percent throughout the upper 30 inches of the soil. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizon is 9 to 22 inches thick with dry color of 7.5YR 4/2, 4/4; 5YR 4/2, 4/3, 4/4; 10YR 4/3 or 4/4 and moist color of 7.5YR 3/2; 5YR 2.5/2, 3/2, 3/3; 10YR 3/2 or 3/3. Texture is loam and contains from 5 to 30 percent by volume gravel and a few cobbles. Structure is granular, or subangular blocky and soil pH is medium acid to slightly acid.

The B horizon makes up the remaining soil and has dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/2, 4/4, 5/4; 5YR 4/3, 4/4, 5/3, 5/4 and moist color of 10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/4, 4/4; 5YR 3/3, 3/4, 4/3 or 4/4. The upper parts of the argillic B horizon has mollic colors and may include the whole soil profile. Texture is loam or clay loam and contains from 5 to 75 percent by

volume rock fragments which increase in amount with depth. Structure is subangular blocky and soil pH is slightly acid to neutral.

DEVEN FAMILY

The Deven family consists of shallow, well drained soils that formed in material weathered from basalt, andesite and volcanic tuff. Permeability is slow. These soils are found primarily on basalt plateaus and mountain sideslopes of volcanic origin at an elevation of 4300 to 6000 feet. Slopes range from 1 to 40 percent. The annual precipitation is 10 to 20 inches most of which falls during winter as snow. The mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonomic Class: Clayey, montmorillonitic, mesic, Lithic Argixerolls.

Reference Pedon: Deven family cobbly loam on a nearly level basalt plateau at 4920 feet elevation under western juniper, bitterbrush and cheatgrass rangeland. Soil was dry throughout when described on 8/24/73. (Colors are for dry soil unless otherwise noted.)

A1–0 to 2 inches; brown (10YR 5/3) cobbly loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores; 10 percent cobbles and 10 percent gravel by volume; slightly acid (pH 6.3); clear smooth boundary.

B1t–2 to 7 inches; dark brown (7.5YR 4/2) heavy clay loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, very friable, sticky and plastic; common very fine, fine and medium roots; common very fine tubular and few very fine interstitial proes; many moderately thick clay films on peds and in pores; slightly acid (pH 6.5); clear wavy boundary.

B2t–7 to 16 inches; dark reddish borwn (5YR 3/4) light clay, dark reddish brown (5YR 3/2) moist; moderate medium and coarse angular blocky structure; hard, very friable, sticky and plastic; few very fine, common fine and medium roots; few very fine tubular and interstitial pores; continuous moderately thick clay films on peds and in pores; slightly acid (pH 6.5); abrupt irregular boundary.

R–16 to 24 inches; gray (N/5) hard fractured basalt.

Reference Pedon Location: Modoc County, California; about 5 miles west of Alturas; about 0.9 miles south on Crowder Flat Road from the Modoc National Forest boundary and 75 feet east of the road in the NE 1/4 of SW1/4, Section 6, T.42N., R.12E. (State Modal)

Range in Characteristics: Depth to a lithic contact of basalt, andesite or volcanic tuff is 8 to 20 inches. In some areas where Deven has been mapped, notably in the southwestern portion of the survey area, much of it is over a softer type volcanic tuff which may be cut with a shovel. Clay content in the control section averages 35 to 60 percent and coarse fragments may occupy up to 35 percent by volume. The mean annual soil temperature at the lithic contact is about 47 to 52°F. and fluctuates by more than 9°F. during The year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1. Where this soil is mapped with map units 132, 151, 153, 158, 208, 221, 242 and 251 the 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped in other map units the moisture control section is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1.

The A horizon is 2 to 7 inches thick and have dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4; 7.5YR 4/2, 5/2, 5/4, and moist color of 10YR 3/2, 3/3; 7.5YR 3/2; 2.5Y 3/2. Texture is loam or clay loam with 0 to 70 percent surface rock fragments predominately of the gravel and cobble size with some larger stones. Structure is granular or platy and soil pH is slightly acid to neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4, 6/2, 6/3; 7.5YR 4/2, 5/2, 5/4; 5YR 3/4, 4/2 or 4/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 7.5YR 3/2, 3/4, 4/2, 4/4; 5YR 3/2, 3/3 or 3/4. Mollic colors make up at least the upper 7 inches of soil and can include the whole soil depth. Texture is clay loam or clay and normally contains only a trace of rock fragments but may contain up to 35 percent by volume in some pedons. Structure is prismatic or subangular or angular blocky and soil pH is slightly acid to neutral.

Additional Data: Riverside Laboratory, Pedon S73 Calif 25-10.

DISHNER FAMILY

The Dishner family consists of shallow, well drained soils that formed in material derived from basalt. Permeability is slow. These soils are found on basalt plateaus with 1 to 15 percent slopes at an elevation of 4300 to 5500 feet. The annual precipitation is 10 to 16 inches most of which falls during winter as snow. The mean annual air temperature is 45 to 49°F. The frost free season is 80 to 110 days.

Taxomonic Class: Clayey, montmorillonitic, mesic, Lithic Xerollic Haplargids.

Reference Pedon: Dishner family cobbly sandy clay loam on a west facing 10 percent sloping basalt plateau at 4320 feet elevation under rabbitbrush, cheatgrass, wheatgrass and bottlebrush rangleand. Soil was dry throughout when described on 11/6/81. (Colors are for dry soil unless otherwise stated.)

A1–0 to 5 inches; light brownish gray (10YR 6/2) cobbly sandy clay loam, dark brown (10YR 3/3) moist; moderate fine and medium platy structure which parts into granular; slightly hard, friable, slightly sticky and slightly plastic; 15 percent cobbles and 5 to 10 percent gravel by volume; common very fine and fine and few medium roots; common very fine and fine and many medium vesicular pores; neutral (pH 6.8); clear smooth boundary.

B1t–5 to 9 inches; pale brown (10YR 6/3) silty clay loam, dark yellowish brown (10YR 3/4) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few to common moderately thick clay films on pores and ped faces; 5 to 10 percent gravel and less than 5 percent cobbles by volume; few to common very fine, fine and medium roots; few to common very fine and fine pores, neutral (pH 6.8); clear smooth boundary.

B21t–9 to 12 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common moderately thick clay films on pores and ped faces; 5 to 10 percent gravel and 5 percent cobbles by volume; few very fine, fine and medium roots; few to common very fine and fine pores; neutral (pH 7.0); clear smooth boundary.

B22t–12 to 16 inches; yellowish brown (10YR 5/4) cobbly clay, dark yellowish brown (10YR 4/4) moist; strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; many thick clay films on pores and ped faces; 10 percent cobbles and 5 percent gravel by volume; few fine and medium roots; few very fine and fine pores; neutral (pH 7.2); abrupt smooth boundary.

R–16 plus inches; hard vesicular basalt.

Reference Pedon Location: Siskiyou County, California, about 50 feet south and 250 feet west of the NE corner of Section 36, T.46N., R.3E.

Range in Characteristics: Depth to bedrock is 8 to 20 inches. Clay content in the control section averages 35 to 50 percent and coarse fragment content may comprise up to 25 percent by volume. The mean annual soil temperature at the lithic contact is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1 of most years. The 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizon is 2 to 5 inches thick with dry color of 10YR 5/3, 5/4, 6/2, 6/3; 7.5YR 5/2, 5/4, 6/2, 6/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/3; 7.5YR 3/4 or 4/2. Texture is loam, sandy clay loam, or clay loam with 15 to 50 percent surface rock fragments predominately of the gravel and cobble size with occasional larger stones. Structure is platy, vesicular, or granular and soil pH is neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 5/3, 5/4, 6/3, 6/4; 7.5YR 4/4, 5/3, 5/4, 6/3 and moist color of 10YR 3/4, 4/3, 4/4; 7.5YR 3/4, 4/4. Texture is clay loam, silty clay loam or clay and may contain up to 25 percent by volume gravel and cobbles. Structure is subangular and angular blocky and soil pH is neutral.

DITCHCAMP FAMILY

The Ditchcamp family consists of moderately deep, well drained soils that formed in aeolian material derived from basalt, andesite and tuff. Permeabiity is slow. These soils are underlain by a silica duripan at a depth of 20 to 35 inches. These soils are on hummocky basalt plateaus with 3 to 10 percent slopes at elevations of 4400 to 5500 feet. Ditchcamp soils occupy the mounds where hummocky relief occurs. Basalt rock usually underlays the duripan at depths of 20 to 40 inches. Annual precipitation is 12 to 14 inches most of which falls in winter as snow. Mean annual air temperature is 44 to 48°F. The frost free season is 90 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Xerollic Durargids.

Reference Pedon: Ditchcamp family loam under western juniper and bunchgrass rangeland.

A11–0 to 7 inches; brown (10YR 5/3) heavy loam, dark brown (10YR 3/3) moist; moderate thick and very thick platy structure; hard, very friable, slightly sticky, slightly plastic; common very fine roots; many very fine interstitial, few very fine and fine tubular pores; slightly acid (pH 6.5); clear smooth boundary.

A12–7 to 15 inches; borwn (7.5YR 5/4) heavy loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; common very fine roots; few very fine interstitial and common very fine tubular pores; few thin clay films appear as stains on mineral grains; slightly acid (pH 6.5) clear wavy boundary.

B1t–15 to 26 inches; brown (7.5YR 5/4) light clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; very hard, very friable, sticky, slightly plastic; common very fine roots; few very fine interstitial and many very fine tubular pores; common thin clay films line pores and form bridges; slightly acid (pH 6.5); clear smooth boundary.

B2t–26 to 30 inches; brown (7.5YR 5/4) light clay loam, dark yellowish brown (10YR 3/4) moist; moderate coarse angular blocky structure; very hard, very friable, sticky, slightly plastic; many very fine tubular and few very fine interstitial pores; many thin clay films on faces of peds, and lining pores, and many moderately thick clay films form bridges; 2 percent basalt gravel by volume; slightly acid (pH 6.3); abrupt; smooth boundary.

Csim–30 to 34 inches; reddish yellow (7.5YR 7/6) strong cemented duripan with 0.5 mm laminar bands; medium common distinct manganese bodies of very dark gray (N 3/); strong thick and very thick platy structure; extremely hard; abrupt wavy boundary.

R–34 to 35 plus inches; fractured basalt rock.

Reference Pedon Location: Modoc County, California; about 11.4 miles north of Modoc National Forest boundary on Crowder Flat Road, or 2,000 feet north from Whittemore Springs Road and 110 feet west of Crowder Flat Road in the NE1/4 of NW1/4, Section 16, T.44N., R.11E. (State Modal)

Range in Characteristics: Depth to silica duripan ranges from 20 to 35 inches. The silica duripan is generally only a few millimeters to a foot in thickness and is underlain by basalt. The control section averages 30 to 35 percent clay. The mean annual soil temperature at 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1. The 4 to 12 inch moisture control section is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. The upper 7 inches of soil averages less than 1 percent organic matter.

The A horizons are 3 to 15 inches thick with dry color of 10YR 4/3, 5/3, 6/2, 6/3, 6/4; 7.5YR 4/4, 5/2, /54; 5YR 4/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/3; 7.5YR 3/2, 3/4; 5YR 3/4. Textures are loam or fine sandy loam and may contain up to 20 percent surface coarse fragments. Structure is platy, granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizons have dry color of 10YR 4/3, 5/3; 7.5YR 4/4, 5/4, 6/4, 4/6, 5/6; 5YR 4/4, 5/3 and moist color of 10YR 3/3, 3/4, 4/3, 4/4; 7.5YR 3/4, 4/4, 5/4; 5YR 3/4. Textures are clay loam to clay and increase in clay content with depth. Coarse fragments may make up to 15 percent by volume. Structure is subangular and angular blocky and soil pH is slightly acid to neutral.

Csim horizon is massive and is strongly cemented to indurated, or is platy with 1 or 2 mm thick laminar plates coated with opal or silica 1 to 5 cms apart.

Additional Data: Riverside Lab data sample no. S73 Ca-25-2.

DIVERS FAMILY

The Divers family consists of moderately deep and deep, somewhat excessively drained soils formed in andesite, basalt and geologically recent pumice. Permeability is rapid in the pumice overburden, if present, and moderately rapid below. These soils are on volcanic mountain sideslopes and calderas with 5 to 60 percent slopes on the Medicine Lake Highlands at 6500 to 7600 feet elevation. The annual precipitation is 35 to 45 inches which mostly falls during winter as snow. The mean annual air temperature is 36 to 40°F. The frost free season is 40 to 80 days.

Taxonomic Class: Medial-skeletal, Andic Cryochrepts.

Reference Pedon: Divers family, very gravelly loamy coarse sand on a 45 percent slope with a north aspect at 6900 feet elevation under red fir, western white pine and lodgepole pine forest. The soil was moist in all horizons when described on 8/2/80. (Colors are for dry soils unless otherwise stated.)

01–0 to 0 inches; fir and pine needles.

A11–0 to 3 inches; brown (10YR 5/3) very gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak medium plates and weak fine and medium granular structure; loose, non-sticky and non-plastic; 35 percent gravel of which 25 percent are cinder and 10 percent are basalt by volume; common to many very fine and fine and few medium and coarse roots; strongly acid (pH 5.2); weakly smeary; clear smooth boundary.

A12–3 to 11 inches; brown (10YR 5/3) extremely cobbly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky and weak fine granular structure; soft, loose, non-sticky and non-plastic; 35 percent andesite and basalt cobbles and 30 percent cinder gravel by volume; common to many very fine and fine and common medium and coarse roots; few fine pores; strongly acid (pH 5.4); weakly smeary; grandual wavy boundary.

B1–11 to 28 inches; yellowish brown (10YR 5/4) extremely cobbly sandy loam, brown (10YR 3/4) moist; weak fine and medium subangular blocks and weak fine granular structure; slightly hard, very friable, slightly sticky and non-plastic; 40 percent cobbles, 20 percent stones and 15 percent gravel by volume of andesite and basalt; common very fine, fine, medium and coarse roots; few fine pores; medium acid (pH 5.6); weak to moderately smeary; gradual wavy boundary.

B2–28 to 53 inches; light yellowish brown (10YR 6/4) extremely cobbly sandy loam, dark yellowish brown (10YR 4/4) moist; weak to moderate medium subangular blocky structure; soft, very friable, slightly sticky and non-plastic; very few thin clay films on ped faces and pores; 35 percent andesite and basalt cobbles, 30 percent cinder gravel and 15 percent andesite and basalt gravel, in total 80 percent coarse frgaments by volume; common very fine and fine and few medium and coarse roots; common very fine and fine pores; medium acid (pH 5.6); weak to moderately smeary; clear smooth boundary.

B3si–53 to 60 inches; olive yellow (2.5Y 6/6) extremely cobbly sandy loam, yellowish brown (10YR 5/4) moist; strong medium and coarse platy structure, weakly consolidated silica pan which rubs with hand pressure to sandy loam; very hard, very friable; slightly sticky and non-plastic; 40 percent andesite and basalt cobbles and 35 percent cinders, andesite and basalt gravel by volume; common very fine and fine and few medium pores; medium acid (pH 5.8); weakly smeary.

Reference Pedon Location: Siskiyou County, California, about 30 feet south of road and about 2450 feet south and 1200 feet west of NE corner of Section 9, T.43N., R.3E.

Range in Characteristics: Depth to a lithic contact is greater than 30 inches. Rock fragments average 40 to 80 percent in the control section and are predominately basalt and andesite cobbles and gravel. The mean annual soil temperature at 20 inches is about 38 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 15 through September 25 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The soils 5 to 15 inch moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 20 through October 10 in most years.

The Divers family commonly has an approximate 900 year old pumice deposit of up to 24 inches in thickness. This deposit is always less than half the thickness of the underlying combined A and B horizons. The pumice overburden, if present, consists of an A, or an A-C horizon development in the deeper deposits. If present, the pumice A horizon has dry color of 10YR 5/1, 5/2, 5/3, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3 and may be up to 4 inches thick. Texture is coarse loamy sand or coarse sandy loam and contains from 35 to 60 percent by volume pumice gravel. It is single grained

and soil pH is moderately acid. The pumice overburden C horizon, if present, has dry color of 10YR 7/2, 7/3, 8/2, 8/3 and moist color of 10YR 5/2, 6/2, 6/3, 7/2. Texture is coarse loamy sand or coarse sand and contains from 50 to 90 percent by volume pumice gravel. It is single grained and soil pH is moderately acid.

The loam textured soil beneath the pumice overburden, if present, has an A-B horizon development.

The A horizon is 8 to 13 inches thick and have dry color of 10YR 4/2, 5/2, 5/3, 5/4, 6/3; 7.5YR 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 7.5YR 3/4, 4/2, 4/4. Texture is loamy sand, coarse sandy loam or sandy loam and contain between 30 to 50 percent by volume cobbles and gravel. Mollic colors do not extend beyond 6 inches from the soil surface. Structure is granular, platy, or subangular blocky and soil pH is strongly acid to medium acid.

The B horizon has dry color of 10YR 5/3, 5/4, 6/4, 6/6; 7.5YR 6/4 and moist color of 10YR 3/4, 4/4, 4/6, 5/4; 7.5YR 4/4. Texture is sandy loam or loamy sand and contain from 40 to 80 percent by volume cobbles, stone and gravel size rock fragments. Structure is subangular blocky and soil pH is strongly acid to medium acid.

DUNCOM FAMILY

The Duncom family consists of shallow, well drained soils which formed from andesite, basalt or tuff. Permeability is moderate. These soils are on 5 to 30 percent slopes and occur on sideslopes, ridges, and knolls of mountain uplands at 7000 to 8000 feet elevation. The climate is cold with a mean annual air temperature of 36 to 40°F. The annual precipitation is 25 to 35 inches and falls mostly as snow in winter. The frost free season is 40 to 70 days.

Taxonomic Class: Loamy, mixed, Lithic Cryoborolls.

Reference Pedon: Duncom family loam on a southwest facing 10 percent slope of a mountain ridge at 7600 feet elevation under big sagebrush, mule ears, phlox sp., lupine and bunchgrass rangeland. Soil was dry when described on 9/17/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure which parts into moderate fine granular; slightly hard, very friable, non-sticky and non-plastic; 5 percent gravel by volume; common to many very fine and fine and few medium roots; few very fine and fine pores; neutral (pH 6.6); gradual wavy boundary.

A12–6 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, non-sticky and non-plastic; 5 percent gravel by volume; common very fine, fine and medium and few coarse roots; few very fine and fine pores; slightly acid (pH 6.4); clear smooth boundary.

A13–12 to 17 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, non-sticky and slightly plastic; 5 to 10 percent gravel by volume; common very fine and fine, few medium and coarse roots; few to common pores; slightly acid (pH 6.4) abrupt smooth boundary.

R–17 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 200 feet east and 1400 feet north of the SW corner of Section 16, T.44N., R.15E.

Range in Characteristics: Depth to a lithic contact is 10 to 20 inches. The mean annual soil temperature at the lithic contact is about 38 to 42°F. and the mean summer temperature at the contact is about 50 to 59°F. The soil temperature at the lithic contact exceeds 41°F. from June 1 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 1 through June 15 and dry in all parts from August 10 through October 10. Clay content in the control section averages 16 to 24 percent.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2, 4/3 and have moist color of 10YR 2/1, 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam and contains from 5 to 35 percent by volume rock fragments normally of the cobble and gravel size with some stones. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

ELMORE FAMILY

The Elmore family consists of deep and moderately deep, well drained soils formed in material weathered from volcanic tuff and basalt. Permeability is moderately slow. These soils are found on basalt plateaus, mountain sideslopes and alluvial fans and draws. Slopes are 1 to 50 percent. Elevations are 4300 to 6000 feet. The annual precipitation is 16 to 25 inches, most of which falls during winter as snow. The mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Pachic Ultic Argixerolls.

Reference Pedon: Elmore family loam on a northwest facing 5 percent undulating basalt plateau at 4800 feet elevation under a ponderosa pine and Jeffrey pine forest. Soil was moist throughout when described on 6/2/78. (Colors are for dry soil unless otherwise stated.)

01–2 to 0 inches; duff layer of ponderosa pine and Jeffrey pine needles and twigs.

A11–0 to 3 inches; dark brown (7.5YR 4/4) loam, dark reddish borwn (5YR 3/2) moist; moderate and weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and few medium roots; slightly acid (pH 6.4); clear wavy boundary.

A12–3 to 13 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/3) moist; weak fine granular structure; very friable, slightly sticky and slightly plastic; common medium coarse and fine roots; many fine and few medium tubular pores; neutral (pH 6.6); gradual wavy boundary.

B21t–13 to 30 inches; dark brown (7.5YR 4/4) gravelly heavy loam, dark reddish brown (5YR 3/3) moist; weak and moderate fine subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; 20 percent by volume basalt gravel; common medium and coarse and many fine roots; common fine tubular pores; neutral (pH 6.6); clear wavy boundary.

B22t–30 to 48 inches; brown (7.5YR 5/4) gravelly clay loam, dark reddish brown (5YR 3/4) moist; weak and moderate fine subanghular blocky structure; slightly hard, friable, sticky and plastic; few to common thin clay films on ped faces; 25 percent gravel by volume; common medium and coarse and many fine roots; common fine pores; neutral (pH 6.6); clear smooth boundary.

IICr–48 to 60 inches; light yellowish brown (10YR 6/4) moist; highly weathered soft vesicular basalt which rubs to a loam texture.

Reference Pedon Location: Modoc County, California, about 30 feet south of Loveness Road and about 1850 feet east and 1300 feet south of NW corner of Section 22, T.42N., R.7E.

Range in Characteristics: Depth to bedrock is generally greater than 40 inches but ranges from 20 to 40 inches in map units 204, 205, 206, 222 and some pedons in map units 166 and 169. The control section averages 22 to 35 percent clay content and coarse fragments range from 5 to 35 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 50 to 75 percent throughout the upper 30 inches of the soil. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The A horizon is 8 to 16 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/2; 7.5YR 4/2, 4/4, 5/4; 5YR 3/3, 3/4, 4/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 2.5/2, 3/2, 3/3. Texture is loam and may contain up to 25 percent by volume gravel. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon makes up the remaining soil and have dry color of 10YR 4/3, 5/3, 5/6, 6/4; 7.5YR 4/2, 4/4, 4/6, 5/4, 5/6; 5YR 4/4, 5/4, 5/6, 6/4 and moist color of 10YR 3/3, 3/4, 4/4, 5/4; 7.5YR 3/2, 3/4, 4/2, 4/4; 5YR 3/2, 3/3, 3/4, 4/4 or 4/6. The upper parts of the argillic B horizon has mollic colors and may include the whole soil depth. Texture is loam or clay loam and contain from 5 to 35 percent by volume gravel and cobbles. Structure is prismatic or subangular blocky and soil pH is slightly acid to neutral.

FORDICE FAMILY

The Fordice family consists of moderately deep, well drained soils that formed from basalt, andesite, or tuff. Permeability is moderately slow. These soils are on basalt plateaus and mountain sideslopes of 1 to 60 percent slope. Where these soils have been mapped on steeper ground they are predominantly on the warmer southeast to westerly exposures. They occur at elevations of 4400 to 6000 feet. The annual precipitation is 16 to 20 inches which mostly falls in the winter as snow. The mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Ultic Argixerolls.

Reference Pedon: Fordice family very stony loam on a west facing 20 percent mountain sideslope at 5500 feet elevation under a sparce ponderosa pine and western juniper woodland with big sagebrush, rabbitbrush and bunchgrass understory. Soil was dry throughout when described on 9/15/78. (Colors are for dry soil unless otherwise noted.)

01–1 to 0 inches; ponderosa pine and western juniper needles and grass litter.

A11–0 to 3 inches; dark grayish brown (10YR 4/2) very stony loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, non-sticky and non-plastic; 50 percent rock fragments by volume consisting of stones, cobbles and gravel of basalt; many fine and very fine roots; slightly acid (pH 6.2); abrupt smooth boundary.

A12–3 to 9 inches; grayish brown (10YR 5/2) extremely cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; soft, friable, slightly sticky and non-plastic; very few thin clay films on ped faces; 60 percent rock fragments by volume consisting of stones, cobbles and gravel of basalt; common very fine and fine and few medium and coarse roots; common very fine and fine tubular pores; slightly acid (pH 6.4); clear wavy boundary.

B21t–9 to 12 inches; brown (10YR 4/3) extremely cobbly clay loam, dark brown (10YR 3/3) moist; weak fine and moderate medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few thin clay films on ped faces; 65 percent by volume fragments consisting of stones, cobbles and gravel of basalt; common very fine and fine, few medium and coarse roots; common very fine and fine tubular pores; slightly acid (pH 6.4); gradual smooth boundary.

B22t–12 to 18 inches; brown (7.5YR 5/4) extremely cobbly clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; common moderately thick clay films on ped faces; 70 percent by volume rock fragments consisting of stones, cobbles and gravel of basalt; common very fine and fine, few medium and coarse roots; common very fine and fine tubular pores; neutral (pH 6.6); gradual smooth boundary.

B23t–18 to 28 inches; brown (7.5YR 5/4) extremely cobbly clay loam, dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common moderately thick clay films on ped faces; 70 percent by volume rock fragments consisting of stones, cobbles and gravel of basalt; few very fine, and fine and medium roots; common very fine and fine tubular pores; neutral (pH 6.6); abrupt smooth boundary.

R–28 inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 100 feet west and 1900 feet north of SE corner of Section 15, T.45N., R.14E.

Range of Characteristics: Depth to bedrock is 20 to 40 inches. The control section averages 22 to 35 percent clay content and coarse fragments normally average 50 to 80 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 60 and 75 percent normally throughout the whole soil depth. The mean annual soil temperature at a depth of 20 inches is 47 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 6 to 18 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The A horizon is 6 to 14 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2, 4/4, 5/4; 5YR 4/3, 4/4 and moist color of 10YR 2/2, 3/2, 3/3;

7.5YR 3/2; 5YR 3/2, 3/3. Texture is loam and rock fragment content ranges from 40 to 75 percent by volume. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon makes up the remaining soil and have dry color of 10YR 4/3, 5/3, 5/4; 7.5YR 4/4, 5/4; 5YR 4/3, 4/4, 5/3, 5/4 and moist color of 10YR 3/3, 3/4, 4/3; 7.5YR 3/4; 5YR 3/3, 3/4. The mollic epipedon is 10 to 20 inches thick and commonly includes the upper part of the argillic B horizon. Texture is loam or clay loam and rock fragment content is 50 to 80 percent by volume and normally consists of stone, cobble, and gravel size fragments. Structure is subangular blocky and soil pH is slightly acid to neutral.

FRIANA FAMILY

The Friana family consists of moderately deep to deep, well drained soils which weathered from volcanic tuff. Permeability is slow. These soils are on 30 to 60 percent slopes and occur on lower sideslopes and toeslopes of mountain uplands at 7000 to 8000 feet elevation. The climate is cold with 36 to 40°F. mean annual air temperature. The annual preciptiation is 25 to 30 inches which falls mostly as snow during the winter and the frost free season is 40 to 70 days.

Taxonomic Class: Fine, montmorillonitic, Pachic Argic Cryoborolls.

Reference Pedon: Friana family silty clay loam on a north facing 32 percent lower sideslope at 7450 feet elevation under an open canopy of white fir, lodgepole pine and western white pine forest with big sagebrush and various montaine shrubs, forbs, and grasses. Soil was moist below 17 inches when described on 10/9/80. (Colors are for dry soil unless otherwise stated.)

01–1/2 to 0 inches; Lodgepole pine and white fir needles.

A11–0 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, friable, sticky and plastic; 5 percent gravel; many very fine and fine, common medium roots; many very fine and fine, few medium pores; slightly acid (pH 6.4); gradual wavy boundary.

A12–4 to 11 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few to common moderately thick clay films on ped faces; 5 percent gravel; common very fine, fine and medium, few coarse roots; many very fine, fine and few medium pores; slightly acid (pH 6.2); clear wavy boundary.

B21t–11 to 17 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate to strong fine and medium angular blocky structure; very hard, firm, very sticky and very plastic; common thick clay films on ped faces and pores; common very fine and fine, few medium and coarse roots; common very fine and fine and few medium pores; strongly acid (pH 5.4); gradual wavy boundary.

B22t–17 to 38 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist. Moderate to strong fine and medium angular blocky structure; very hard, firm, very sticky and very plastic; common thick clay films on ped faces and pores; few very fine, fine and medium roots; few very fine and fine pores; strongly acid (pH 5.4); gradual wavy boundary.

B3–38 to 53 inches; brown (7.5YR 5/2) very gravelly silty clay loam, dark brown (7.5YR 4/2) moist; massive; very hard, friable, very sticky and plastic; 45 percent gravel; few very fine and fine roots; few very fine and fine pores; medium acid (pH 5.6); abrupt smooth boundary.

R–53 plus inches; congolmerated tuff.

Reference Pedon Location: Modoc County, California, about 800 feet west and 2200 feet north of the SE corner, Section 10, T.47N., R.15E.

Range of Characteristics: Depth to a lithic contact of hard conglomerated volcanic tuff is greater than 30 inches. The mean annual soil temperature at the 20 inch depth is about 38 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years, however, the mean summer soil temperature at 20 inches is less than 47°F. The 4 to 12 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10. The control section averages 35 to 50 percent clay and may contain up to 15 percent by volume coarse fragments.

The A horizon is 7 to 15 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/3 and moist color of 10YR 2/2, 3/2, 3/3. Texture is clay loam or silty clay loam. Structure is granular or subangular blocky and soil pH is moderately acid to neutral.

The B horizon normally makes up the rest of the soil with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 6/3; 7.5YR 4/4, 5/2, 5/4, and moist color of 10YR 3/2, 3/3, 4/2, 4/4; 7.5YR 3/2, 3/34 or 4/2. The upper parts and often the whole B horizon is mollic in color. Texture is silty clay loam, silty clay or clay. Structure is blocky or massive and soil pH is strongly acid to slightly acid. Coarse fragments range from 0 to 50 percent by volume and tend to be more numerous with increased depth.

GALLATIN FAMILY

The Gallatin family consists of moderately deep, well drained soils weathered from basalt and andesite. Permeability is moderate. These soils are on mountain sideslopes of 5 to 50 percent slopes. They occur at elevations of 7000 to 9000 feet. The annual precipitation is 25 to 35 inches which mostly falls during the winter as snow. The mean annual air temperature is 34 to 40°F. The frost-free season is less than 30 to 70 days.

Taxonomic Class: Fine-loamy, mixed, Pachic Cryoborolls.

Reference Pedon: Gallatin family loam on a north facing 9 percent mountain sideslope at 7100 feet elevation under big sagebrush, mule ears, arrowleaf balsomroot and bunchgrass rangeland with scattered ponderosa pine, white fir and western juniper. Soil was dry below 9 inches when described on 8/30/79. (Colors are for dry soil unless otherwise noted.)

A11–0 to 16 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure which parts into weak to moderate very fine and fine granular; slightly hard, friable, slightly sticky and non-plastic; 5 percent gravel by volume; many very fine and fine, and common medium roots; few fine and medium pores; slightly acid (pH 6.4); gradual wavy boundary.

A12–16 to 21 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak to moderate medium and coarse subangular blocky structure which parts into moderate very fine and fine granular; slightly hard, very friable, slightly sticky and slightly plastic; 5 to 10 percent gravel by volume; common very fine and fine, and few medium roots; common very fine and fine and few medium pores; slightly acid (pH 6/2); clear wavy boundary.

A13–21 to 29 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak to moderate medium and coarse subangular blocky structure which parts into moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; 50 percent basalt cobbles and stones by volume; common very fine and fine, and few medium roots; common very fine and fine and few medium pores; slightly acid (pH 6/4); abrupt wavy boundary.

R–29 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 200 feet south of road and about 750 feet west and 2000 feet south of the NE corner of Section 27, T.39N., R.15E.

Range in Characteristics: Depth to a lithic contact is 20 to 40 inches. The mean annual soil temperature at the 20 inch depth is about 36 to 42°F. and the mean summer temperature is about 50 to 59°F. The soil temperature at 20 inches exceeds 41°F. from June 1 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 10 through October 10. Clay content in the control section averages 18 to 27 percent, and rock fragments average 10 to 35 percent by volume.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3; 7.5YR 4/2, 4/4 and have moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or light clay loam and contains from 5 to 50 percent by volume rock fragments normally of the cobble and gravel size with some stones. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

GERMANY FAMILY

The Germany family consists of moderately deep and deep, well drained soils formed in material weathered from volcanic ash and basalt. Permeability is moderately rapid. These soils are found on basalt plateaus. Slopes range from 1 to 5 percent. Elevations are 4300 to 5000 feet. The annual precipitation ranges from 18 to 28 inches, most of which falls during winter as snow. The mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Medial, mesic, Andic Xerumbrepts.

Reference Pedon: Germany family fine sandy loam on a nearly level basalt plateau among reef-like formations of lava flow rock at 4300 feet elevation under an open ponderosa pine forest with greenleaf manzanita, rabbitbrush, bitterbrush, big sagebrush and bunchgrass understory. Soil was moist to 14 inches when described on 10/17/79. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; ponderosa pine needles and twigs.

A11–0 to 6 inches; dark yellowish brown (10YR 4/4) fine sandy loam, dark brown (7.5YR 3/2) moist; weak fine and medium platy structure which parts into moderate fine granular; soft, very friable, slightly sticky and non-plastic; 5 percent gravel by volume; many very fine and fine, common medium roots; common fine pores; slightly acid (pH 6.2); clear wavy boundary.

A12–6 to 14 inches; yellowish brown (10YR 5/4) fine sandy loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky and non-plastic; 5 percent gravel and 5 percent cobbles by volume; many very fine and fine, common medium and few coarse roots; common fine and medium pores; slightly acid (pH 6.2); gradual wavy boundary.

B2–14 to 32 inches; yellowish brown (10YR 5/4) cobbly fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and non-plastic; 10 percent cobbles and 5 percent gravel by volume; many very fine and fine, common medium and coarse roots; common very fine and fine, few medium pores; medium acid (pH 6.0); clear wavy boundary.

C–32 to 47 inches; brownish yellow (10YR 6/6) very cobbly fine sandy loam, strong brown (7.5YR 5/6) moist; massive; very friable, soft, slightly sticky and non-plastic; 20 percent cobbles and 20 percent gravel by volume; many medium, common very fine, fine and coarse roots; common very fine and fine and few medium pores; medium acid (pH 6.0); abrupt wavy boundary.

R–47 plus inches; fractured hard vesicular basalt.

Reference Pedon Location: Modoc County, California, about 40 feet south of road and about 2300 feet west and 1100 feet north of SE corner of Section 11, T.41N., R.5E.

Range in Characteristics: Depth to a lithic contact is normally 20 to 40 inches in soil map unit 174, and greater than 40 inches in map unit 173. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30. Base saturation by the ammonium acetate method is 25 to 50 percent in most or all parts of the epipedon and remainder of the soil. The soil bulk density in the upper 14 inches or so of soil is 0.90 to 1.00 gm/cm^{3}at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25. NaF pH is normally greater than 10. Rock fragments in the control section average 10 to 35 percent by volume.

The A horizon is 8 to 20 inches thick with dry color of 10YR 4/4, 5/4; 7.5YR 4/4, 4/6; 5YR 4/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2; 5YR 3/3. Texture is sandy loam or fine sandy loam and is weakly to moderately smeary in consistance. Rock fragments average 5 to 20 percent by volume. Structure is platy, granular or subangular blocky and soil pH is medium to slightly acid.

The B horizon has dry color of 10YR 5/4, 5/6, 6/4; 7.5YR 5/4 and moist color of 10YR 3/4, 4/3, 4/4, 4/6; 7.5YR 3/4; 5YR 3/4. Texture is sandy loam, fine sandy loam or loam and rock fragments range from 10 to 50 percent by volume and increase with depth. Structure

is subangular blocky and soil pH is medium to slightly acid.

The C horizon, if present, has dry color of 10YR 6/4, 6/6, 7/3, 7/4 and moist color of 10YR 5/3, 5/4, 5/6; 7.5YR 5/4, 5/6. Texture is sandy loam or fine sandy loam and contains from 35 to 60 percent by volume rock fragments. Structure is massive and soil pH is medium to slightly acid.

Additional Data: Lincoln Lab. Sample #S79Ca-049-013.

GINSER FAMILY

The Ginser family consists of moderately deep, well drained soils that have formed from basalt or andesite. Permeability is moderate. These soils are on 20 to 40 percent slopes and occur on sideslopes of mountain uplands at 5500 to 7000 feet elevation. The climate is cool with 42 to 46°F. mean annual air temperature and annual precipitation of 20 to 22 inches which mostly falls as snow during winter. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Pachic Haploxerolls.

Reference Pedon: Ginser family cobbly loam, on a south facing 37 percent mountain sideslope at 6400 feet elevation under a predominately big sagebrush, mule ears and Idaho fescue rangeland with scattered ponderosa pine and white fir. (Colors are for dry soil unless otherwise stated.)

A11–0 to 3 inches; dark brown (10YR 4/3) cobbly loam, very dark brown (10YR 2/2) moist; moderate medium and coarse granular structure; slightly hard, very friable, sticky and slightly plastic; 15 percent cobbles and stones and 15 percent gravel by volume; many very fine and fine and common medium roots; slightly acid (pH 6.4); clear smooth boundary.

A12–3 to 12 inches; dark brown (10YR 4/3) very cobbly loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; 25 percent cobbles and 20 percent gravel by volume; many very fine and fine and common medium roots; common very fine and fine pores; neutral (pH 6.6); gradual wavy boundary.

A13–12 to 24 inches; dark yellowish brown (10YR 4/4) extremely cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; very few thin clay films on ped faces; 35 percent cobbles and 25 percent gravel by volume; common to many very fine and fine and few medium roots; common very fine and fine and few medium pores; neutral (pH 6.8); abrupt wavy boundary.

R–24 plus inches; hard, moderately weathered vesicular basalt.

Reference Pedon Location: Modoc County, California, about 30 feet north of road and about 1300 feet east and 900 feet north of the SW corner of Section 25, T.45N., R.14E.

Range in Characteristics: Depth to a lithic contact of fractured basalt or andesite is 20 to 40 inches. The mean annual soil temperature at the 20 inch depth is about 44 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average rock fragment content of the control section is 35 to 60 percent by volume, and also averages 18 to 25 percent clay.

The A horizon normally occupies the whole soil depth and have dry color of 7.5YR 4/2, 4/3; 10YR 4/2, 5/3, 5/4 and moist color of 7.5YR 3/2; 10YR 2/2, 3/2 or 3/3. Texture is loam and contains from 35 to 60 percent by volume rock fragments consisting mainly of gravels, cobbles and stones. Structure is granular and subangular blocky and soil pH is slightly acid to neutral.

GLEASON FAMILY

The Gleason family consists of deep, well drained soils formed from tuff, andesite, or obsidian. Permeability is moderately rapid. These soils are on 10 to 40 percent slopes and occur on rolling foothills and sideslopes of mountain uplands at 4800 to 6200 feet elevation. The climate is cool and dry in summer with 40 to 46°F. mean annual air temperature and 16 to 25 inches annual precipitation which mostly falls as snow during the winter. Frost free season is 70 to 90 days.

Taxonomic Class: Coarse-loamy, mixed, frigid, Entic Haploxerolls.

Reference Pedon: Gleason family gravelly sandy loam on a rolling foothill under a ponderosa pine forest with bitterbrush, big sagebrush and squaw carpet understory. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; litter of ponderosa pine needles.

A11–0 to 4 inches; grayish brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; loose, very friable, non-sticky, non-plastic; many very fine roots; many very fine interstitial pores; 30 to 35 percent by volume obsidian gravel; slightly acid (pH 6.5); clear smooth boundary.

A12–4 to 16 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, non-sticky, non-plastic; common very fine roots; many very fine interstitial and tubular pores; less than 10 percent by volume obsidian gravel; medium acid (pH 6.0); clear wavy boundary.

C–16 to 22 inches; grayish brown (10YR 5/2) sandy loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, very friable, non-sticky, non-plastic; few very fine and fine, common medium and few coarse roots; many very fine interstitial and common very fine tubular pores; less than 10 percent by volume obsidian gravel; medium acid (pH 6.0); gradual wavy boundary.

C1–22 to 35 inches; light gray (10YR 7/2) gravelly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, non-sticky, non-plastic; few fine roots, common coarse roots; many very fine interstitial pores; 15 percent gravel by volume; slightly acid (pH 6.2); gradual smooth boundary.

C2–35 to 50 inches; very pale brown (10YR 7/3) very gravelly coarse sand, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable, non-sticky, non-plastic; few fine roots; few very fine interstitial pores; 50 percent gravel by volume of weathered tuff; slightly acid (pH 6.2); gradual smooth boundary.

R–50 plus inches; pale brown (10YR 6/3) hard tuff agglomerate.

Reference Pedon Location: Modoc County, California; about 8 miles north of Davis Creek; 30 feet south and 90 feet west of the east quarter corner of Section 10, T.46N., R.14E. (State Model).

Range in Characteristics: Depth to a lithic contact is greater than 40 inches. The mean annual soil temperature at a depth of 20 inches is 43 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The 6 to 18 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20. The coarse fragment content of the control section averages 10 to 35 percent by volume and clay content averages 12 to 18 percent.

The A horizon is 12 to 20 inches thick with dry color of 10YR 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 3/2, 3/3 or 7.5YR 3/2. Texture is sandy loam or fine sandy loam and contains from 15 to 45 percent by volume coarse fragments. Structure is granular or massive and soil pH is medium to slightly acid.

The C horizon occupies the remainder of the soil with dry color of 10YR 6/3, 6/4, 7/2, 7/3, 7/4 and moist color of 10YR 5/2, 5/3, 5/4, 6/3, 6/4. Texture is sandy loam, loamy sand or coarse sand, normally becoming sandier with depth. Coarse fragments average 10 to 60 percent and becomes more numerous with depth. It is massive to single grained and soil pH is medium acid to slightly acid.

Additional Data: Riverside Lab pedon no. S72 Calif. 25-12.

GRALIC FAMILY

The Gralic family consists of moderately deep and deep, well drained soils that formed in andesite and obsidian. Permeability is moderately rapid. These soils are on 10 to 65 percent slopes and occur on smooth and convex mountain sideslopes at 7000 to 8000 feet elevation. The annual precipitation is 25 to 30 inches which mostly falls as snow during the winter. The mean annual air temperature is 36 to 40°F. The frost free season is 40 to 70 days.

Taxonomic Class: Loamy-skeletal, mixed, non-acid, Typic Cryorthents.

Reference Pedon: Gralic family very gravelly fine sandy loam on a 28 percent southwest facing upper sideslope at 7440 feet elevation under lodgepole pine, western white pine and Washoe pine forest with an understory of prostrate manzanita and ceanothus. Soil was moist below 17 inches when described on 9/17/80. (Colors are for dry soils unless otherwise stated.)

01–1 to 0 inches; lodgepole pine needles and twigs.

1–0 to 4 inches; grayish brown (10YR 5/2) very gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, loose, non-sticky and non-plastic; 40 percent gravel by volume; common very fine, fine, medium and coarse root; slightly acid (pH 6.2); smooth boundary.

AC–4 to 17 inches; pale brown (10YR 6/3) very gravelly fine sandy loam, brown (10YR 4/3) moist; weak fine and medium granular structure; soft, loose, non-sticky and non-plastic; 45 percent gravel by volume; common, very fine, fine, medium and coarse roots; slightly acid (pH 6.2); gradual wavy boundary.

C1–17 to 33 inches; light yellowish brown (10YR 6/4) very gravelly sandy loam, brown (10YR 5/3) moist; single grain with some weak fine granular structure; loose, non-sticky and non-plastic; 60 percent gravel by volume; few to common very fine and fine, few medium and coarse roots; slightly acid (pH 6.2); clear smooth boundary.

C2–33 to 42 inches; very pale brown (10YR 7/3) very gravelly sandy loam, pale brown (10YR 6/3) moist; single grain structure; loose, non-sticky and non-plastic; 45 percent weathered obsidian gravel by volume; slightly acid (pH 6.4); clear smooth boundary.

C3–42 to 60 inches; very pale brown (10YR 7/3) very gravelly loamy sand, pale brown (10YR 6/3) moist; massive; soft, loose; non-sticky and non-plastic; 40 percent weathered obisdian gravel by volume; few very fine roots; slightly acid (pH 6.4).

Reference Pedon Location: Modoc County, California, about 30 feet above road and about 250 feet east and 1800 feet south of NW corner of Section 33, T.45N., R.15E.

Range in Characteristics: Depth to weathered tuff, cinders, obsidian or andesite bedrock is greater than 30 inches. Clay content in the control section averages 8 to 15 percent and coarse fragments average 35 to 60 percent by volume. The mean annual soil temperature at the 20 inch depth is about 38 to 42°F. The soil temperature at 20 inches exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10.

The A horizon is 3 to 6 inches thick with dry color of 10YR 5/2, 5/3, 5/4, 6/2 and moist color of 10YR 3/2, 3/3, 3/4, 4/2. Texture is fine sandy loam or sandy loam and contains from 20 to 50 percent by volume coarse fragments. Structure is granular and soil pH is slightly acid to neutral.

The C horizon makes up the remainder of the soil with dry color of 10YR 6/2, 6/3, 7/2, 7/3, 7/4 and moist color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4, 6/2, 6/3. Texture is fine sandy loam, sandy loam or loamy sand and contains from 35 to 60 percent by volume coarse fragments. Structure is massive or single grained and soil pH is slightly acid to neutral.

GWIN FAMILY

The Gwin family consists of shallow, well drained soils that formed from material derived from basalt, andesite or tuff. Permeability is moderately slow. These soils are on basalt plateaus or mountain sideslopes with 2 to 70 percent slopes and mainly on southerly to westerly aspects at 4200 to 6400 feet elevation. The climate is warm with 44 to 50°F. mean annual air temperature and annual precipitation of 10 to 20 inches, most of which falls during winter as snow. Frost free season is 80 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Lithic Argixerolls.

Reference Pedon: Gwin family, very cobbly loam on an 8 percent southwest exposure on an undulating basalt plateau at 4700 feet elevation under western juniper, big sagebrush, bitterbrush, and bunchgrass rangeland. (Colors are for dry soils unless otherwise stated.)

A11–0 to 7 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure which parts into weak to moderate fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; 30 percent gravel and 25 percent cobbles by volume; common very fine, fine and medium and few coarse roots; common very fine and fine pores; neutral (pH 6.8); gradual wavy boundary.

A12–7 to 11 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, very friable; slightly sticky and slightly plastic; 35 percent cobbles and 20 percent gravel by volume; few to common fine and medium and few coarse roots; few very fine and fine pores; neutral (pH 6.8); clear wavy boundary.

B2t–11 to 18 inches; brown (10YR 4/3) extremely cobbly clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few to common thin clay films on pores and ped faces; 40 percent cobbles and 30 percent gravel by volume; few fine, medium and coarse roots; few very fine, fine and medium pores; neutral (pH 7.0); abrupt wavy boundary.

R–18 plus inches; hard fractured vesicular basalt.

Reference Pedon Location: Siskiyou County, California, about 1300 feet south and 2300 feet west of the NE corner of Section 20, T.45N., R.4E.

Range in Characteristics: Depth to the lithic contact ranges from 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 47 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1. Where this soil is mapped in map unit 247 the soil between depths of about 5 to 15 inches, or lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped with other units the soil at the 5 to 15 inch depth, or lithic contact if shallower, is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1. The average rock fragment content of the control section is 35 to 75 percent by volume and clay content averages 20 to 35 percent.

The A horizon is 3 to 11 inches thick with dry color of 10YR 4/2, 4/3, 5/2, /5/3, 5/4; 7.5YR 4/2, 4/4, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or sandy loam and contains from 25 to 65 percent by volume rock fragments. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4, 5/4, and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 7.5YR 3/2, 3/4, 4/4. The upper 7 inches of soil and often the whole soil depth is mollic in color. Texture is loam or clay loam and contains from 35 to 75 percent by volume rock fragments. Structure is subangular blocky and soil pH is neutral.

HADES FAMILY

The Hades family consists of moderately deep, well drained soils that formed from basalt and andesite. Permeability is moderately slow. These soils are on 10 to 25 percent slopes and occur on lower sideslopes and alluvial fans in mountain uplands at 5700 to 6500 feet elevation. The climate is cool with 42 to 46°F mean annual air temperature and annual precipitation of 20 to 22 inches. Frost free season is 60 to 90 days.

Taxonomic Class: Fine-loamy, mixed, frigid, Pachic Argixerolls.

Reference Pedon: Hades family loam, on a 14 percent east facing mountain sideslope at 6480 feet elevation under big sagebrush, rabbitbrush, mountain mahogany, squawcarpet, Ceanothus, mule ears, wheat grass and Idaho fescue transitional rangeland with a few scattered encroaching ponderosa pine. Soil was moist in all horizons when described on 11/4/81. (Colors are for dry soil unless otherwise stated).

A11–0 to 6 inches; dark brown (7.5YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent gravel by volume; many very fine, common fine and medium and few coarse roots; neutral (pH 6.6); gradual wavy boundary.

A12–6 to 15 inches; dark brown (7.5YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure which parts into moderate fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; 5 to 10 percent gravel by volume; moderate fine, very fine, and medium and few coarse roots; few to common very fine, fine and coarse pores; neutral (pH 6.8); clear smooth boundary.

B21t–15 to 22 inches; brown (10YR 4/3) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; 10 to 15 percent gravel and 5 percent cobbles by volume; few moderately thin clay films on ped faces and pores; common very fine and fine, and few to common medium and coarse roots; common very fine and fine and few coarse pores; neutral (pH 6.8); gradual wavy boundary.

B22t–22 to 36 inches; brown (10YR 4/3) gravelly silty clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces and pores; 25 percent gravel by volume; few very fine, fine, medium and coarse roots; few to common very fine, fine and coarse pores; neutral (pH 6.8); abrupt wavy boundary.

R–36 plus inches; hard fractured basalt, with some soil between fractures.

Reference Pedon Location: Lassen County, California, about 300 feet east and 1800 feet south of the NW corner of Section 11, T.38N., R.11E.

Range in Characteristics: Depth to a lithic contact of fractured basalt or andesite is 20 to 40 inches. The mean annual soil temperature at a depth of 20 inches is about 44 to 47° F. and fluctuates by more the 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average coarse fragment contact of the control section is 5 to 35 percent by volume, and also averages 24 to 35 percent clay.

The A horizon is 12 to 20 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2, 4/4 and moist color of 10YR 2/2, 3/2. 3/3; 7.5YR 3/2. Texture is loam and may contain up to 20 percent by volume coarse fragments in some pedons. Structure is granular to subangular blocky and soil pH is neutral to slightly acid.

The B horizon makes up the remainder of the soil depth with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4, 5/4 and moist color of 10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/4. The upper parts of the argillic B horizon has mollic colors and may include the whole soil depth. Texture is loam, clay loam or silty clay loam and contains from 5 to 35 percent by volume coarse fragments. Structure is subangular blocky or prismatic and soil pH is netural.

HIIBNER FAMILY

The Hiibner family consists of moderately deep, well drained soils formed in material weathered from basalt and tuff. Permeability is slow. These soils are on mountain sideslopes of 1 to 60 percent slope and are commonly on southeast to west aspects, and occur at elevations of 4400 to 5800 feet. The climate is cool. The annual precipitation is 14 to 20 inches, most of which falls during the winter as snow. The mean annual air temperature is 44 to 50F. Frost free season is 80 to 110 days.

Taxonomic Class: Clayey-skeletal, montmorillonitic mesic, Typic Argixerolls.

Reference Pedon: Hiibner family stony loam on a 21 percent south facing mountain sideslope at 4500 feet elevation under scattered ponderosa pine, mountain mahogany and western juniper with mulesear and bunchgrass understory. Soil was moist throughout when described on 5/11/79. (Colors are for dry soil unless otherwise noted.)

A11–0 to 3 inches; brown (10YR 4/3) stony loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable, sticky and slightly plastic; 25 percent stones and cobbles by volume; many very fine and fine roots; neutral (pH 6.6); clear smooth boundary.

A12–3 to 12 inches; brown (10YR 4/3) very cobbly clay loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine subangular blocky structure which parts to moderate fine and medium granular; slightly hard, friable, sticky and plastic; 35 percent cobbles and stones by volume; common very fine, fine medium and coarse roots; neutral (pH 6.6); clear smooth boundary.

B21t–12 to 21 inches; brown (7.5YR 4/4) very cobbly clay, dark brown (7.5YR 3/4) moist; moderate to strong fine and medium subangular blocky structure; hard, firm, very sticky and very plastic; common moderately thick clay films on ped faces; 40 percent cobbles and stones by colume; common very fine and fine and few medium roots; neutral (pH 6.8); clear smooth boundary.

B22t–21 to 25 inches; brown (7.5YR 4/4) very cobbly clay, dark brown (7.5YR 3/4) moist; moderate to strong fine and medium subangular blocky structure; hard, firm, very sticky and very plastic; common moderately thick clay films on ped faces; 25 percent gravel and 20 percent cobbles by volume; common very fine and fine roots; neutral (pH 6.8); abrupt smooth boundary.

R–25 plus inches; slightly weathered fractured basalt.

Reference Pedon Location: Modoc County, California, about 40 feet south of road and about 2400 feet west and 1300 south of the NE corner of Section 18, T.41N., R.9E.

Range in Characteristics: Depth to a lithic contact of basalt, andesite or volcanic tuff is 20 to 40 inches. Clay content in the control section averages 35 to 60 percent and rock fragments occupy 35 to 70 percent by volume. The mean annual soil temperature at 20 inches is about 47 to 53°F. and flucturates by more then 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1. The 5 to 15 inch soil moisture control section is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1.

The A horizon is 8 to 14 inches thick and have dry color of 10YR 4/2, 4/3, 5/3 and moist color of 10YR 2/2, 3/2, 3/3. Texture is loam or clay loam and contains 25 to 60 percent by volume rock fragments. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7/5YR 4/4, 5/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/3; 7.5YR 3/4. The mollic epipedon is 10 to 20 inches thick and commonly includes the upper part of the argillic B horizon. Texture is clay loam or clay and contain 35 to 70 percent by volume rock fragments. Structure is subangular or angular blocky and soil pH is neutral to slightly acid.

HOLLAND FAMILY

The Holland family consists of deep and moderately deep, well drained soils that formed in material weathered from volcanic ash and basalt with a recent pumice overburden layer. Permeability is rapid in the pumice overburden to moderately slow below. These soils are on basalt plateaus or on basalt plateau scarp breaks. Elevation ranges from 4200 to 4700 feet. Slopes range from 1 to 40 percent. The annual precipitation is 16 to 20 inches most of which falls during the winter as snow. The mean annual air temperature is 46°F. The frost free season is 90 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Ultic Haploxeralfs.

Reference Pedon: Holland family (pumice overburden) gravelly loamy coarse sand on a nearly level basalt plateau at 4200 feet elevation under an open canopy of ponderosa pine and Jeffrey pine with bitterbrush and big sagebrush understory. Soil was dry in all parts when described on 10/10/78. (Colors are for dry soil unless otherwise stated.)

01–1/2 to 0 inches; Ponderosa and Jeffrey pine needles.

A1–0 to 6 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grained; loose, non-sticky, nonplastic; pumice gravel 30 percent by volume; many fine, very fine and few to common medium roots; neutral (pH 6.6); clear smooth boundary.

C1–6 to 11 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand, very pale brown (10YR 7/3)moist; single grained; loose, non-sticky and nonplastic; pumice gravel 70 percent by volume; common to many fine and very fine and few medium and coarse roots; neutral (pH 6.7); abrupt smooth boundary.

IIA1b–11 to 17 inches; yellowish brown (10YR 5/4) heavy loam, dark yellowish brown (10YR 3/4) moist; weak to moderate fine and medium subangular blocky structure parting to moderate fine and very fine granular; hard, friable, sticky and slightly plastic; gravel 10 percent by volume; common fine and very fine, few medium and coarse roots; many fine and very fine and few medium pores; neutral (pH 6.6); clear smooth boundary.

IIB21tb–17 to 28 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate to strong fine and medium subangular blocky and angular blocky structure; hard, friable, sticky and plastic; gravel 2 to 5 percent by volume; few to common fine and very fine, few medium and coarse roots; many fine and very fine, few medium and coarse pores; neutral (pH 6.8); common thin clay films on ped faces; clear smooth boundary.

IIB22tb–28 to 38 inches; brownish yellow (10YR 6/6) clay loam, dark yellowish brown (10YR 4/6) moist; moderate to strong, fine and medium angular and subangular blocky structure; hard, friable, sticky and plastic; common thin clay films on ped faces; gravel 2 to 5 percent by volume; few to common fine, very fine and few medium and coarse roots; many fine and very fine and few medium pores; neutral (pH 6.8); clear wavy boundary.

IIB3tb–38 to 48 inches; brownish yellow (10YR 6/6) gravelly light clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine to medium subangular blocky structure; hard, friable, sticky and slightly plastic; few thin clay films on ped faces; gravel 20 percent by volume; few fine, very fine, medium and coarse roots; many fine, very fine and few medium pores; neutral (pH 6.8); abrupt smooth boundary.

IIR–48 inches; hard basalt.

Reference Pedon Location: Modoc County, California, about 300 feet north of road and about 1900 feet west and 1600 feet north of the SE corner of Section 24, T.44N., R.5E.

Range in Characteristics: Depth to a lithic contact is 20 to 40 inches in soil map units 182 and 246 and greater than 40 inches in map unit 183. The control section averages 24 to 35 percent clay content and also averages 5 to 35 percent by volume rock fragments. Base saturation is estimated to be 60 to 75 percent, by sum of cations, in at least the upper parts of the argillic horizon. The mean annual soil temperature at 20 inches is about 49 to 53°F. and flucturates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The Holland family soils in this survey have an approximate 900 year old pumice deposit from 4 to 20 inches thick. This pumice deposit is always less than half the thickness of the combined A and B horizons of the underlying soil. The pumice overburden consists of an A, or an A-C horizon development in the deeper deposits.

The pumice A horizon is 2 to 6 inches thick and has dry color of 10YR 5/1, 5/2, 5/3, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3. Texture is coarse loamy sand or coarse sand and contains 25 to 45 percent gravel mainly of the less than 0.6 inch size. It is single grained and soil pH is neutral. The pumic overburden C horizon, if present, has dry color of 10YR 7/3, 7/4, 8/3 and moist color of 10YR 6/3 or 7/3. Texture is coarse sand and contains 65 to 90 percent by volume gravel mainly of the 0.2 to 1.0 inch size. It is single grained and soil pH is neutral.

The soil underlying the pumice overburden has an A-B horizon development.

The A horizon is 4 to 9 inches thick and have dry color of 10YR 5/4, 6/3, 6/4; 7.5YR 4/4, 5/4 and moist color of 10YR 3/4, 4/4; 7.5YR 3/4, 4/4. Texture is loam and contains 5 to 20 percent by volume weathered cinder gravels. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 5/4, 6/4, 6/6; 7.5YR 5/4, 5/6, 6/4 and moist colors of 10YR 3/4, 3/6, 4/4, 4/6; 7.5YR 3/4, 4/4, 4/6. Texture is clay loam or loam and contains from 5 to 35 percent by volume rock fragments. Structure is subangular or angular blocky and soil pH is neutral to slightly acid.

INDIAN CREEK FAMILY

The Indian Creek family consists of shallow, well drained soils that formed in material derived from basalt and tuff. Permeability is very slow. These soils are on 0 to 5 percent slopes and occur on basalt plateaus at 4300 to 5300 feet elevation. These soils are underlain by a cemented silica duripan. The mean annual air temperature is 44 to 49°F. The annual precipitation is 12 to 14 inches, most of which falls in winter as snow. The frost free season is 80 to 110 days.

Taxonomic Class: Clayey, montmorillonitic, mesic, shallow, Xerollic Durargids.

Reference Pedon: Indian Creek family cobbly clay loam on a nearly level basalt plateau at 5020 feet elevation under low sagebrush, phlox sp., scattered western juniper, bluebunch wheatgrass and cheatgrass rangeland. The soil was moist below 5 inches when described on 5/8/79. (Colors are for dry soil unless otherwise stated.)

A11-0 to 3 inches; brown (7.5YR 5/4) cobbly clay loam, dark brown (7.5YR 3/2) moist; weak to moderate medium platy structure which parts into weak to moderate very fine and fine granular; slightly hard, friable, sticky and plastic; few moderately thick clay films on ped faces; 20 percent cobbles extending from the surface into the profile and 10 to 15 percent gravel by volume; common very fine and fine, and few medium roots; few very fine pores; neutral (pH 6.8); clear smooth boundary.

A12–3 to 5 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 4/4) moist; moderate medium and coarse platy structure; hard, firm, sticky and plastic; few moderately thick clay films on ped faces; 10 percent gravel by volume; common very fine and fine, and few medium and coarse roots; few very fine pores; neutral (pH 6.6); clear smooth boundary.

B2t–5 to 11 inches; reddish brown (5YR 5/4) clay, brown (7.5YR 4/4) moist; strong medium and coarse platy structure; hard, very firm, very sticky and very plastic; common moderately thick clay films on ped faces; few to common very fine, fine, medium and coarse roots; few very fine pores; slightly acid (pH 6.4); abrupt smooth boundary.

Csim–11 to 60 inches; weakly to strongly cemented silica duripan composed of strong medium and coarse plates of 1 to 5 mm in thickness; few very fine and fine roots between the plates to the 17 inch depth; material becomes massive and strongly cemented, below 30 inches in depth.

Reference Pedon Location: Modoc County, California, about 200 feet west of road and about 1800 feet west and 2200 feet north of SE corner as Section 4, T44N., R11E., (#498).

Range in Characteristics: Depth to the silica duripan ranges from 10 to 20 inches. The silica duripan may be only a few millimeters to several feet thickness and underlain by basalt bedrock or volcanic tuff. The control section averages 35 to 60 percent clay. The mean annual soil temperature at the contact is about 47 to 52°F. and fluctuates by more then 9°F. during the year. The soil temperature at the duripan contact exceeds 41°F. from April 1 through December 1. The 4 to 12 inch soil moisture control section, or the duripan contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizon is 2 to 5 inches thick with dry color of 10YR 5/3, 5/4, 6/3; 7.5YR 5/4, 6/4 and moist color of 10YR 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/4. Texture is loam or clay loam and contains 25 to 50 percent surface gravel, cobbles and some stones. Structure is platy or subangular blocky and soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 5/3, 5/3; 7.5YR 4/4, 5/4, 5/6; 5YR 4/4, 5/4 and moist color of 10YR 4/3, 4/4; 7.5YR 3/4, 4/4; 5YR 3/4, 4/4. Texture is clay or clay loam and may contain up to 15 percent by volume coarse fragments. Structure is platy or angular blocky and soil pH is slightly acid to neutral.

The Csim horizon is platy to massive and strongly cemented or indurated and may have opal coated laminar plates cemented in a mosiac.

INVILLE FAMILY

The Inville family consists of deep and moderately deep, well drained soils formed from andesite, basalt, volcanic ash and geologically recent pyroclastic pumice. Permeability is rapid in the pumice overburden to moderate below. These soils are found on old alluvial fans, basalt plateaus and sideslopes of volcanic mountain uplands with 2 to 30 percent slopes. Elevations are 5300 to 6500 feet. Mean annual air temperature is 42 to 46°F. Annual precipitation is 20 to 40 inches which mostly falls during winter as snow. The frost free season is 70 to 100 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Ultic Haploxeralfs.

Reference Pedon: Inville family very gravelly loamy coarse sand on a nearly level alluvial fan at 5960 feet elevation under Jeffrey pine and ponderosa pine forest with a scattered bitterbrush understory. The soil was moist throughout when described on 5/20/80. (Colors are for dry soil unless otherwise stated.)

01–2 to 0 inches; Jeffrey and ponderosa pine needles, twigs and cones.

A1–0 to 2 inches; dark grayish brown (10YR 4/2) very gravelly loamy coarse sand, very dark brown (10YR 2/2) moist; single grained; loose, non-sticky and non-plastic; 40 percent pumice gravel by volume; many very fine and fine and common medium roots; slightly acid (pH 6.2); abrupt smooth boundary.

C1–2 to 6 inches; pale brown (10YR 6/3) very gravelly loamy coarse sand, brown (10YR 5/3) moist; single grained; loose, non-sticky and non-plastic; 40 percent pumice gravel by volume; common very fine and fine and common medium roots; neutral (pH 6.6); clear smooth boundary.

C2–6 to 12 inches; grayish brown (2.5YR 5/2) gravelly loamy fine sand, dark grayish brown (10YR 4.2) moist; massive; soft, very friable, non-sticky and non-plastic; 15 percent pumice gravel by volume; common very fine and fine and common to many medium and coarse roots; neutral (pH 6.7); abrupt smooth boundary.

IIIA1b–12 to 15 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark brown (7.5YR 4/4) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky and non-plastic; 50 percent gravel by volume; common very fine, fine, medium and coarse roots; slightly acid (pH 6.4); clear smooth boundary.

IIIB21tb–15 to 21 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak to moderate fine and medium subangular blocky structure which parts into weak fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; few to common thin clay films on ped faces; 55 percent gravel by volume mainly of the less than 0.4 inch size; common very fine, fine, medium and coarse roots; slightly acid (pH 6.2); gradual wavy boundary.

IIIB22tb–21 to 32 inches; yellowish brown (10YR 5/4) very gravelly loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and slightly plastic; few to common thin clay films on ped faces; 40 percent gravel by volume of less than 0.4 inch size; common very fine, fine and medium and few coarse roots; slightly acid (pH 6.4); gradual wavy boundary.

IIIB3tb–32 to 60 inches; light yellowish brown (10YR 6/4) very gravelly loam, brown (7.5YR 4/4) moist; moderate to strong medium subangular and angular blocky structure; hard, friable, sticky and slightly plastic; few thin clay films on ped faces; 55 percent gravel by volume; few to common very fine and fine and few coarse roots; slightly acid (pH 6.4).

Reference Pedon Location: Siskiyou County, California, about 300 feet east and 750 feet north of SW corner of Section 12, T.44N., R.3E.

Range in Characteristics: Depth to a lithic contact is greater than 40 inches. The control section averages 18 to 27 percent clay and also averages 35 to 70 percent by volume gravel, cobbles and some stones consisting of weathered cinders, andesite or basalt. Base saturation is estimated to be 60 to 75 percent, by sum of cations, in at least the upper parts of the argillic horizon. The mean annual soil temperature at a depth of 20 inches is 42 to 47°F. The 5 to 15 inch soil moisture control section is moist in all parts from about November 15 through May 30. It is dry in all parts from about August 1 through October 20 in most years. The soil temperature at the 20 inch depth exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years.

The Inville family soils in this survey area have an approximate 900 year old pumice and/or ash deposit of 8 to 20 inches in thickness. The pumice or ash deposit is always less than half the thickness of the combined A

and B horizons of the underlying soil. The pumice or ash overburden consists of an A-C horizon development. The A horizon is 2 to 6 inches thick and has dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3. Texture is loamy coarse sand or loamy sand and contains 25 to 50 percent by volume gravel mainly of the less than 0.4 inch size. It is single grained and soil pH is slightly acid to neutral. The C horizon has dry color of 10YR 5/3, 6/3, 6/4, 7/2, 7/3, 8/3; 2.5YR 5/2 and moist color of 10YR 4/2, 5/3, 6/3, 6/4, 7/3. Texture is loamy coarse sand, loamy fine sand or coarse sand and contains 15 to 90 percent by volume gravel mainly of the 0.2 to 1.0 inch size. It is single grained or massive and soil pH is neutral to slightly acid.

The soil underlying the pumice or ash overburden has an A-B horizon development.

The A horizon is 3 to 7 inches thick with dry color of 10YR 4/3, 4/4, 5/3, 5/4, 6/3; 7.5YR 5/4 and moist color of 10YR 3/4, 4/2, 4/3; 7.5YR 3/4. Texture is fine sandy loam or sandy loam and contains 15 to 60 percent by volume gravel, cobbles and stones. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon has dry color of 10YR 5/4, 6/3, 6/4; 7.5YR 5/4 and moist color of 10YR 3/4, 4/3, 4/4; 7.5YR 4/4. Texture is sandy loam, loam, or clay loam and contains 35 to 70 percent by volume rock fragments. Structure is subangular or angular blocky and soil pH is medium acid to neutral.

JACKET FAMILY

The Jacket family consists of deep and moderately deep, well drained soils derived from volcanic ash, basalt or tuff. Permeability is slow. These soils are on 1 to 50 percent slopes and occur on smooth sideslopes, along drainage ways and concave areas of mountain uplands at 4400 to 5800 feet elevation. The climate is cool with 44 to 48°F mean annual air temperature. Annual precipitation is 16 to 25 inches which mostly falls during the winter as snow. Forst free season is 80 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Pachic Ultic Argixerolls.

Reference Pedon: Jacket family loam, on a 8 percent northwest facing mountain sideslope at 4640 foot elevation under a ponderosa/Jeffrey pine forest with a few white fir and incense-cedar and an understory of greenleaf manzanita, bitterbrush, squawcarpet, Ross's sedge and grasses. Soil was dry throughout when described on 8/22/78. (Colors are for dry soil unless otherwise stated.)

01–2 to 0 inches; ponderosa and Jeffrey pine needles and twigs.

A11–0 to 2 inches; dark brown (7.5YR 4/4) loam, dark reddish brown (5YR 3/2) moist; moderate fine and very fine granular structure; slightly hard, friable, sticky and slightly plastic; 5 percent gravel by volume; common fine and very fine roots; slightly acid (pH 6.2); clear smooth boundary.

A12–2 to 9 inches; reddish brown (5YR 4/4) loam, dark reddish brown (5YR 3/3) moist; weak fine and medium platy structure parting to moderate fine subangular blocky; slightly hard, friable, sticky and plastic; 5 percent gravel by volume; common to many fine, very fine and medium roots; many fine and very fine pores; slightly acid (pH 6.4); clear wavy boundary.

B21t–9 to 14 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; 10 percent gravel by volume; common to many fine, very fine and medium roots; many fine, very fine and few medium roots; many fine, very fine and few medium pores; neutral (pH 6.6); gradual wavy boundary.

B22t–14 to 36 inches; reddish brown (5YR 4/4) light clay, dark reddish brown (5YR 3/3) moist; moderate medium and coarse prismatic structure parting to moderate and strong fine and medium angular and subangular blocky; hard firm, very sticky and plastic; many distinct clay films on ped faces; 10 to 15 percent gravel by volume; few coarse, common medium and many very fine roots; many fine, very fine and few medium pores; neutral (pH 6.6); gradual wavy boundary.

B3t–36 to 60 inches; yellowish red (5YR 4/6) gravelly clay loam, dark reddish brown (5YR 3/4) moist; moderate medium and coarse prismatic structure parting to moderate and strong angular and subangular blocky; hard, firm, sticky and plastic; many distinct clay films on ped faces; 30 percent gravel by volume; few medium and coarse and common fine and very fine roots; many fine and very fine pores; neutral (pH 6.6).

Reference Pedon Location: Modoc County, California, about 100 feet south of road and about 2000 feet west and 2100 feet north of SE corner of Section 20, T41N., R7E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches in soil map units 187, 188 and 189 and greater than 40 inches in map units 167 and 168. The control section averages 35 to 50 percent clay content and coarse fragments also average from 5 to 35 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 60 to 75 percent normally throughout the upper 30 inches of soil. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The A horizons are 8 to 16 inches thick with dry color of 10YR 4/2, 4/3, 5/2; 7.5YR 4/4, 5/2; 5YR 4/3, 4/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 2.5/2, 3/2, 3/3. Textures are loam or clay loam and rock fragments may make up to 30 percent by volume. Structure is granular, platy or subangular blocky and soil pH is slightly acid to neutral.

The B horizons make up the remaining soil and have

dry color of 7.5YR 4/2, 4/4, 4/6, 5/4; 5YR 4/3, 4/4, 4/6, 5/3, 5/4 and moist color of 10YR 3/3; 7.5YR 3/2, 4/4; 5YR 3/2, 3/3, 3/4, 4/3 or 4/4. The upper parts of the argillic B horizons have mollic colors and may include the whole soil depth. Texture is clay loam or clay and may contain up to 35 percent by volume coarse fragments. Structure is prismatic and, or blocky and soil pH is slightly acid to neutral.

JACKNIFE FAMILY

The Jacknife family consists of deep, well drained soils that formed in alluvial material derived from basalt and ash. Permeability is slow. These soils are on alluvial fans and undulating volcanic plateaus with slopes of 1 to 5 percent. Elevations range from 4400 to 5300 feet. Annual precipitation is 14 to 18 inches most of which falls during the winter as snow. The mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Pachic Argixerolls.

Reference Pedon: Jacknife family loam on a nearly level basalt plateau at 4700 foot elevation under big sagebrush, Idaho fescue and Junegrass with a few scattered ponderosa pine and western juniper. Soil was dry to 32 inches when described on 10/12/78. (Colors are for dry soil unless otherwise noted.)

A1–0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak and moderate medium and coarse platy structure parting to moderate fine and very fine granular; hard, friable, sticky and plastic; many very fine and fine, few medium roots; many very fine and fine, few medium tubular pores; slightly acid (pH 6.2); clear smooth boundary.

B1t–4 to 9 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium and coarse platy structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; few thin clay films on ped faces; many very fine and fine, few medium roots; many very fine and fine, few medium tubular pores; slightly acid (pH 6.4); clear wavy boundary.

1t–9 to 17 inches; brown (7.5YR 5/4) heavy silty clay loam, dark reddish brown (5YR 3/3) moist; moderate and strong medium and coarse prismatic structure parting to moderate and strong medium and coarse subangular blocky and angular blocky; very hard, friable, very sticky and plastic; common moderately thick clay films on ped faces; common very fine and fine, few medium roots; many very fine and fine, common medium tubular pores; slightly acid (pH 6.4); gradual wavy boundary.

B22t–17 to 32 inches; brown (7.5YR 4/4) silty clay, dark reddish brown (5YR 3/3) moist, moderate and strong medium and coarse prismatic structure parting to strong medium and coarse angular blocky and subangular blocky; very hard, firm, very sticky and very plastic; many moderately thick clay films on ped faces; few very fine, fine and medium roots; many very fine, common fine and medium pores; slightly acid (pH 6.4); gradual wavy boundary.

B23t–32 to 42 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 3/4) moist; moderate and strong medium and coarse prismatic structure parting to moderate and strong fine and medium subangular blocky and angular blocky; hard, friable, very sticky and plastic; many moderately thick clay films on ped faces; few very fine and fine roots; many very fine and fine pores; neutral (pH 6.6); clear wavy boundary.

IIC–42 to 60 inches; brown (7.5YR 5/4) 2 to 6 inch thick stratified lenses of loam, sandy loam and loamy sand, dark brown (7.5YR 4/4) moist; massive structure; hard to loose, friable to loose, sticky to nonsticky and slightly plastic to nonplastic; few very fine roots; few very fine and fine pores; neutral (pH 6.6).

Reference Pedon Location: Modoc County, California, about 1150 feet west and 600 feet north of SE corner of Section 4, T42N., R7E.

Range in Characteristics: Depth to a lithic contact is grater than 40 inches. The control section averages 35 to 50 percent clay content. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1 and exceeds 47°F. from April 15 through November 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 thorugh October 30.

The A horizons are 4 to 12 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2, 4/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 3/2, 3/3. Texture is loam or clay loam. Structure is platy or granular and soil pH is slightly acid to neutral.

The B horizons have dry color of 10YR 4/3, 5/3, 5/4; 7.5YR 4/2, 4/4 5/4; 5YR 4/3, 4/4, 5/3, 5/4 and moist color of 10YR 3/3, 3/4; 7.5YR 3/2, 3/4, 4/4; 5YR 3/3, 4/3, 4/4. The upper parts of the argillic B horizons

have mollic colors and may include the whole soil depth. Texture is clay loam, silty clay loam, clay or silty clay. Structure is prismatic, platy or blocky and soil pH is slightly acid to neutral.

The C horizons, if present, have dry color of 10YR 6/2, 6/3, 6/4; 7.5YR 5/4, 6/2, 6/4 and moist color of 10YR 4/4, 5/2, 5/3, 5/4; 7.5YR 4/4, 5/4. Texture is loamy sand, sandy loam, loam, or clay loam and may contain up to 40 percent by volume gravel. It is massive or has been deposited by stratified fluvial alluviation. Soil pH is neutral.

KEATING FAMILY

The Keating family consists of moderately deep, well drained soils that formed from material derived from basalt or volcanic tuff. Permeability is slow. These soils are on volcanic plateaus and mountain sideslopes of 1 to 60 percent slopes. Elevation ranges from 4400 to 6000 feet. Annual precipitation is 14 to 18 inches most of which falls during the winter as snow. Mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonimic Class: Fine, montmorillonitic, mesic, Typic Argixerolls.

Reference Pedon: Keating family, cobbly clay loam on a nearly level basalt plateau at 4560 feet elevation under big sagebrush, vetch and bunchgrass rangeland. Soil was moist below 6 inches when described on 6/5/79. (Colors are for dry soil unless otherwise stated.)

A1– 0 to 2 inches; dark grayish brown (10YR 4/2) cobbly clay loam, very dark grayish brown (10YR 3/2) moist; moderate to strong fine granular structure; hard, friable, sticky and plastic; 10 percent cobbles and 10 percent gravel by volume; many fine and very fine roots; neutral (pH 6.8); abrupt smooth boundary.

B1t–2 to 6 inches; brown (10YR 4/3) heavy clay loam, dark brown (7.5YR 3/2) moist; weak fine and medium subangular blocky structure parting to moderate to strong fine and medium granular; slightly hard, friable, sticky and plastic; few thin clay skins on ped faces; common fine, very fine and medium roots; common fine and very fine tubular pores; neutral (pH 6.8); clear smooth boundary.

B21t–6 to 14 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate to strong medium prismatic structure parting to strong medium and coarse angular blocky; very hard, firm, very sticky and plastic; common thin clay skins on ped faces; common fine and very fine roots; few very fine tubular pores; neutral (pH 7.0); clear smooth boundary.

B22t– 14 to 32 inches; brown (10YR 4/3) clay, dark yellowish brown (10YR 3/4) moist; moderate to strong medium angular and subangular blocky structure; common thin clay skins on ped faces; very hard, friable, very sticky and plastic; few fine and very fine roots; few very fine tubular pores; mildly alkaline (pH 7.4); abrupt smooth boundary.

R–32 plus inches; fractured hard basalt.

Reference Pedon Location: Modoc County, California, about 500 feet west and 2300 feet south of the NE corner of Section 16, T47N., R.8E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. In map units 155, 156, 157 and 180 the bedrock is predominately a soft volcanic tuff that can be dug with a spade. In the other map units it is mainly over hard fractured basalt bedrock. The clay content of the control section averages 35 to 60 percent and up to 35 percent by volume rock fragments may be found but they normally range from 0 to 5 percent. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1 and exceeds 47°F. from April 15 through November 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 through October 30.

The A horizon is 2 to 8 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3. Texture is loam to clay loam and rock fragments may range from 0 to 40 percent on the surface and 0 to 25 percent by volume in the A horizon itself. Structure is granular or subangular blocky and soil pH is neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/3, 4/4, 5/3, 5/4, 6/3; 7.5YR 4/4, 5/4 and moist color of 10YR 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/4. Mollic colors occupy the upper 8 to 20 inches of soil and normally includes the upper parts of the argillic B horizon. Texture is clay loam or clay. Structure is prismatic and angular or subangular blocky and soil pH is neutral to mildly alkaline.

KINZEL FAMILY

The Kinzel family consists of moderately deep, well drained soils formed from ash, cinders, andesite, basalt and geologically recent pumice. Permeability is moderately rapid to the paralithic contact. These soils are on 1 to 40 percent slopes and occur on hummocky areas, concave depressions and lower mountain sideslopes in the Medicine Lake Highlands at 6500 to 7600 feet elevation. The climate is cool with 36 to 40°F mean annual air temperature and 35 to 45 inches annual precipitation which mostly falls during winter as snow. The frost free season is 40 to 80 days.

Taxonomic Class: Medial-skeletal, Andic Cryumbrepts.

Reference Pedon: Kinzel family gravelly loamy sand on a nearly level concave area of the Medicine Lake Caldera at 6830 feet elevation under an open lodgepole pine and western white pine forest with an understory of rabbitbrush and a few grasses. The soil was dry in all parts when described on 10/9/79. (Colors are for dry soil unless otherwise states.)

Pumice and cinder gravel pavement on surface.

A11–0 to 2 inches; dark grayish brown (10YR 4/2) gravelly loamy sand, very dark brown (10YR 2/2) moist; single grained; loose, non-sticky and non-plastic; 20 percent pumice gravel by volume; many very fine, common fine and few medium roots; strongly acid (pH 5.5); clear wavy boundary.

A12-2 to 6 inches; dark grayish brown (10YR 4/2) gravelly loamy sand, very dark brown (10YR 2/2) moist; single grained; loose, non-sticky and non-plastic; 30 percent pumice and basalt gravel by volume; many very fine, common fine and few medium roots; strongly acid (pH 5.5); clear wavy boundary.

IIA13–6 to 10 inches; grayish brown (10YR 5/2) very cobbly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 35 percent cobbles and 32 percent gravel by weight; many very fine and common fine and medium roots; many very fine and fine pores; weakly smeary; medium acid (pH 6.0); clear wavy boundary.

IIB21–10 to 20 inches; yellowish brown (10YR 5/4) extremely stony sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 36 percent stones, 25 percent gravel and 14 percent cobbles by weight; common very fine and fine and few medium roots; many very fine and fine pores; weakly smeary, slightly acid (pH 6.5); gradual wavy boundary.

IIB22–20 to 30 inches; pale brown (10YR 6/3) extremely stony sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 36 percent cobbles, 32 percent stones and 21 percent gravel by weight; common very fine and fine, few medium roots; many very fine and fine pores; weakly smeary; slightly acid (pH 6.5); abrupt wavy boundary.

IICr–30 to 41 plus inches; light brownish gray (2.5Y 6/2) weakly cemented and compacted volcanic ash with 60 percent by volume andesite gravel and few cobbles, olive brown (2.5Y 4/4) moist; ash material textures to a sandy loam when rubbed; massive, very hard; firm; non-sticky and non-plastic; faint silica deposits desciminated throughout; very few fine and very fine roots.

Reference Pedon Location: Siskiyou County, California, about 200 feet west of road and about 1800 feet west and 800 feet south of the NE corner of Section 3, T.43N., R.3E.

Range in Characteristics: Depth to the root limiting paralithic contact is 20 to 40 inches. Rock fragments average 40 to 80 percent by volume in the control section. The mean annual soil temperature at 20 inches is 38 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 25 in most years. The mean summer soil temperature at 20 inches is less than 47°F. in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 20 through October 10 in most years. The bulk density of the soil fine earth fraction is between 0.80 and 1.00 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally throughout the upper 30 inches of soil.

The Kinzel family can have a pumice overburden of up to 12 inches thick composed of an approximately 900 year old pumice deposit. This deposit is always less than half the thickness of the underlying combined A & B horizons. The pumice overburden, if present, consists of an A, or an A-C horizon development in the deeper deposits. If present the pumice A horizon has dry color of 10YR 5/1, 5/2, 5/3, and moist color of 10YR 3/2, 3/3

and may be up to 6 inches thick. Texture is coarse loamy sand or coarse sandy loam and contains from 35 to 60 percent by volume pumice gravel. It is single grained and soil pH is moderately acid. The pumice overburden C horizon, if present, has dry color of 10 YR 7/2, 7/3, 8/3, 8/3 and moist color of 10YR 5/2, 6/2, 6/3, 7/2, 7/3. Texture is coarse loamy sand or coarse sand and contains from 50 to 90 percent by volume pumice gravel. It is single grained and soil pH is moderately acid.

The loam textured soil beneath the pumice overburden, if present, has an A-B-Cr horizon development.

The A horizon is 10 to 20 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is coarse sandy loam, sandy loam or loam and contains 20 to 50 percent coarse fragments by volume. Structure is single grained or granular and soil pH is strongly acid to medium acid.

The B horizon has dry color of 10YR 5/3, 5/4, 6/3, 6/4, 6/6; 7.5YR 6/4 and moist color of 10YR 3/4, 4/3, 4/4, 4/6; 7.5YR 3/4, 4/4. Texture is sandy loam or loam and contains 40 to 85 percent by volume rock fragments. Structure is subangular blocky and soil pH is medium acid to slightly acid.

The Cr horizon is normally compacted and weakly cemented with disseminated silica. It is massive and very hard and severely restricts root growth.

Additional Data: Lincoln Lab. Sample # S79Ca-093-10.

LAMONDI FAMILY

The Lamondi family consists of deep, well drained soils that formed from basalt, andesite or volcanic tuff. Permeability is moderate. These soils are on mountain sideslopes of 2 to 60 percent slope. They occur at elevations of 5500 to 7500 feet. The annual precipitation is 20 to 30 inches and mostly falls during the winter as snow. Mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Pachic Ultic Haploxerolls.

Reference Pedon: Lamondi family, gravelly loam on a 22 percent southwest facing mountain sideslope at 7280 feet elevation under a white fir forest with few forbes and grasses. Soil was dry in all parts when described on 10/19/70. (Colors are for dry soil unless otherwise noted.)

01–4 to 0 inches; black (10YR 2/1) litter of white fir needles and bark; few fine and medium roots; abrupt smooth boundary.

A11–0 to 9 inches; brown (7.5YR 4/4) gravelly loam, dark brown (7.5YR 3/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; 20 percent gravel by volume; many very fine, fine and medium and few coarse roots; many very fine and medium interstitial pores; slightly acid (pH 6.2); gradual smooth boundary.

A12–9 to 19 inches; brown (7.5YR 5/4) very gravelly loam, dark brown (7.5YR 3/2) moist; weak to moderate fine and medium granular structure; soft, very friable, nonsticky and nonplastic; 35 percent gravel by volume; many very fine, fine medium and coarse roots; many fine interstitial and common very fine tubular pores; slightly acid (pH 6.4); clear wavy boundary.

A13–19 to 26 inches; brown (7.5YR 5/4) very gravelly loam, dark reddish brown (5YR 3/3) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few thin clay films on ped faces; 40 percent gravel and 5 percent cobbles by volume; many medium and common very fine and fine roots; many very fine and fine tubular pores and many very fine interstitial pores; slightly acid (pH 6.4); gradual irregular boundaries.

B2–26 to 42 inches; brown (10YR 5/3) extremely gravelly loam, dark yellowish brown (10YR 3/4) moist; weak medium and coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; 60 percent gravel and 20 percent cobbles by volume; common very fine and fine pores; many very fine and fine interstitial pores; slightly acid (pH 6.2); gradual irregular boundary.

R–42 to 51 inches; gray (7.5YR 5/0) moderately weathered and fractured volcanic tuff; dark gray (7.5YR 3/0) moist; very few, very fine, fine and coarse roots; abrupt wavy boundary.

IIR–51 plus inches; reddish brown (2.5YR 4/4), moderately weathered and fractured lapilli tuff; dark reddish brown (2.5YR 3/4) moist; very few coarse roots.

Reference Pedon Location: Modoc County, California, about 500 feet west and 1050 feet south of the NE corner of Section 1, T44N., R.14E.

Range in Characteristics: Depth to bedrock is greater than 40 inches. The control section averages 12 to 24 percent clay content and coarse fragments also average 35 to 60 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 50 and 75 percent throughout the upper 30 inches of the soil. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizon is 24 to greater than 40 inches thick and commonly make up the whole soil depth with dry color of 10YR 4/2, 4/3, 5/3; 7.5YR 4/2. 4/4, 5/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2, 5YR 3/2, 3/3. Texture is loam or sandy loam and contains from 20 to 70 percent by volume gravel, cobbles and stones. Structure is granular to subangular blocky and soil pH is medium acid to slightly acid.

The B horizon, if present, has dry color of 10YR 5/3, 5/4; 7.5YR 5/4, and moist color of 10YR 3/4, 4/3, 4/4; 7.5YR 3/4, 4/4. Texture is sandy loam or loam and contains from 35 to 80 percent by volume gravel and cobbles and occasionally a few stones. Structure is subangular blocky and soil pH is medium acid to slightly acid.

LAPINE FAMILY

The Lapine family consists of deep and moderately deep, somewhat excessively drained soils formed from pyroclastic cinders and pumice over andesite, and basalt. Permeability is rapid. These soils are on 1 to 60 percent slopes and occur in the caldera and on sideslopes of volcanic mountain uplands in the Medicine Lake Highlands at 6500 to 7600 feet elevation. The climate is cool with 35 to 45 inches annual precipitation which mostly falls as snow during winter. Mean annual air temperature is 36 to 40°F. The frost free season is 40 to 80 days.

Taxonomic Class: Cindery, Typic Cryorthents.

Reference Pedon: Lapine family very gravelly coarse sand on a 40 percent northeast facing mountain sideslope at 7100 feet elevation under a mixed alpine conifer forest of red fir, western white pine, mountain hemlock and lodgepole pine. Soil was moist below 13 inches when described on 10/12/79. (Colors are for dry soil unless otherwise noted.)

01–1 to 0 inches; continuous duff mat of needles and twigs.

A1–0 to 2 inches grayish brown (10YR 5/2) very gravelly coarse sand, very dark grayish brown (10YR 3/2) moist; single grained; loose, non-sticky and non-plastic; 35 percent by volume pumice gravel mainly of the less than 0.4 inch size; many very fine and fine roots; medium acid (pH 5.6); abrupt smooth boundary.

C1–2 to 13 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand, very pale brown (10YR 7/3) moist; single grained; loose, non-sticky and non-plastic; 70 percent by volume pumice gravel mainly of the less than 3/4 inch size; many very fine, fine and common medium roots; medium acid (pH 5.6) clear wavy boundary.

C2–13 to 23 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand, very pale brown (10YR 7/3) moist; single grained; loose, non-sticky and non-plastic; 90 percent by volume pumice gravel mainly of the 0.2 to 1.0 inch size; many very fine, fine, common medium and few coarse roots; medium acid (pH 5.8); abrupt wavy boundary.

IIA1b–23 to 26 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; moderate fine granular structure; loose, non-sticky and non-plastic; 50 percent by volume weathered cinder gravel mainly of the less than 3/4 inch size, 5 percent by volume basalt cobbles; many very fine, fine, common medium and coarse roots; medium acid (pH 6.0); clear wavy boundary.

IIIC1–26 to 38 inches; brownish yellow (10YR 6/6) extremely stony sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, loose, non-sticky and non-plastic; 30 percent stones and 20 percent cobbles by volume of basalt and 35 percent by volume weathered cinder gravel mainly of the less than 3/4 inch size; many very fine, fine, common medium and coarse roots; common fine and medium tubular continuous pores; slightly acid (pH 6.2); clear wavy boundary.

IVC2–38 to 50 inches; brownish yellow (10YR 6/6) extremely gravelly sandy loam, dark yellowish brown (10YR 4/6) moist; massive; soft, loose, non-sticky and non-plastic; 65 percent by volume weathered cinder gravel mainly of the less than 3/4 inch size; many fine, very fine, common medium and few coarse roots; common fine and few medium tubular continuous pores; neutral (pH 6.6); clear wavy boundary.

IVC3–50 to 62 inches; brownish yellow (10YR 6/6) extremely gravelly loamy coarse sand, dark yellowish brown (10YR 4/6) moist; single grained; loose, non-sticky and non-plastic; 75 percent by volume cinder gravel mainly of the 0.2 to 1.2 inch size; few fine, very fine and medium roots; neutral (pH 6.6).

Reference Pedon Location: Siskiyou County, California, about 40 feet upslope of road and about 1650 feet east and 1700 feet north of the SW corner of Section 10, T.43N., R.4E.

Range in Characteristics: Depth to a lithic contact is greater than 30 inches. The mean annual soil temperature at 20 inches is about 38 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 15 through September 25 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 20 through October 10 in most years.

The Lapine family commonly has an approximate 900 year old pumice deposit of up to 24 inches thick. The pumice overburden, if present, consists of an A, or an A-C horizon development in the deeper deposits. If present, the pumice A horizon has dry color of 10YR

5/1, 5/2, 5/3, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3 and may be up to 4 inches thick. Texture is coarse sand or coarse loamy sand and contains from 35 to 60 percent by volume pumice gravel. It is single grained and soil pH is medium acid. The pumice overburden C horizon, if present, has dry color of 10YR 7/2, 7/3, 8/2, 8/3 and moist color of 10YR 5/2, 6/2, 6/3, 7/2 or 7/3. Texture is coarse loamy sand or coarse sand and contains from 50 to 90 percent by volume pumice gravel. It is single grained and soil pH is medium acid.

The more weathered cinder material beneath the recent pumice overburden, if present, has an A-C horizon development.

The A horizon is 2 to 5 inches thick with dry color of 10YR 5/3, 5/4; 7.5YR 5/4 and moist color of 10YR 3/3, 3/4, 3/6; 7.5YR 3/4. Texture is coarse sandy loam or sandy loam and contains from 30 to 60 percent by volume weathered cinder gravel. Structure is granular and soil pH is medium to slightly acid.

The C horizon has dry color of 10YR 6/3, 6/4, 6/6, 7/3, 7/4; 7.5YR 6/6 and moist color of 10YR 4/4, 4/6, 5/4, 5/6; 7.5YR 4/6, 5/4, 5/6. Texture is sandy loam, coarse sandy loam, loamy coarse sand or coarse sand and contains from 40 to 90 percent by volume cinder gravel. Some pedons contain gravel, cobble and stone size basalt rock fragments in the 10 to 40 inch control section which can range up to 35 percent by volume. It is massive or single grained and soil pH is medium acid to neutral.

Additional Data: Lincoln Lab. Sample # S79Ca-093-11.

LAWYER FAMILY

The Lawyer family consists of deep and moderately deep, well drained soils that formed in material weathered from volcanic ash and basalt. Permeability is moderately slow. These soils are on basalt plateaus and mountain sideslopes at elevations of 4300 to 6000 feet and have slopes ranging from 1 to 60 percent. The annual precipitation is 16 to 25 inches most of which falls during winter as snow. The mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Pachic Ultic Argixerolls.

Reference Pedon: Lawyer family stony loam - on a 7 percent southwest facing basalt plateau at 4400 feet elevation under a ponderosa pine, white fir and incense cedar forest with greenleaf manzanita, bitterbrush, mule ears, Ross's sedge and bunchgrass understory. Soil was dry throughout when described on 10/10/78. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches of ponderosa pine, white fir and incense-cedar needles and twigs.

A11–0 to 2 inches; brown (7.5YR 5/4) stony loam, dark reddish brown (5YR 3/2) moist; weak fine platy structure parting to weak fine granular; soft, very friable, slightly sticky, non-plastic; 5 to 10 percent surface stones and 15 percent gravel by volume; common very fine roots; common fine and very fine pores; medium acid (pH 6.0); abrupt smooth boundary.

A12–2 to 8 inches; brown (7.5YR 5/4) cobbly loam, dark reddish brown (5YR 3/3) moist; weak to moderate fine granular structure; soft, friable, slightly sticky, non-plastic; 20 percent gravel and 10 percent cobbles by volume; many very fine and fine and few medium roots; few fine, very fine and medium pores; slightly acid (pH 6.2); clear wavy boundary.

A13–8 to 21 inches; reddish brown (5YR 4/4) very cobbly loam, dark reddish brown (5YR 3/3) moist; weak fine subangular blocky parting to moderate fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; few thin clay films on ped faces; 25 percent cobbles and 20 percent gravel by volume; many very fine and fine, common medium, and few coarse roots; common fine, very fine and medium pores; medium acid (pH 6.0); clear wavy boundary.

B21t–21 to 35 inches; strong brown (7.5YR 4/6), very cobbly clay loam, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few to common thin clay films on ped faces; 30 percent cobbles and 25 percent gravel by volume; common very fine and fine and few medium roots; common, fine, very fine and medium pores; medium acid (pH 6.0); gradual wavy boundary.

B22t–35 to 50 inches; strong brown (7.5YR 5/6) extremely cobbly clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, slightly firm, sticky and slightly plastic; few to common thin clay films on ped faces; 35 percent cobbles and 30 percent gravel by volume; common very fine, fine and few medium roots; common fine, very fine and medium pores; medium acid (pH 6.0); abrupt wavy boundary.

Cr–50 to 60 inches; highly weathered soft vesicular basalt which can be cut with a spade.

Reference Pedon Location: Modoc County, California, about 50 feet west of road near Lava Camp and about 1600 feet west and 750 feet north of the SE corner of Section 12, T.41N., R.5E.

Range in Characteristics: Depth to bedrock is greater than 40 inches in map units 201, 202, and 203 and 20 to 40 inches in map units 152, 167, 168, 204, 205, 206 and both 20 to 40 and greater than 40 inches in map unit 200. The control section averages 24 to 35% clay content and rock fragments range from 35 to 60% by volume. Base saturation by the ammonium acetate method is estimated to be between 50 to 75 percent throughout the upper 30 inches of the soil. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The A horizon is 12 to 24 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/2; 7.5YR 4/2, 4/4, 5/4; 5YR 3/3, 3/4, 4/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 2.5/2, 3/2, 3/3. Texture is loam and may contain up to 50 percent by volume gravel, cobbles and some stones. Structure is granular or subangular blocky and soil pH is medium acid to neutral.

The B horizon makes up the remaining soil and have

dry color of 10YR 4/3, 4/4, 5/3, 5/6, 6/4; 7.5YR 4/2, 4/4, 4/5, 5/4, 5/6; 5YR 4/4, 5/4, 5/6, 6/4 and moist color of 10YR 3/3, 3/4, 4/4, 5/4; 7.5YR 3/2, 3/4, 4/2, 4/4; 5YR 3/2, 3/3, 3/4, 4/4 or 4/6. The upper part of the argillic B horizon has mollic color and may include the whole soil depth. Texture is loam or clay loam and contains from 35 to 70 percent by volume gravel, cobbles and stones. Structure is prismatic or subangular blocky and soil pH is medium acid to neutral.

LITHIC CRYOCHREPTS

Lithic Cryochrepts consists of shallow, well drained soils derived from hard volcanic tuff conglomerate, andesite or basalt at elevations of 7,300 to 8,000 feet. Permeability is slow. These soils are on mid to upper mountain sideslopes and ridgetops of 10 to 40 percent slope. The climate is cold with a mean annual air temperature of 36 to 40°F. The annual precipitation is 30 to 35 inches and mostly falls as snow in winter. The frost free season is 40 to 70 days.

Taxonomic Class: Lithic Cryochrepts.

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Lithic Cryochrepts extremely gravelly clay on a 13 percent west facing windswept mountain ridgetop at 7,350 feet elevation under stunted Phlox sp., vetch, club moss and Idaho fescue rangeland. Soil was dry throughout when described on 9/3/82. (Colors are for dry soil unless otherwise stated.)

A1–0 to 2 inches grayish brown (10YR 5/2) extremely gravelly clay, grayish brown (10YR 5/2) moist; moderate to strong fine angular and subangular blocky structure which parts to strong fine granular; hard, firm, very sticky and very plastic; 90 percent surface gravel and few cobbles which grade to 25 percent gravel by volume at 2 inch depth; many fine, very fine and common medium roots; common to many fine and very fine pores; neutral (pH 7.0); abrupt smooth boundary.

B21t–2 to 13 inches; brown (10YR 5/3) clay, brown (10YR 5/3) moist; strong medium and coarse prismatic structure which parts into strong fine and medium angular blocky structure; very hard; very firm, very sticky and very plastic; common thin clay skins on ped faces and pores; few to common fine and very fine and few medium roots; common fine and very fine pores; slightly acid (pH 6.4); clear smooth boundary.

B3t–13 to 16 inches; light olive brown (2.5Y 5/4) very gravelly clay, olive brown (2.5Y 4/4) moist; strong fine and medium angular blocky structure; very hard, very firm, very sticky and very plastic; common to many thin clay skins on ped faces and pores; 50 percent by volume moderately weathered basalt gravel; very few fine and very fine roots; common very fine pores; neutral (pH 6.6) abrupt smooth boundary.

R–16 plus inches; grayish brown (2.5Y 5/2) to light yellowish brown (2.5Y 6/4) slightly weathered hard fractured basalt bedrock.

Reference Pedon Location: Modoc County, California, about 2100 feet east and 2200 feet south of the NW corner of Section 33, T.44N., R.15E.

Range in Characteristics: Depth to bedrock is 6 to 20 inches. The mean annual soil temperature at the lithic contact is about 38 to 42°F. and the mean summer temperature at the contact is about 50 to 59°F. in most years. The soil temperature at the contact exceeds 41°F. from June 1 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 1 through June 15 and dry in all parts from August 10 through October 10. The clay content in the control section averages 25 to 60 percent and coarse fragments average 10 to 35 percent by volume.

The A horizon is 2 to 4 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 2.5Y 4/2, 5/2, 5/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/3, 5/2; 2.5Y 4/2. Texture is clay loam or clay and contains from 40 to 90 percent surface coarse fragments. Structure is blocky or granular and soil pH is slightly acid to neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 5/3, 5/4, 6/3, 6/4; 2.5Y 5/2, 5/4, 6/4 and moist color of 10YR 4/3, 4/4, 5/2, 5/3, 5/4; 2.5Y 4/2, 4/4, 5/4. Texture is clay loam or clay and normally contains from 5 to 60 percent by volume coarse fragments and increases with depth. The B horizon shows evidence of illuviated clay, however, the increase in absolute clay content is slight and never reaches a ratio of 1.2:1 from the above horizon. Structure is prismatic or blocky and soil pH is slightly acid to neutral.

LITHIC XERORTHENTS

The Lithic Xerorthents consists of somewhat excessively drained, very shallow and some shallow soils derived from volcanic tuff, basalt, or andesite at elevations of 4,200 to 8,000 feet. Permeability is moderate to rapid. These soils are on volcanic plateaus and sideslopes, ridges and knolls of mountain uplands. Slopes range from 1 to 100 percent. The annual precipitation ranges from 10 to 40 inches most of which falls during the winter as snow. The mean annual air temperature is 38 to 50°F. and the frost free season is 40 to 110 days.

Taxonomic Class: Lithic Xerorthents.

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Lithic Xerorthents very cobbly loam on a nearly level volcanic plateau at 4,450 feet elevation under an open and stunted low sagebrush and cheatgrass rangeland. Soil was dry in all parts when described on 8/22/78. (Colors are for dry soil unless otherwise stated.)

A11–0 to 1 inch; brown (10YR 5/3) very cobbly loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium platy structure which parts into weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; 40 percent by volume cobbles and gravel; few to common fine and very fine roots; many fine and medium vesicular pores; neutral (pH 6.8) abrupt smooth boundary.

A12–1 to 5 inches; yellowish brown (10YR 5/4) gravelly loam, brown (10YR 4/3) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; 15 percent by volume gravel; few to common fine and very fine roots; neutral (pH 6.6) abrupt smooth boundary.

R–5 plus inches; hard volcanic tuff conglomerate.

Reference Pedon Location: Modoc County, California, about 2,200 feet east and 1,700 feet north of the SW corner of Section 20, T.41N., R.7E.

Range in Characteristics: Depth to bedrock is normally 4 to 10 inches, except in soil map unit 209 where it is 10 to 20 inches deep and in map unit 263 where it is 6 to 20 inches deep. The mean annual soil temperature at the lithic contact is about 47 to 53°F. and exceeds 41°F. from about April 1 through December 1 in most years. The soil is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1. The average rock fragment content of the control section is 10 to 80 percent and the clay content averages 10 to 40 percent.

The A horizon normally occupies the whole soil depth and have dry color of 10YR 5/2, 5/3, 5/4, 6/2, 6/3, 6/4 and moist color of 10YR 3/4, 3/6, 4/2, 4/3, 4/4. Texture is sandy loam, loamy coarse sand, coarse sandy loam, loam or clay loam and contains from 10 to 80 percent by volume rock fragments. Structure is platy, granular or massive and soil pH is slightly acid to neutral.

The C horizon, if present, has dry color of 10YR 6/2, 6/3, 6/4, 7/3, 7/4; 2.5Y 6/4, 7/2, 7/4 and moist color of 10YR 5/3, 5/4, 5/6, 6/3, 6/4; 2.5Y 5/4, 5/6, 6/4. Texture is loamy coarse sand, coarse sandy loam, sandy loam, loam, clay loam or light clay and contains 5 to 80 percent by volume rock fragments predominately of the gravel and cobble size. It is massive and soil pH is slightly acid to neutral.

LITHIC XERUMBREPTS

The Lithic Xerumbrepts consists of shallow, well-drained soils that formed over hard basalt flow rock. Permeability is moderately rapid. These soils are on relatively recent basalt plateau lava flows at elevations of 4,300 to 5,000 feet and have slopes of 1 to 10 percent. The annual precipitation is 18 to 25 inches most of which falls during winter as snow. The mean annual air temperature is 46 to 48°F. The frost free season is 90 to 110 days.

Taxonomic Class: Lithic Xerumbrepts.

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Lithic Xerumbrepts very cobbly sandy loam on a nearly level relatively recent lava flow basalt plateau at 4,340 feet elevation under a sparce ponderosa pine forest with an understory of bitterbrush, rabbitbrush, greenleaf manzanita, currant sp., squaw carpet, bottlebrush and Idaho fescue. Soil was dry throughout when described on 8/27/82. (Colors are for dry soil unless otherwise stated).

01–1/2 to 0 inch; Ponderosa pine, greenleaf manzanita and bitterbrush needles, leaves and twigs.

A11–0 to 4 inches; brown (10YR 5/3) very cobbly sandy loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine and medium granular structure; soft, soft, slightly sticky and non-plastic; about 30 percent cobbles and 20 percent gravel by volume; many fine, very fine and few to common medium and coarse roots; medium acid (pH 6.0); clear wavy boundary.

A12–4 to 12 inches; yellowish brown (10YR 5/4) extremely cobbly sandy loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; soft, soft, slightly sticky and non-plastic; 55 percent cobbles and 15 percent gravel by volume; common fine, very fine and few to common medium and coarse roots; slightly acid (pH 6.2).

R–12 plus inches; hard fractured vesicular basalt flow rock.

Reference Pedon Location: Modoc County, California, about 50 feet south of road and about 2,000 feet south and 1,300 feet east of the NW corner of section 22, T.42N., R.5E.

Range in Characteristics: Depth to bedrock is 10 to 20 inches. The mean annual soil temperature at the lithic contact is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The 5 to 15 inch soil moisture control section or to the lithic contact, if shallower, is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30. Base saturation by the ammonium acetate method is estimated to be between 25 and 50 percent throughout the soil. The soil bulk density is estimated to be between 0.90 and 1.00 gm/cm^3 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25.

The A horizon makes up the whole soil depth with dry color of 10YR 4/3, 4/4, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2 or 3/3. Texture is sandy loam and rock fragments average 15 to 75 percent by volume in the control section. Structure is granular or subangular blocky and soil pH is medium acid to slightly acid.

LOBERG FAMILY

The Loberg family consists of moderately deep, well drained soils derived from volcanic tuff. Permeability is slow. These soils are on 30 to 60 percent slopes and occur on toeslopes and sideslopes of mountain uplands at 7000 to 8000 feet elevation. The climate is cool with 36 to 40°F mean annual air temperature and 25 to 35 inches annual precipitation which mostly falls during winter. The frost free season is 40 to 70 days.

Taxonomic Class: Clayey-skeletal, mixed, Typic Cryoboralfs.

Reference Pedon: Loberg family gravelly loam on a 35 percent north facing mountain sideslope at 7300 feet elevation under a lodgepole pine and western white pine forest with an understory of prostrate manzanita and few grasses. Soil was moist throughout when described on 10/8/80. (Colors are for dry soil unless otherwise stated.)

01–2 to 0 inches; Lodgepole pine and western white pine needles, twigs and leaf duff mat in a prostrate manzanita carpet.

A1–0 to 7 inches; brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure which parts into moderate fine and medium granules; slightly hard, friable, sticky and plastic; 30 percent gravel by volume; many very fine and fine and common medium and coarse roots; many very fine and fine and few medium pores; medium acid (pH 6.0); gradual wavy boundary.

A3–7 to 15 inches; light brown (7.5YR 6/4) very gravelly loam, strong brown (7.5YR 4/6) moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few thin clay films in pores; 35 percent gravel by volume; common very fine, fine, medium and coarse roots; many very fine and fine and few medium pores; medium acid (pH 5.8); clear smooth boundary.

B21t–15 to 20 inches; light brown (7.5YR 6/4) very gravelly clay loam, strong brown (7.5YR 4/6) moist; moderate fine and medium angular and subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on tubular pores and ped faces; 35 percent gravel by volume; common very fine, fine and medium and few coarse roots; common very fine and fine pores; medium acid (pH 5.8); clear smooth boundary.

B22t–20 to 37 inches; light brown (7.5YR 6/4) very gravelly clay loam, strong brown (7.5YR 4/6) moist; strong fine and medium angular blocky structure; very hard, firm, sticky and plastic; common thick clay films on ped faces; 40 percent gravel by volume; few to common very fine and fine and few medium and coarse roots; few to common very fine and fine pores; medium acid (pH 5.6); gradual wavy boundary.

Cr–37 plus inches; semi-hard weathered conglomerated tuff which can be rubbed to a clay or clay loam.

Reference Pedon Location: Modoc County, California, about 30 feet upslope from road and about 1000 feet south and 2100 feet west of the NE corner of Section 1, T.47N., R.15E.

Range in Characteristics: Depth to the para-lithic contact is 20 to 40 inches. The mean annual soil temperature at the 20 inch depth is about 38 to 42°F. The soil temperature at 20 inches exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10. Coarse fragment content of the control section averages 35 to 50 percent and clay content averages 35 to 45 percent.

The A horizon is 6 to 15 inches thick with dry color of 7.5YR 4/4, 4/6, 5/4, 5/6, 6/4; 10YR 5/4, 5/6, 6/2, 6/3, 6/4 and moist color of 7.5YR 3/4, 4/4, 4/6; 10YR 3/4, 4/2, 4/3, 4/4. Texture is loam or silty clay loam with 20 to 45 percent by volume gravel size coarse fragments. Structure is granular or subangular blocky and soil pH is medium acid to slightly acid.

The B horizon makes up the remainder of the soil with dry color of 7.5YR 5/6, 6/4, 6/6; 10YR 5/4, 5/6, 6/4, 6/6; 2.5YR 6/2, 6/4 and moist color of 7.5YR 4/4, 4/6, 5/4, 5/6; 10YR 4/4, 4/6; 2.5YR 4/4, 5/4, 5/6. Texture is clay loam, silty clay loam, clay or silty clay with 35 to 50 percent by volume predominately gravel size coarse fragments. Structure is angular or subangular blocky and soil pH is medium acid to strongly acid.

LOS GATOS FAMILY

The Los Gatos family consists of moderately deep, well drained soils derived from basalt and ash. Permeability is moderate. These soils are on basalt plateaus and mountain sideslopes on 1 to 30 percent slopes. Elevations range from 4300 to 5800 feet. The annual precipitation is 14 to 18 inches most of which falls during the winter as snow. Mean annual air temperature is 44 to 49°F. The frost free season is 80 to 110 days.

Taxonomic Class: Fine-loamy, mixed mesic, Typic Argixerolls.

Reference Pedon: Los Gatos family gravelly loam on a nearly level basalt plateau at 4300 feet elevation under big sagebrush, rabbitbrush and bunchgrass rangeland with few western juniper. Soil was moist below 7 inches when described on 5/15/79. (Colors are for dry soil unless otherwise stated.)

A11–0 to 7 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, non-sticky and non-plastic; 15 percent gravel by volume including weathered pumice; common fine, very fine and few medium roots; neutral (pH 6.8); clear smooth boundary.

A12-7 to 19 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure parting into weak to moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; 15 percent gravel by volume; common fine and very fine roots; common fine and very fine tubular pores; neutral (pH 7.0); clear smooth boundary.

B21t–19 to 28 inches; dark yellowish brown (10YR 4/4) clay loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few thin clay films on ped faces; 5 percent basalt gravel by volume; common very fine and few fine roots; common fine and very fine pores; neutral (pH 6.8); gradual wavy boundary.

B22t–28 to 36 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few to common thin clay films on ped faces; 5 to 10 percent basalt gravel by volume; few fine very fine roots; common fine and very fine tubular pores; neutral (pH 6.8); clear smooth boundary.

B3t–36 to 38 inches; brown (7.5YR 5/4) gravelly clay loam, dark brown (7.5YR 4/4) moist; moderate coarse subangular blocky structure; very hard, friable, sticky and plastic; common thin clay films on ped faces; 15 to 20 percent gravel of basalt by volume; few fine and very fine roots; neutral (pH 6.6).

R–38 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 1700 feet west and 2200 feet south of the NE corner of Section 36, T.45N., R.6E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. The clay content of the control section averages 20 to 35 percent and up to 35 percent by volume rock fragments may be found but they normally range from 5 to 15 percent. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1 and exceeds 47°F. from April 15 through November 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 through October 20.

The A horizon is 7 to 19 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3, 5/4; 7.5YR 4/2, 4/4, 5/2, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or sandy loam and coarse fragments may occupy up to 25 percent by volume. Structure is granular or subangular blocky and soil pH is neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/3, 4/4, 5/3, 5/4, 6/3, 6/4; 7.5YR 5/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/3, 4/4; 7.5YR 3/4, 4/2, 4/4. Mollic color occupies the upper 7 to 20 inches of soil and may include the upper parts of the argillic B horizon. Texture is loam or clay loam and rock fragments may make up to 45 percent by volume and generally increase with depth. Structure is subangular blocky and soil pH is neutral.

MANILA FAMILY

The Manila family consists of moderately deep, well drained soils formed from conglomerated volcanic tuff. Permeability is slow. These soils are on 10 to 50 percent slopes and occur on sideslopes, toeslopes and draws of mountain uplands at 5500 to 7000 feet elevation. The climate is cool with 42 to 46°F mean annual air temperature and 20 to 25 inches annual precipitation which mostly falls during winter as snow. The frost free season is 60 to 90 days.

Taxonomic Class: Fine, montmorillonitic, frigid, Typic Argixerolls.

Reference Pedon: Manila family cobbly clay loam on a 10 percent west facing mountain sideslope at 5800 feet elevation under big sagebrush, sedges, Idaho fescue and other bunchgrass rangeland with scattered western juniper. Soil was dry throughout when described on 9/8/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 4 inches; dark grayish brown (10YR 4/2) cobbly clay loam, very dark brown (10YR 2/2) moist; moderate fine platy structure which parts into strong medium granular; slightly hard, friable, sticky and plastic; 25 percent cobbles and gravel by volume; common very fine and fine and few medium roots; few to common very fine tubular pores; neutral (pH 6.6); clear smooth boundary.

B1t–4 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure which parts into strong medium granular; hard, firm, very sticky and plastic; few to common thin clay films on ped faces; common very fine, fine and medium roots; common to many very fine and fine pores; neutral (pH 6.6); clear smooth boundary.

B21t–8 to 13 inches; dark grayish brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; moderate to strong medium angular and subangular blocky structure; hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and pores; common very fine, fine and medium roots; common very fine pores; neutral (pH 6.6); clear smooth boundary.

B22t–13 to 19 inches; grayish brown (10YR 5/2) silty clay, brown (10YR 4/3) moist; strong medium prismatic structure which parts to strong fine and medium subangular blocky; very hard, firm, very sticky and very plastic; many thick clay films on ped faces; 5 percent gravel by volume; few very fine, fine and medium roots; few to common very fine pores; neutral (pH 6.8); clear wavy boundary.

B3t–19 to 27 inches; light olive borwn (2.5Y 5/4) gravelly silty clay, olive brown (2.5Y 4/4) moist; moderate to strong medium and coarse prismatic structure which parts to moderate to strong angular and subangular blocky; hard, firm, very sticky and plastic; common to many thick clay films on ped faces and pores; 30 percent weathered conglomerate tuff gravel by volume; few very fine, fine and coarse roots; few very fine and fine pores; neutral (pH 6.8); clear wavy boundary.

Cr–27 plus inches; light brownish gray (2.5Y 6/2) weathered conglomerated platy tuff with some soil between fractures; common thick clay films on fractured faces; few medium and fine roots between fractures.

Reference Pedon Location: Modoc County, California, about 20 feet east of road and about 1450 feet east and 400 feet north of the SW corner of Section 26, T.42N., R.14E.

Range in Characteristics: Depth to the conglomerated tuff contact is 20 to 40 inches. The mean annual soil temperature at the 20 inch depth is about 44 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The soil 4 to 12 inch soil moisture control section is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average coarse fragment content in the control section is 5 to 35 percent by volume and the clay content averages 35 to 50 percent.

The A horizon is 3 to 10 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3. Texture is loam or clay loam and may contain up to 30 percent by volume coarse fragments. Structure is platy, granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon makes up the remainder of the soil with

dry clor of 10YR 4/2, 4/3, 5/2, 5/3, 5/4, 6/2, 6/3; 2.5Y 5/2, 5/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 2.5Y 4/2, 4/4. Mollic color occupies the upper 7 to 20 inches of soil and normally includes the upper parts of the argillic B horizon. Texture is clay loam, silty clay or clay and may contain up to 40 percent by volume coarse fragments and increases in volume with depth. Structure is prismatic and/or angular or subangular blocky and soil pH is neutral.

MASCAMP FAMILY

The Mascamp family consists of shallow, well drained soils formed from material weathered from andesite, basalt or volcanic tuff. Permeability is moderate. These soils are on mountain sideslopes of 5 to 60 percent slope and at 5500 to 7500 feet elevation. The annual precipitation is 20 to 30 inches which mostly falls during the winter as snow. The mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Lithic Argixerolls.

Reference Pedon: Mascamp family very cobbly loam on a 35 percent west facing mountain sideslope at 6300 feet elevation under big sagebrush, bitterbrush, mountain mahogany, Idaho fescue and wheatgrass rangeland with a few scattered western juniper and ponderosa pine. Soil was moist to 6 inches when described on 11/4/81. (Colors are for dry soil unless otherwise noted.)

A1–0 to 6 inches; dark grayish brown (10YR 4/2) very cobbly loam, black (10YR 2/1) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 25 percent gravel and 25 percent cobbles by volume; many very fine and fine and common medium roots; neutral (pH 6.8); gradual wavy boundary.

B1t–6 to 12 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure which parts into moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; few thin clay films on ped faces and pores; 25 percent gravel and 10 percent cobbles by volume; many very fine and common fine and medium roots; few to common fine and medium tubular pores; neutral (pH 7.0); clear wavy boundary.

B2t–12 to 19 inches; brown (10YR 4/3) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few to common thin clay films on ped faces and pores; 35 percent gravel and 20 percent cobbles by volume; common fine and few to common medium roots; common fine and medium tubular pores; neutral (pH 7.0); abrupt wavy boundary.

R–19 plus inches; hard fractured vesicular basalt.

Reference Pedon Location: Lassen County, California, about 2200 feet east and 750 feet north of the SW corner of Section 3, T.38N., R.11E.

Range in Characteristics: Depth to a lithic contact of fractured basalt, andesite or volcanic tuff is 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average rock fragment content of the control section is 35 to 60 percent by volume, and also averages 20 to 35 percent clay.

The A horizon is 3 to 9 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3 and moist color of 10YR 2/1, 2/2, 3/2, 3/3. Texture is loam and contains from 10 to 50 percent by volume rock fragments. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/2, 4/4, 5/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2. Texture is loam or clay loam and rock fragments occupy 35 to 60 percent by volume. Structure is subangular blocky and soil pH is neutral.

MENZEL FAMILY

The Menzel family consists of deep, well drained soils formed from basalt, ash and geologically recent pyroclastic pumice. Permeability is rapid in the pumice overburden to moderately rapid below. These soils are on basalt plateaus or plateau scarp breaks with slopes of 1 to 40 percent and at 4200 to 4700 feet elevation. Annual precipitation is 16 to 20 inches which mostly falls during the winter as snow. Annual air temperature is 46 to 48°F. The frost free season is 90 to 110 days.

Taxonomic Class: Coarse-loamy, mixed, mesic, Andic Xerochrepts.

Reference Pedon: Menzel family gravelly coarse sand (pumice overburden) on a nearly level basalt capped plateau under an open ponderosa pine forest with an understory of bitterbrush, rabbitbrush and cheatgrass at 4200 feet elevation. When described on 10/16/79 the soil was dry below the 4 inch depth. (Colors are for dry soil unless otherwise noted).

01–1/2 to 0 inches; ponderosa pine needles and pumice gravel pavement.

A1–0 to 4 inches; grayish brown (10YR 5/2) gravelly coarse sand, very dark gray (10YR 3/1) moist; single grained; loose, nonsticky and nonplastic; 20 percent pumice gravel by volume; many very fine and fine, common medium roots; neutral (pH 6.6) clear smooth boundary.

C1–4 to 14 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand, very pale brown (10YR 7/3) moist; single grained; loose; nonsticky and nonplastic; 75 percent pumice gravel by volume; common very fine and fine and medium few coarse roots; neutral (pH 6.7); abrupt smooth boundary.

IIA1b–14 to 18 inches; yellowish brown (10YR 5/4) gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure which parts into weak to moderate fine granules; soft, very friable, nonsticky and nonplastic; 30 percent weathered cinder gravel by volume; common very fine and fine, medium and coarse roots; many very fine and fine, few medium pores; neutral (pH 6.8); gradual wavy boundary.

IIB21b–18 to 29 inches; yellowish brown (10YR 5/6) gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak to moderate medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; 30 percent weathered cinder gravel by volume; common very fine, fine medium and coarse roots; many very fine and fine, few medium pores; neutral (pH 6.8); gradual wavy boundary.

IIB22b–29 to 44 inches; brownish yellow (10YR 6/6) gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak to moderate medium and coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; 30 percent weathered cinder gravel by volume; few very fine, fine, medium and coarse roots; many fine and fine, common medium pores; slightly acid (pH 6.4); gradual wavy boundary.

IIB3b–44 to 60 inches; brownish yellow (10YR 6/6) very gravelly sandy loam, dark yellowish brown (10YR 3/6) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; 45 percent weathered cinder gravel by volume; common very fine and fine, few medium and coarse roots; common very fine and fine, few medium pores; slightly acid (pH 6.5).

Reference Pedon Location: Modoc County, California; about 450 feet south and 2200 feet west of NE corner of Section 22, T.44N., R.5E.

Range in Characteristics: Depth to a lithic contact of fractured basalt is greater than 40 inches. The mean annual soil temperature at a depth of 20 inches is about 48 to 52°F and fluctuates by more than 9°F during the year. The soil temperature at 20 inches exceeds 41°F from April 15 through November 30 and exceeds 47°F from May 1 through November 1 in most years. The soil between depths of 6 to 18 inches is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30. The weighted average content of coarse fragments in the control section is 25 to 35 percent by volume and consists of weathered cinder gravel. The bulk density of the soil fine earth fraction is estimated to be 0.50 to 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 throughout the upper 30 inches of soil.

The pumice overburden consists of an approximate 900 year old pumice deposit of 4 to 20 inches which overlies the loamier textured material. This pumice deposit is always less than half the thickness of the

combinded A and B horizons of the underlying soil. The pumice overburden consists of an A or an A-C horizon development in the deeper deposits. The A horizon is 3 to 5 inches thick and has dry color of 10YR 4/2, 4/3, 5/2 or 5/3 and moist color or 10YR 3/1, 3/2, 2/2 or 3/3. Texture is coarse sand or coarse loamy sand and contain 15 to 40 percent by volume pumice gravel mainly of the less than 0.6 inch size. The pumice overburden C horizon has dry color of 10YR 8/2, 8/3, 7/3 or 7/2 and moist color of 10YR 7/3, 7/2 or 6/3. Texture is coarse sand with 70 to 95 percent by volume pumice gravel mainly of the 0.2 to 1.0 inch size. It is single grained and the soil pH of the pumice overburden is slightly acid to neutral.

The loam textured soil beneath the pumice overburden has a A-B horizon development.

The A horizon is 2 to 6 inches thick and has dry color of 10YR 5/2, 5/3, 5/4, 5/6, 6/3 or 7.5YR 5/4 and moist color of 10YR 3/3, 3/4, 4/2, 4/4 or 7.5YR 3/4 or 4/4. Texture is fine sandy loam or sandy loam and contains 20 to 35 percent by volume cinder gravel. Structure is weak subangular blocky and weak to moderate granular. Soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 5/4, 5/6, 6/4, 6/6 or 7.5YR 5/4 and moist color of 10YR 3/4, 3/6, 4/4, 4/6 or 7.5YR 3/4 or 4/4. Texture is sandy loam or loam with 25 to 50 percent by volume cinder gravel which increases with depth. Structure is weak to moderate subangular blocky. Soil pH ranges from neutral to slightly acid.

Burried C horizon normally is not present.

Additional Data: Lincoln Laboratory, Pedon S79Ca-049-012.

MERKEL FAMILY

The Merkel family consists of moderately deep to deep, well drained soils that formed from basalt, andesite or tuff. Permeability is moderate. These soils are on mountain sideslopes with slopes ranging from 10 to 60 percent. Elevations range from 4800 to 7000 feet. The annual precipitation is 16 to 30 inches most of which falls during the winter as snow. Mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Typic Xerochrepts.

Reference Pedon: Merkel family very gravelly loam on a 15 percent west facing mountain sideslope at 6600 feet elevation under a white fir and ponderosa pine forest with a sparce understory of rabbitbrush, Ross's sedge, and bunchgrasses. The soil was dry below 4 inches when described on 8/30/79. (Colors are for dry soil unless otherwise noted.)

01–1 to 0 inches; white fir needles and twigs.

A11–0 to 4 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; weak fine and medium platy structure parting to moderate fine and medium granular; soft, very friable, slightly sticky and slightly plastic; 40 percent gravel by volume; many very fine and fine common medium roots; neutral (pH 6.8); gradual wavy boundary.

A12–4 to 11 inches; pale brown (10YR 6/3) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure parting to moderate fine and medium granular; soft, very friable, slightly sticky and slightly plastic; 50 percent gravel by volume; many very fine, fine and medium, few coarse roots; common fine pores; neutral (pH 6.8); clear wavy boundary.

B21–11 to 24 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; 40 percent cobbles and 35 percent gravel by volume; few very fine, fine and coarse and common medium roots; many fine and common medium pores; neutral (pH 6.6); clear wavy boundary.

R–32 plus inches; Hard ashy tuff impregnated with biotite crystals.

Reference Pedon Location: Modoc County, California, about 100 feet upslope of where road terminates and about 1800 feet west and 2400 feet south of NE corner of Section 15, T.39N., R.15E.

Range in Characteristics: Depth to tuff, andesite or basalt is greater than 30 inches. The control section averages 16 to 24 percent clay and coarse fragments average from 35 to 70 percent by volume. The mean annual soil temperature at the 20 inch depth is 42 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizon is 6 to 12 inches thick with dry color of 10YR 5/3, 5/4, 6/2, 6/3, 6/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4. Texture is loam or sandy loam and normally contains from 15 to 40 percent by volume coarse fragments. Structure is platy, granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizon normally makes up the remainder of the soil with dry color of 10YR 5/3, 5/4, 5/6, 6/2, 6/3, 6/4; 2.5Y 6/2, 6/3 and moist color of 10YR 4/2, 4/3, 4/4, 5/2, 5/3; 2.5Y 4/2, 4/4. Texture is loam and contains from 35 to 70 percent by volume coarse fragments. Structure is subangular blocky and soil pH is neutral to slightly acid.

MERLIN FAMILY

The Merlin family consists of shallow, well drained soils formed from conglomerated tuff or fractured basalt. Permeability is slow. These soils are on 1 to 70 percent slopes and occur on basalt plateaus, middle to upper sideslopes, knolls, ridges and along eroded drainageways of mountain uplands at 5400 to 7200 feet elevation. The annual precipitation is 20 to 30 inches which falls mostly during the winter as snow. The mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Clayey, montmorillonitic, frigid, Lithic Argixerolls.

Reference Pedon: Merlin family very cobbly clay loam on a 16 percent west facing mountain sideslope at 5800 feet elevation under western juniper, low sagebrush, western yarrow and Idaho fescue rangeland. Soil was dry throughout when described on 9/10/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 2 inches; grayish brown (10YR 5/2) very cobbly clay loam, very dark grayish brown (10YR 3/2) moist; moderate to strong medium and coarse granular structure; slightly hard, friable, sticky and slightly plastic; 25 percent gravel and 20 percent basalt cobbles by volume; many very fine and fine, common medium roots; slightly acid (pH 6.4); clear smooth boundary.

B2t–2 to 9 inches; grayish brown (10YR 5/2) gravelly clay, dark brown (10YR 3/3) moist; strong fine and medium angular blocky structure; very hard, firm, very sticky and plastic; common moderately thick clay films on ped faces and pores; 25 percent basalt gravel by volume; common very fine, fine and medium and few coarse roots; neutral (pH 6.6); clear smooth boundary.

B3t–9 to 12 inches; grayish brown (10YR 5/2) gravelly clay, dark grayish brown (10YR 4/2) moist; strong fine and medium angular blocky structure; very hard, firm, very sticky and very plastic; common to many moderately thick clay films on ped faces and pores; 25 percent basalt and conglomerated tuff gravel by volume; few very fine, fine, medium and coarse roots, neutral (pH 6.6); abrupt smooth boundary.

R–12 plus inches; light gray (2.5YR 7/2) hard conglomerated tuff; thick clay skins on fracture faces; few fine roots between fractures.

Reference Pedon Location: Modoc County, California, about 50 feet east of road and about 1650 feet east and 1000 feet south of the NW corner of Section 30, T.42N., R.15E.

Range of Characteristics: Depth to a lithic contact of fractured basalt or volcanic tuff is 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average rock fragment content of the control section is 5 to 35 percent by volume, and also averages 35 to 50 percent clay.

The A horizon is 2 to 5 inches thick with dry color of 10YR 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3. Texture is loam or clay loam. Surface rock fragments normally occupy 15 to 50 percent and consists of cobbles, gravel and some stone size. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 5/2, 5/3, 5/4, 6/3, 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3. Mollic color occupies at least the upper 7 inches of soil and may include the whole soil depth. Texture is clay loam or clay. Structure is angular or subangular blocky and soil pH is neutral to slightly acid.

NEER FAMILY

The Neer family consists of moderately deep and deep, well drained soils formed in material weathered from volcanic ash material and geologically recent pyrolastic pumice. Permeability is rapid in the pumice overburden to moderately rapid below. These soils are found on basalt plateaus and on volcanic mountain uplands with 10 to 30 percent slopes at 4400 to 5300 feet elevation. The annual precipitation is 16 to 25 inches, most of which falls during winter as snow. The mean annual air temperature is 45 to 49°F. The frost free season is 90 to 110 days.

Taxonomic Class: Medial-skeletal, mesic, Andic Xerochrepts.

Reference Pedon: Neer family gravelly loamy coarse sand on a 10 percent east facing slope on a basalt plateau at 4520 feet elevation under a ponderosa pine forest with an understory of bitterbrush and rabbitbrush. Soil was dry throughout when described on 10/16/71. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; Ponderosa pine needles and twigs, mixed with pumice gravels.

A1–0 to 5 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand very dark grayish brown (10YR 3/2) moist; single grained; loose, non-sticky and non-plastic; 30 percent pumice gravel by volume; common fine and very fine and few to common medium and coarse roots; neutral (pH 6.6); clear smooth boundary.

C1–5 to 18 inches; very pale brown (10YR 8/3) extremely gravelly coarse sand, very pale brown (10YR 7/3) moist; single grained; loose, non-sticky and non-plastic; 70 percent pumice gravel; few to common fine and very fine and few medium and coarse roots; neutral (pH 6.8); abrupt smooth boundary.

IIA1b–18 to 22 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium granular structure; slightly hard, very friable, non-sticky and non-plastic; 30 percent gravel and 10 percent cobbles of mixed weathered cinders, basalt and obsidian by volume; common very fine and fine and few medium and coarse roots; common very fine and fine tubular pores; neutral (pH 6.8); clear smooth boundary.

IIB21b–22 to 28 inches; yellowish brown (10YR 5/4) very cobbly sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 40 to 50 percent basalt and obsidian cobbles and gravel by volume; common very fine and fine and few medium roots; common to many very fine and fine tubular pores; neutral (pH 6.8); gradual wavy boundary.

IIB22b–28 to 38 inches; light yellowish brown (10YR 6/4) extremely cobbly coarse sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and non-plastic; 60 percent basalt and obsidian cobbles and gravel by volume; few to common very fine, fine and medium roots; neutral (pH 6.6); clear wavy boundary.

IIB3b–38 to 60 inches; light yellowish brown (10YR 6/4) extremely cobbly coarse sandy loam, dark yellowish brown (10YR 4/6) moist; weak medium and coarse subangular blocky structure; soft, very friable, nonsticky and non-plastic; 70 to 80 percent basalt and obsidian cobbles, gravel and few stones by volume; few fine, very fine and medium roots; neutral (pH 6.6).

Reference Pedon Location: Modoc County, California, about 1800 feet west and 1400 feet south of the NE corner of Section 20, T.44N., R.5E.

Range in Characteristics: Depth to a lithic contact is greater than 30 inches. Rock fragments in the control section average 35 to 70 percent by volume and are predominately basalt, obsidian and weathered cinder cobbles and gravel. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F from May 1 through November 1 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The Neer family in this survey has an approximate 900 year old pumice deposit of 10 to 20 inches in depth. This pumice deposit is always less than half the thickness of the underlying combined A and B horizons. The pumice overburden consists of an A-C horizon development.

The pumice A horizon is 4 to 6 inches thick with dry color of 10YR 5/2, 5/3, 5/4, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2. Texture is coarse loamy sand or coarse sandy loam and contains from 30 to 50 percent by volume pumice gravel mainly of the less than 0.6 inch size. It is single grained and soil pH is slightly acid to neutral. The pumice C horizon has dry color of 10YR 7/2, 7/3, 8/2, 8/3 and moist color of 10YR 6/2, 6/3, 7/2 or 7/3. Texture is coarse loamy sand or coarse sand and contains from 60 to 90 percent by volume pumice gravel mainly of the 0.2 to 1.0 inch size. It is single grained and soil pH is neutral to slightly acid.

The loamy textured soil beneath the pumice overburden has an A-B horizon development.

The A horizon is 3 to 8 inches thick with dry color of 10YR 5/3, 5/4, 5/6, 6/2, 6/3 and moist color of 10YR 3/4, 3/6, 4/2, 4/3, 4/4. Texture is sandy loam or loam and contains from 20 to 50 percent by volume weathered cinders and gravel and cobble size basalt and obsidian. Structure is granular and soil pH is slightly acid to neutral.

The B horizon has dry color of 10YR 5/4, 6/3, 6/4, 6/6 and moist color of 10YR 4/2, 4/3, 4/4, 4/6, 5/3, 5/4. Texture is sandy loam, loam, coarse sandy loam, or coarse loamy sand and contains from 35 to 80 percent by volume rock fragments. Structure is subangular blocky or massive and soil pH is slightly acid to neutral.

PACKWOOD FAMILY

The Packwood family consists of shallow, well drained soils that formed in material derived from volcanic ash or basalt. These soils overlay a strongly cemented to indurated silica duripan at 7 to 20 inch depth. Permeability is slow. These soils are on 1 to 10 percent slopes and occur on slightly concave areas as well as intermound areas between 10 to 30 foot diameter mounds on basalt plateaus at 4400 to 5800 feet elevation. Annual precipitation is 12 to 18 inches most of which falls during winter as snow. Mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy, mixed, mesic, shallow, Xerollic Durargids.

Reference Pedon: Packwood family very stony loam on a nearly level basalt plateau under rangeland. (Colors are for dry soil unless otherwise stated.)

A11–0 to 2 inches; light yellowish brown (10YR 6/4) very stony loam, brown (7.5YR 4/4) moist; weak medium and thick platy structure; slightly hard, very friable, slightly sticky, slightly plastic; few very fine roots; common very fine interstitial, few very fine tubular, and common very fine and fine vesicular pores; 20 percent basalt stones by volume and 20 percent cobbles and gravel on surface; slightly acid (pH 6.5); clear smooth boundary.

A12–2 to 5 inches; light yellowish brown (10YR 6/4) loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; few very fine roots; common very fine interstitial and few very fine tubular pores; few thin clay films as bridges of mineral grains; slightly acid (pH 6.2); clear smooth boundary.

B2t–5 to 8 inches; dark brown (7.5YR 4/4) light clay loam, dark reddish brown (5YR 3/4) moist; weak medium and coarse subangular blocky structure; hard, very friable, sticky and plastic; few very fine roots; few very fine tubular and interstitial pores; common moderately thick clay films on peds and in pores; neutral (pH 7.0); abrupt smooth boundary.

C1sim–8 to 11 inches; yellow (10YR 7/6) silica duripan, yellowish brown (7.5YR 5/6) moist; strong medium and thick platy structure with 0.5 mm thick laminar silica and clay plates, reddish yellow (5YR 6/8) and yellowish red (5YR 4/8) moist; very hard; few very fine horizontal roots on plate surfaces; strongly cemented; abrupt smooth boundary.

C2sicam–11 to 16 inches; brown (10YR 5/3) silica duripan, dark yellowish brown (10YR 4/4) moist; massive parting to weak medium and thick plates; very hard, strongly cemented; slightly effervescent with fine irregular line in seams; abrupt smooth boundary.

R–16 plus inches; dark gray (N 4/) hard, fractured basalt.

Reference Pedon Location: Modoc County, California; about 11.4 miles north of Modoc National Forest Boundary on Crowder Flat Road or 2000 feet north from Whitemore Springs Road and 100 feet west of Crowder Flat Road in the NE 1/4 of NW 1/4, Section 16, T.44N., R.11E. (State model)

Range in Characteristics: Depth to the silica duripan ranges from 7 to 20 inches. The silica duripan is generally only a few millimeters to a foot in thickness and is underlain by basalt or volcanic tuff. The control section averages 25 to 35 percent clay. The mean annual soil temperature at the silica duripan contact is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact exceeds 41°F. from April 1 through December 1 in most years. The soils 4 to 12 inch moisture control section, or to the contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizons are 2 to 6 inches thick with dry color of 10YR 5/4, 6/2, 6/3, 6/4; 7.5YR 5/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4; 7.5YR 3/4, 4/2, 4/4; 5YR 3/4. Texture is loam or fine sandy loam and normally contains from 20 to 60 percent surface cobble, stone and gravel size rock fragments. Structure is platy, granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizons have dry color of 10YR 5/3, 5/4, 5/6, 6/3, 6/4; 7.5YR 4/4, 4/6, 5/4, 5/6; 5YR 4/4, 5/3, 5/4 and moist color of 10YR 3/4, 4/3, 4/4, 5/4; 7.5YR 3/4, 4/4, 4/6; 5YR 3/4, 4/3, 4/4. Texture is clay loam or clay and normally contains 0 to 10 percent by volume rock fragments. Structure is subangular and angular blocky and soil pH is neutral to slightly acid.

The Csim horizons are massive or platy and are strongly cemented or indurated.

Additional Data: Riverside Laboratory, Pedon No. S73 Ca-25-1.

PASS CANYON FAMILY

The Pass Canyon family consists of shallow, well drained soils that formed from basalt, andesite or volcanic tuff. Permeability is moderately slow. The soils are on 1 to 70 percent slopes and occur on basalt plateaus and sideslopes, ridges and knolls of mountain uplands at 4300 to 6000 feet elevation. Annual precipitation is 10 to 20 inches, and mostly falls as snow during winter. The mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy, mixed, mesic, Lithic Argixerolls.

Reference Pedon: Pass Canyon family very cobbly loam on a 7 percent west facing sideslope on an undulating basalt plateau at 4980 foot elevation under western juniper, low sagebrush, and bunchgrass rangeland. Soil was moist throughout when described on 4/16/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 2 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark brown (10YR 2/2) moist; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 35 percent cobbles and stones and 20 percent gravel by volume, many very fine and fine, and few to common medium roots; neutral (pH 6.8); clear smooth boundary.

A12-2 to 4 inches; dark grayish brown (10YR 4/3) loam, dark brown (7.5YR 3/2) moist; weak to moderate fine and medium platy structure which parts into moderate fine granular; hard, friable, sticky and plastic; 5 to 10 percent basalt cobbles and 5 percent gravel by volume; common to many very fine and fine and common medium and coarse roots; common to many very fine and fine tubular continuous pores; neutral (pH 6.6); gradual wavy boundary.

B21t–4 to 9 inches; brown (7.5YR 4/4) clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few thin clay films on ped faces; 10 percent basalt cobbles and less than 5 percent gravel by volume; common very fine, fine, medium and coarse roots; many very fine and fine and common medium tubular continuous pores; neutral (pH 6.6); clear wavy boundary.

B22t–9 to 12 inches; brown (7.5YR 4/4) cobbly clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular and angular blocky structure; hard, friable, very sticky and plastic; few to common thick clay films on ped faces and pores; 25 percent basalt cobbles and gravel by volume; common very fine, fine medium and coarse roots; common very fine and fine, few medium tubular continuous pores; neutral (pH 6.6); abrupt wavy boundary.

R–12 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 100 feet north of road and about 950 feet west and 2400 feet north of the SE corner of Section 12, T.46N., R.9E.

Range in Characteristics: Depth to a lithic contact of basalt, andesite or volcanic tuff is 8 to 20 inches. In some areas where Pass Canyon has been mapped, notably in the south central portion of the survey area, much of it is over a softer type volcanic tuff which may be cut with a shovel. Clay content in the control section averages 22 to 35 percent and coarse fragments may occupy up to 35 percent by volume. The mean annual soil temperature at the lithic contact is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the contact is greater than 41°F. from April 1 through December 1. Where this soil is mapped with map units 153, 221, 229, and 243 the 4 to 12 inch soil moisture control section, or to the lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped in other map units the soil moisture control section is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1.

The A horizons are 2 to 5 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4; 7.5YR 4/4, 5/2, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam and normally contains 15 to 60 percent cobble, stone and gravel size surface rock fragments. Structure is granular of platy and soil pH is neutral to slightly acid.

The B horizons have dry color of 10YR 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4, 5/4; 5YR 4/3, 4/4, 5/3 and moist color of 10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/3. The upper 7 inches of soil have mollic color and commonly includes the whole soil depth. Texture is loam or clay loam and contains up to 35 percent coarse fragments in some pedons. Structure is angular or subangular blocky and soil pH is neutral to slightly acid.

PATIO FAMILY

The Patio family consists of moderately deep and deep, well drained soils that formed in material derived from basalt and andesite. Permeability is moderate. These soils are on mountain sideslopes of 15 to 80 percent slopes. Elevation ranges from 4800 to 7200 feet. The annual precipitation is 16 to 30 inches, most of which falls during the winter as snow. The mean annual air temperature is 40 to 46°F. Frost-free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Ultic Haploxerolls.

Reference Pedon: Patio family very gravelly loam on a 50 percent northwest facing mountain sideslope at 6770 foot elevation under a white fir forest with a sparce understory of current sp. and bunchgrass. Soil was moist below 24 inches when described on 8/30/79. (Colors are for dry soil unless otherwise noted.)

01–1 to 0 inches; white fir needles and twigs.

A11–0 to 9 inches; yellowish brown (10YR 5/4) very gravelly loam, dark brown (10YR 3/3) moist; moderate fine and very fine granular structure; slightly hard, friable, slightly sticky and non-plastic; 45 percent basalt gravel by volume; many very fine, fine and medium and common coarse roots; neutral (pH 6.8); gradual wavy boundary.

A12–9 to 18 inches; yellowish brown (10YR 5/4) very gravelly loam, dark brown (10YR 3/3) moist; moderate fine and very fine granular structure; slightly hard, friable, slightly sticky and non-plastic; 50 percent gravel and 5 percent cobbles of basalt by volume; many fine, very fine, medium and coarse roots; slightly acid (pH 6.2); gradual wavy boundary.

B21–18 to 33 inches; pale brown (10YR 6/3) extremely gravelly loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure parting to weak to moderate fine and very fine granular; slightly hard, friable, slightly sticky and non-plastic; 60 percent gravel and 15 percent cobbles of basalt by volume; many fine, very fine and common medium and coarse roots; medium acid (pH 6.0); gradual wavy boundary.

B22–33 to 60 inches; light yellowish brown (10YR 6/4) extremely cobbly loam, brown (10YR 4/3) moist; weak to moderate medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; 40 percent cobbles and stones and 40 percent gravel of basalt by volume; many fine, very fine and common medium and coarse roots; medium acid (pH 5.8).

Reference Pedon Location: Modoc County, California; about 40 feet upslope from road and about 1000 feet west and 1600 feet north of the SE corner of Section 22, T.39N., R.15E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches in soil map units 114 and 233, and is greater than 40 inches in other map units. The control section averages 14 to 24 percent clay and coarse fragments average 35 to 75 percent by volume. Base saturation by the ammonium acetate method is estimated to be between 50 and 75 percent normally throughout the whole soil depth. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizons are 7 to 20 inches thick with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4, 5/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2; 5YR 3/2, 3/3. Texture is loam or sandy loam and contains from 20 to 60 percent by volume coarse fragments mainly of the gravel size. Structure is granular or subangular blocky and soil pH is neutral to medium acid.

The B horizons make up the remainder of the soil with dry color of 10YR 5/3, 5/4, 6/2, 6/3, 6/4; 7.5YR 5/4, 6/2, 6/4; 5YR 5/3, 5/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4; 7.5YR 3/4, 4/4, 4/6; 5YR 3/4, 4/3, 4/4. Texture is loam or sandy loam and contains from 35 to 80 percent by volume rock fragments mainly of the gravel and cobble size with few stones. Structure is subangular blocky and soil pH is slightly acid to medium acid.

PULS FAMILY

The Puls family consists of shallow, well drained soils that have formed in material derived from volcanic ash or basalt. These soils overlie a silica duripan at a depth of 10 to 20 inches. Permeability is very slow. Puls soils are on basalt plateaus of 0 to 10 percent slopes at elevations of 4300 to 5800 feet. Annual precipitation is 12 to 16 inches most of which falls in winter as snow. Mean annual air temperature is 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Clayey, montmorillonitic, mesic, shallow, Abruptic Xerollic Duragids.

Reference Pedon: Puls family very stony clay loam on a nearly level basalt plateau at 5100 foot elevation under low sagebrush, sedges, cheatgrass and other bunchgrass rangeland. (Colors are for dry soil unless otherwise stated.)

A1–0 to 5 inches; pinkish gray (7.5YR 6/2) very stony clay loam, brown (7.5YR 4/2) moist; weak coarse granular structure; slightly hard, friable, sticky and plastic; common very fine roots; common very fine interstitial pores and very few very fine tubular pores; 15 percent stones and 20 percent cobbles, by volume, on the surface; slightly acid (pH 6.3); clear smooth boundary.

B1–5 to 9 inches; reddish brown (5YR 5/3) clay loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; common very fine interstitial pores and few very fine tubular pores; 5 percent gravel and cobbles, by volume; slightly acid (pH 6.3); abrupt smooth boundary.

B2t–9 to 19 inches; dark reddish brown (5YR 3/3) clay, dark reddish brown (5YR 3/3) moist; strong coarse prismatic structure; very hard, extremely firm, sticky and very plastic; lower 1 inch is weakly cemented; roots on peds; few very fine interstitial and few very fine tubular pores; continuous thick clay films on peds and in pores; slightly acid (pH 6.3); clear smooth boundary.

C1sim–19 to 24 inches; reddish yellow (7.5YR 7/6) indurated silica- cemented duripan that has common medium distinct very dark gray (N 3/0) manganese mottles; massive; slightly acid (pH 6.3); abrupt smooth boundary.

C2sim–24 to 28 inches; reddish brown (5YR 4/4) indurated silica-cemented duripan that has common medium distinct very dark gray (N 3/0) manganese mottles; 10 percent rounded obsidian gravel, by volume.

R–28 inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 100 feet east of the center of old U.S. Highway 395, 0.24 miles northeast from the junction with a dirt road that leads south to willow Ranch NE1/4NE1/4, Seciton 3, T.46N., R.14E.

Range in Characteristics: Depth to the silica duripan is 10 to 20 inches. Generally the duripan is only a few millimeters to two feet in thickness over hard fractured basalt. Clay content in the control section averages 40 to 60 percent. The mean annual soil temperature at the contact is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the duripan contact exceeds 41°F. from April 1 through December 1 in most years. The 4 to 12 inch soil moisture control section, or to the duripan contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizons are 2 to 5 inches thick with dry color of 10YR 5/4, 6/2, 6/3; 7.5YR 5/4, 6/4, 6/2 and moist color of 10YR 3/4, 4/3, 4/4; 7.5YR 3/4, 4/4, 4/2. Texture is loam or light clay loam and normally contains from 25 to 60 percent surface rock fragments of cobbles, gravel and stones. Structure is platy, granular or subangular blocky and soil pH is medium acid to neutral.

The B horizons have dry color of 10YR 5/4, 5/6, 6/6; 7.5YR 4/4, 5/4, 5/6, 6/6; 5YR 3/3, 3/4, 5/3 and moist color of 10YR 4/4, 4/6; 7.5YR 3/4, 4/4, 4/6; 5YR 3/4, 3/3, or 4/4. Texture is clay or clay loam and generally contains 0 to 10 percent by volume coarse fragments. Structure is primatic or angular blocky and soil pH is slightly acid to mildly alkaline.

The Csim is platy to massive and strongly cemented or indurated and may have opal coated laminar plates cemented in a mosaic.

RIDD FAMILY

The Ridd family consists of moderately deep, well drained soils that formed from basalt and andesite. Permeability is moderately slow. These soils are on 1 to 35 percent slopes of basalt plateaus and mountain uplands at 4400 to 5800 feet elevation. The annual precipitation is 14 to 18 inches which mostly falls during winter as snow. Mean annual air temperature is 44 to 48°F. and the frost-free season is 80 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Typic Argixerolls.

Reference Pedon: Ridd family, cobbly loam on a 20 percent west facing sideslope at 5320 feet elevation under big sagebrush, rabbitbrush and bunchgrass rangeland. Soil was dry throughout when described on 9/25/79. (Colors are for dry soil unless otherwise stated.)

A1–0 to 5 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine, very fine and few medium roots; 15 percent basalt cobbles and 15 percent gravel by volume; medium acid (pH 6.0) clear wavy boundary.

B1t–5 to 12 inches; brown (10YR 4/3) very cobbly clay loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine and medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, sticky and slightly plastic; few thin clay films on ped faces; 25 percent gravel and 15 percent cobbles by volume; common fine, fine, very fine and few medium and coarse roots; common fine and very fine pores; slightly acid (pH 6.2) clear smooth boundary.

B2t–12 to 18 inches; brown (10YR 5/3) very cobbly clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common thin clay films on ped faces and pores; 15 percent cobbles and stones and 25 percent gravel by volume; common fine and very fine and few medium roots; common fine and very fine pores; neutral (pH 6.8) clear smooth boundary.

B22t–18 to 37 inches; light yellowish brown (10YR 6/4) very cobbly clay loam, dark yellowish brown (10YR 4/4) moist; moderate to strong fine and medium subangular blocky structure; hard, friable, sticky and plastic; common thick clay films on ped faces and pores; 20 percent cobbles and stones and 30 percent gravel by volume; few fine, medium and very fine roots; few to common fine and very fine pores; neutral (pH 6.8).

R–37 plus inches; hard fractured andesite.

Reference Pedon Location: Modoc County, California, about 40 feet east of road and about 1100 feet east and 1550 feet north of the SW corner of Section 15, T.46N., R.14E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. Clay content in the control section averages 24 to 35 percent and rock fragments average 35 to 60 percent by volume. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1 and exceeds 47°F. from April 15 through November 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 through October 30.

The A horizon is 4 to 12 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam and contains from 20 to 50 percent by volume gravel, cobbles and some stones. Structure is granular or subangular blocky and soil pH is medium acid to neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/3, 5/3, 5/4, 6/3, 6/4; 7/5YR 4/4, 5/4 and moist color of 10YR 3/2. 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/4. Mollic color occupies the upper 10 to 20 inches of the soil and normally include the upper parts of the argillic B horizon. Texture is loam or clay loam and contains 35 to 70 percent by volume rock fragments. Structure is subangular blocky and soil pH is slightly acid to neutral.

ROVAL FAMILY

The Roval family consists of shallow, well drained soils with a silica duripan formed over basalt. Permeability is slow. These soils are on 1 to 15 percent slopes and occur on volcanic plateaus at 4500 to 6000 feet elevation. The climate is cool with 14 to 16 inches annual precipitation which mostly falls during winter as snow. The mean annual air temperature ranges from 44 to 48°F. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy, mixed, mesic, shallow, Aridic Durixerolls.

Reference Pedon: Roval family very cobbly loam on a nearly level basalt plateau at 5080 feet elevation under low sagebrush, phlox spp., sandberg bluegrass and cheatgrass rangeland. Soil was moist throughout when described on 4/11/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 2 inches; brown (7.5YR 4/4) very cobbly loam, dark reddish brown (5YR 3/3) moist; weak medium platy structure which parts into moderate very fine and fine granular; slightly hard, very friable, slightly sticky and slightly plastic; 55 to 60 percent cobbles and gravel by volume; many very fine and fine and few medium roots; many medium vesicular pores; neutral (pH 6.6); clear smooth boundary.

B21t–2 to 7 inches; brown (7.5YR 4/4) clay loam, dark reddish brown (5YR 3/3) moist; weak to moderate fine subangular blocky structure which parts into moderate fine granular; hard, friable, sticky and plastic; few to common thin clay films on ped faces; common very fine and fine and few medium roots; few to common very fine and fine pores; neutral (pH 6.8) gradual wavy boundary.

B22t–7 to 10 inches; brown (7.5YR 5/4) clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces; common very fine and fine and few medium roots; common to many very fine and fine and few medium pores; neutral (pH 6.7); clear smooth boundary.

B3tsi–10 to 13 inches; brown (7.5YR 4/4) clay, dark brown (7.5YR 3/4) moist; moderate to strong fine angular blocky structure; very hard, firm, very sticky and very plastic; many moderately thick clay films on ped faces; few fine and medium masses of a silica deposit; 10 to 15 percent cobbles and gravel by volume; few to common very fine and fine roots; common very fine and few fine and medium pores; neutral (pH 6.6); abrupt smooth boundary.

Csim–13 to 14 inches; strongly cemented silica duripan.

R–14 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 200 feet north of road and about 600 feet east and 500 feet north of the SW corner of Section 7, T.45N., R.11E.

Range in Characteristics: Depth to silica duripan ranges from 10 to 20 inches. The silica duripan is generally only a few millimeters to a foot in thickness and is underlain by basalt or volcanic tuff. The control section averages 25 to 35 percent clay. The mean annual soil temperature at the contact is about 46 to 52°F. and fluctuates by more then 9°F. during the year. The soil temperature at the duripan contact exceeds 41°F. from April 1 through December 1. The 4 to 12 inch soil moisture control section, or to the duripan contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

The A horizon is 2 to 6 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 or 7.5YR 4/2, 5/2 amd moist color of 10YR 2/2, 3/2, 3/3 or 7.5YR 3/2. Texture is loam and normally contain between 20 to 80 percent surface basalt rock fragments of cobbles, gravel and stones. Structure is platy,granular or blocky and soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 4/3, 4/4, 5/3, 5/4, 6/3, 6/4; 7.5YR 4/4, 5/4, 5/6, 6/4 and moist colors of 10YR 3/2, 3/3, 3/4, 4/3; 7.5YR 3/2, 3/4, 4/4, 4/5; 5YR 3/2 or 3/3. The upper part of the agrillic B horizon has mollic color. Texture is clay loam or clay. Structure is subangular or angular blocky and soil pH is neutral to slightly acid.

The Csim horizon is platy or massive and strongly cemented or indurated and may have opal coated laminar plates cemented in a mosaic.

RUCKLES FAMILY

The Ruckles family consists of shallow, well drained soils which formed from basalt and tuff. Permeability is slow. These soils are on volcanic plateaus and mountain sideslopes of 5 to 70 percent slope. They occur at elevations of 4400 to 6400 feet. The annual precipitation is 14 to 20 inches which mostly falls during winter as snow. The mean annual air temperature ranges from 44 to 48°F. The frost free season is 80 to 110.

Taxonomic Class: Clayey-skeletal, montmorillonitic, mesic, Lithic Argixerolls.

Reference Pedon: Ruckles family very cobbly loam on a 35 percent east facing mountain sideslope at 5080 feet elevation under big sagebrush, rabbitbrush, sandberg bluegrass and cheatgrass rangeleand. Soil was dry throughout when described on 8/21/79. (Colors are for dry soil unless otherwise noted.)

A1–0 to 4 inches; brown (10YR 5/3) very cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure which parts into moderate very fine and fine granular; soft, very friable, slighlty sticky and non plastic, 50 percent basalt cobbles and gravel by volume; many very fine and fine, few medium roots; many very fine and fine pores; neutral (pH 7.0); clear smooth boundary.

B21t–4 to 10 inches; dark grayish brown (10YR 4/2) very gravelly clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; common thin clay films on ped faces; 30 percent basalt gravel and 10 percent cobbles by volume; many very fine and fine, few medium roots; many very fine and fine pores; neutral (pH 7.0); cleary wavy boundary.

B22t–10 to 14 inches; brown (7.5YR 5/2) very gravelly clay, dark brown (7.5YR 4/2) moist; moderate to strong medium angular and subangular blocky structure; very hard, firm, sticky and plastic; many moderately thick clay films on ped faces; 40 percent basalt gravel and 15 percent cobbles by volume; common very fine and fine, few medium roots; common very fine and fine pores, neutral (pH 7.2); abrupt smooth boundary.

R–14 plus inches; hard fractured basalt bedrock.

Reference Pedon Location: Modoc County, California, about 40 feet upslope from road and about 900 feet east and 800 feet south of the NW corner of Section 11, T.39N., R.14E.

Range in Characteristics: Depth to a lithic contact of basalt or volcanic tuff is 10 to 20 inches. Clay content in the control section averages 35 to 60 percent and coarse fragments occupy 35 to 70 percent by volume. The mean annual soil temperature at the lithic contact is about 47 to 52°F. and fluctuates by more then 9°F. during the year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1. Where this soil is mapped with map unit 244 the 5 to 15 inch soil moisture control section, or to the lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped in other map units the moisture control section is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1.

The A horizon is 3 to 7 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 or 7.5YR 4/2, 5/2, 5/4, and moist color of 10YR 3/2, 3/3,; 7.5YR 3/2. Texture is loam or clay loam and contains from 25 to 60 percent by volume rock fragments perdominately of the gravel and cobble size with some larger stones. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon makes up the remainder of the soil with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4, 6/2, 6/3; 7.5YR 4/2, 5/2, 5/4; 5YR 3/4, 4/2 or 4/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 7.5YR 3/2, 3/4, 4/2, 4/4; 5YR 3/2, 3/3 or 3/4. Mollic color makes up at least the upper 7 inches of the soil and can include the whole soil depth. Texture is clay loam or clay and contains 35 to 70 percent rock fragments by volume. Structure is subangular or angular blocky and soil pH is slightly acid to neutral.

SADIE FAMILY

The Sadie family consists of deep, well drained soils formed in geologically recent ash, cinders and pumice which lies on an older basalt capped plateau. Permeability is moderately rapid. The soils are on 1 to 20 percent slopes at 4350 to 5500 feet elevation. Annual precipitation ranges from 20 to 30 inches and mostly falls during the winter as snow. Mean annual air temperature is 45 to 48°F. and the frost free season is 90 to 110 days.

Taxonomic Class: Medial, mesic, Andic Xerochrepts.

Reference Pedon: Sadie family gravelly sandy loam on a 4 percent slope on a southwest aspect at 4650 feet elevation under a ponderosa pine, white fir, incense cedar and sugar pine forest with an understory of bitterbrush, buckbrush and squawcarpet. The soil was dry when described on 7/30/80. (Colors are for dry soil unless otherwise noted).

01–2 to 0 inches; ponderosa pine and white fir needles and twigs.

A1–0 to 5 inches; yellowish brown (10YR 5/4) gravelly sandy loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; soft; very friable; nonsticky and nonplastic; 20 percent less than 0.6 inch size cinder gravel by volume; many very fine and fine roots; moderately smeary; neutral (pH 7.0); clear smooth boundary.

B21–5 to 11 inches; yellowish brown (10YR 5/4) gravelly coarse sandy loam, dark yellowish brown (10YR 3/6) moist; weak medium subangular blocky structure; slightly hard, very friable; nonsticky and nonplastic; 20 percent less than 0.6 inch size cinder gravel by volume; common fine, very fine and many medium and coarse roots; few to common fine and medium pores; slightly smeary; slighlty acid (pH 6.4); gradual wavy boundary.

B22-11 to 19 inches; yellowish brown (10YR 5/6) gravelly coarse sandy loam, dark yellowish brown (10YR 3/6) moist; weak to moderate medium subangular blocky structure; slightly hard; very friable; nonsticky and nonplastic; 15 percent less than 0.6 inch size cinder gravel by volume; common fine, very fine, medium and coarse roots; few to commmon fine and medium pores; slightly smeary; slightly acid (pH 6.4) clear wavy boundary.

C–19 to 50 inches; brownish yellow (10YR 6/6) gravelly coarse sandy loam, dark yellowish brown (10YR 4/6) moist; massive; slighlty hard; friable; nonsticky and nonplastic; 15 to 20 percent less than 3/4 inch size cinder gravel by volume; few to common fine, medium and coarse roots; few fine and medium pores; slightly smeary; neutral (pH 6.8); abrupt smooth boundary.

R–50 plus inches; hard fractured vesicular basalt.

Reference Pedon Location: Siskiyou County, California; about 300 feet east of road and 2400 feet south of the NW corner in SW1/4, NW1/4, Section 25, T.42N., R.4E.

Range in Characteristics: Depth to a lithic contact of hard fractured vesicular basalt is greater than 40 inches. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The soil between depths of 4 to 12 inches is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30. The average content of coarse fragments in the control section is 15 to 35 percent by volume. The bulk density of the soil fine earth fraction is estimated to be between 0.8 and 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally in all parts of the upper 30 inches of soil. The soil has weak to moderate smeary consistency throughout.

The A horizon is 3 to 6 inches thick and has dry color of 10YR 5/3, 5/4, 6/3 or 6/4 and moist color of 10YR 3/3, 3/4, 3/6, 4/3 or 4/4. Texture is sandy loam and contains 15 to 30 percent gravel by volume. It has weak to moderate granular structure. Soil pH is neutral to slightly acid.

The B horizon has dry color of 10YR 5/4, 5/6, 6/4, 6/6 or 7.5YR 5/4, or 5/6 and moist color of 10YR 3/4, 3/6, 4/4, or 7.5YR 3/4, 4/4 or 4/6. Texture is fine sandy loam, sandy loam, or coarse sandy loam and contain 15 to 35 percent gravel by volume. It has weak to moderate subangular blocky structure and soil pH is slightly acid to medium acid.

The C horizon has dry color of 10YR 5/6, 6/4, 6/6, 7/4 and 10YR 4/4, 4/6, 5/4 or 7.5YR 4/4 moist. Texture is sandy loam or coarse sandy loam and contains between 20 to 50 percent by volume gravel. It is massive and soil pH is neutral to medium acid.

SAPRISTS

The Saprists soils consists of deep, very poorly drained, organic soils that formed from highly decomposed herbaceous materials. Permeability is slow. This soil is on floodplains and drainageways with 0 to 2 percent slope and has an apparent water table which fluctuates to within a few inches of the surface. This soil is very localized in the survey area being mapped only in Jess Valley in the Warner Mountains at an elevation of about 5000 to 5100 feet. Annual precipitation is 14 to 16 inches and the mean annual air temperature is about 48°F. The frost free season is 80 to 100 days.

Taxonomic Class: Mesic, Saprists

Reference Pedon: Saprists soil - all horizons are of sapric materials on a level flood plain at 5040 feet elevation under club moss, milk thistle, sedges, forbes, foxtail barley and other grasses. Soil was moist to saturated below 10 inches when described on 8/27/79. (The colors given are those of the mosit soil.)

0a1–0 to 5 inches; black (10YR 2/1) both rubbed and unrubbed; about 10 to 15% fibers after rubbing; moderate fine and medium platy structure parting to moderate fine and very fine subangular blocky; non-sticky; few to common fine and very fine pores; neutral (pH 6.6); abrupt smooth boundary.

0a2–5 to 10 inches; very dark brown (10YR 2/2), black (10YR 2/1) rubbed; about 5 to 10% fibers after rubbing; moderate to strong fine and medium platy structure; non-sticky; common fine and medium pores; slightly acid (pH 6.4); abrupt smooth boundary.

0a3–10 to 24 inches; dark reddish brown (5YR 3/2) dark reddish brown (5YR 2.5/2) rubbed; about 5 to 10% fibers after rubbing; moderate to strong fine and medium platy structure; slighlty sticky; common to many medium and fine pores; slightly acid (pH 6.2); clear wavy boundary.

0a4–24 to 38 inches; black (10YR 2/1) with 50% less prominent very dark gray (10YR 3/1) mottles; less than 5% fibers when rubbed; moderate fine and medium platy structure; non-sticky; common to many fine and medium pores; slightly acid (pH 6.4); gradual wavy boundary.

0a5–38 to 60 inches; black (10YR 2/1) with 60% less prominent very dark gray (10YR 6/2) mottles; less than 5% fibers after rubbing; weak to moderate medium and coarse platy structure; non-sticky; many medium and common fine pores; neutral (pH 6.8).

Reference Pedon Location: About 70 yards south of elevator ramp on an unaltered site about 300 feet east and 1100 feet north of the SW corner of Section 13, T.39N., R14E.

Range in Charactertistics: This soil is subject to a high fluctuating water table. Most of the area has artifical drainage at present. Capillary action from the lowered water table allows the soil to remain moist to within a few inches of the surface during most of the year. The soil pH is slightly acid to neutral. Mean annual soil temperature is 48° to 50°F. and mean summer and mean winter soil temperature at a depth of 12 inches differs by 9°F or more.

The Oa horizon is greater than 60 inches thick. Soil color is 10YR 3/1, 3/2, 3/3, 4/1, 5/1; 7.5YR 3/4 dry and 10YR 2/1, 2/2, 3/1, 5YR3/2 moist. Mottled or glayed colors begin at 20 to 30 inches in depth and increase in abundance with depth. The soil organic material is sapric, being highly decomposed.

SEARLES FAMILY

The Searles family consists of moderately deep, well drained soils that formed from basalt. Permeability is moderately slow. These soils are on basalt plateaus with slopes of 1 to 15 percent. Elevation is 4200 to 5000 feet and the annual precipitation is 10 to 14 inches most of which falls during winter as snow. The climate is cool with 46 to 50°F. mean annual air temperature and the frost free season is 90 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Aridic Argixerolls.

Reference Pedon: Searles family gravelly sandy loam on a 10 percent north facing slope at 4600 feet elevation under bitterbrush, big sagebrush, rabbitbrush, desert mahogany and various bunchgrass rangeland. Soil was dry when described on 7/3/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 4 inches; brown (10YR 5/3) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine granular structure; soft, very friable, slightly sticky and non-plastic; 5 percent cobbles and 15 percent basalt and pumice gravel by volume; many fine and very fine roots; neutral (pH 7.0); clear smooth boundary.

A12–4 to 7 inches; brown (10YR 4/3) gravelly sandy loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and non-plastic; 10 to 15 percent gravel and 5 percent cobbles by volume; many fine, very fine and few medium roots; neutral (pH 7.0); gradual wavy boundary.

B21t–7 to 14 inches; brown (10YR 4/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak to moderate fine and medium subangular blocky structure; slighlty hard, friable, sticky and slightly plastic; few thin clay skins on ped faces and pores; 10 percent gravel and 10 percent cobbles by volume; many fine, very fine and common medium roots; common fine and very fine pores; neutral (pH 7.2) clear smooth boundary.

IIB22t–14 to 34 inches; yellowish brown (10YR 5/4) extremely cobbly heavy loam, dark yellowish brown (10YR 3/4) moist; moderate fine subangular blocky structure which parts to moderate medium granular; slightly hard, friable, sticky and plastic; few to common thin clay skins on ped faces and pores; 45 percent cobbles and 30 percent gravel by volume of basalt; common fine, very fine and few medium roots; common fine and very fine pores; neutral (pH 7.2) abrupt smooth boundary.

R–34 plus inches; hard fractured basalt.

Reference Pedon Location: Siskiyou County, California, about 50 feet north of scenic stop by intersection of Lava Beds road and Medicine Lake road and about 450 feet east and 200 feet north of the SW corner of Section 21, T.45N., R.4E.

Range in Characteristics: Depth to basalt bedrock is 20 to 40 inches. The mean annual soil temperature at 20 inches is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 in most years. The 5 to 15 inch soil moisture control section is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1. The average clay content in the control section is 22 to 35 percent. A thin pumice overburden of up to 12 inches thick may be present in soil map unit 140.

The A horizon is 5 to 12 inches thick and has dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or sandy loam and normally contain 15 to 50 percent by volume coarse fragments; structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon normally makes up the rest of the soil and have dry color of 10YR 5/2, 5/3, 5/4, 4/3, 4/4, 6/3, 6/4; 7.5 YR 5/4, 6/4 and moist color of 10YR 3/2. 3/3. 3/4. 4/3. 4/4; 7.5YR 3/2, 3/4, 5/2, or 4/4. The upper parts of the argillic B horizon is mollic in color. Texture is loam and clay loam and contains 35 to 80 percent by volume coarse fragments. Structure is subangular blocky and soil pH is slightly acid to neutral.

SHELD FAMILY

The Sheld family consists of deep, well drained soils formed from volcanic ash and basalt. Permeability is moderate. These soils are on mountain sideslopes of 5 to 30 percent slope and at 5600 to 7000 feet elevation. The climate is cool with 30 to 45 inches annual precipitation which mostly falls as snow in winter. The frost free season is 70 to 100 days and the mean annual air temperature is 38 to 45°F.

Taxonomic Class: Medial-skeletal, frigid, Andic Xerumbrepts.

Reference Pedon: Sheld family gravelly fine sandy loam on a 5 percent west facing lower sideslope at 5800 feet elevation under a white fir and ponderosa pine forest with an understory of snowberry, greenleaf manzanita, Current sp., mint and various grasses. Soil was moist below 12 inches when described on 7/10/80. (Colors are for dry soil unless otherwise stated.)

01–2 to 0 inches: white fir and ponderosa pine needles, twigs and duff.

A11–0 to 5 inches; dark grayish brown (10YR 4/2) gravelly fine sandy loam, black (10YR 2/1) moist; fine granular structure; soft, very friable nonsticky and nonplastic; 15 percent cinder and andesite gravel by volume; many very fine, fine and medium roots; medium acid (pH 5.8); weak to moderately smeary; gradual wavy boundary.

A12–5 to 12 inches; brown (10YR 4/3) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure which parts into weak fine granular; soft, very friable, nonsticky and nonplastic; 15 percent cinder and andesite gravel by volume; many very fine and fine, common medium and few coarse roots; medium acid (pH 6.0); weak to moderately smeary; clear wavy boundary.

A13–12 to 25 inches; brown (10YR 5/3) very cobbly loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; 20 percent cinder gravel and 25 percent basalt cobbles by volume; common very fine, fine, medium and coarse roots; few fine pores; slightly acid (pH 6.2); weak to moderately smeary; clear wavy boundary.

B2–25 to 44 inches; light yellowish brown (10YR 6/4) very gravelly laom, dark yellowish brown (10YR 3/4) moist; weak medium subangular blocky structure; soft, very friable, slightly stocky and nonplastic; 25 to 30 percent cinder gravel and 10 percent basalt gravel and cobbles by volume; few to common very fine and fine and common medium and coarse roots; few fine tubular pores; slightly acid (pH 6.2) weakly smeary; gradual wavy boundary.

C1–44 to 50 inches; light yellowish brown (2.5YR 6/4) extremely cobbly loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, slightly sticky and nonplastic; 25 percent cinder gravel and 60 percent basalt cobbles and gravel by volume; few very fine, fine and medium roots; slightly acid (pH 6.2); weakly smeary; abrupt wavy boundary.

R–50 plus inches; hard vesicular basalt.

Reference Pedon Location: Siskiyou County, California, about 100 feet south of road intersection and about 650 feet west and 1800 feet south of the NE corner of Section 1, T.42N., R.3E.

Range in Characteristics: The Sheld family soils are deeper than 40 inches to basalt or unweathered volcanic ash. The mean annual soil temperature at a depth of 20 inches is 40 to 47°F. The 5 to 15 inch soil moisture control section is moist in all parts from about November 15 through May 30. It is dry in all parts from about August 1 through October 20. The soil temperature exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The average content of rock fragments in the 10 to 40 inch control section is 35 to 60 percent by volume. The bulk density of the soil fine earth fraction is estimated to be between 0.80 and 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally in all parts of the upper 30 inches of soil. The estimated base saturation in the A horizon is between 30 and 50 percent by the ammonium acetate method. The soil has weak to moderate smeary consistence throughout.

The A horizon is 10 to 25 inches thick. Soil color is 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4. 4/6; 5YR 4/4 dry and 10YR 2/1, 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 3/3 moist. Texture is sandy loam or fine sandy loam and normally contains between 15 to 45 percent gravel and cobbles. It has granular or subangular blocky structure and soil pH is medium acid to slightly acid.

The B horizon has dry color of 10YR 5/3, 5/4, 5/6, 6/4; 7.5YR 5/4 and 10YR 4/3, 3/4, 4/4, 4/6; or 5YR 3/4 moist. Texture is loam, sandy loam or fine sandy loam and contain between 35 to 70 percent by volume gravel and cobbles. It has subangular blocky structure and soil pH is slightly acid to medium acid.

The C horizon, if present, has dry color of 10YR 6/4, 6/6, 7/3, 7/4; 2.5YR 6/4 and moist color of 10YR 5/4, 6/3, 6/4; 2.5YR 5/52, 5/4. Texture is loam, sandy loam or loamy coarse sand and contains 40 to 80 percent by volume coarse fragments. Structure is massive and soil pH is slightly acid.

SIMPSON FAMILY

The Simpson family consists of moderately deep, well drained soils that formed in material weathered from basalt and andesite. Permeability is slow. These soils are on basalt plateaus with slopes of 1 to 15 percent. The annual precipitation is 10 to 14 inches, most of which falls during the winter as snow. The mean annual air temperature is 46 to 49°F. and the frost free season is 90 to 110 days.

Taxonomic Class: Fine, montmorillonitic, mesic, Aridic Argixerolls.

Reference Pedon: Simpson family loam on a 5 percent west facing basalt plateau at 4320 foot elevation under rabbitbrush, big sagebrush, Idaho fescue and sandberg bluegrass rangeland. Soil was moist throughout when described on 5/6/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 3 inches; brown (10YR 5/3) loam; very dark grayish brown (10YR 3/2) moist; weak to moderate fine and very fine platy structure parting to moderate fine and very fine granular; slighlty hard, very friable, sticky and plastic; many fine and very fine roots; common to many fine and very fine tubular pores; 10 to 15 percent by volume basalt cobbles and gravel; neutral (pH 7.2); abrupt, smooth boundary.

B21t–3 to 8 inches; brown (10YR 4/3) silty clay loam, dark brown, (10YR 3/3), moist; moderate medium subangular blocky structure parting to moderate fine and very fine granular; hard, firm, very sticky and plastic; many fine and very fine roots; common very fine tubular pores; few to common thin clay skins on ped faces; less than 5 percent by volume basalt cobbles and gravel; neutral (pH 7.2); clear, smooth boundary.

B22t–8 to 22 inches; brown (7.5YR 5/4) silty clay, brown (7.5YR 4/4) moist; moderate to strong medium prismatic structure parting to strong fine and medium angular blocky; extremely hard, firm, very sticky and very plastic; few to common very fine and fine roots, and few to common very fine tubular pores; common prominent clay skins on ped faces and pores; mildly alkaline (pH 7.4); clear, wavy boundary.

B3t–22 to 28 inches; strong brown (7.5YR 5/6) silty clay, brown (7.5YR 4/4) moist; moderate medium and coarse subangular blocky structure; hard, firm, very sticky and very plastic; few to common fine and very fine roots; many fine, very fine and common medium tubular pores; few to common thin clay skins on ped faces; mildly alkaline (pH 7.6); abrupt, smooth boundary.

IIC1ca–28 to 30 inches; yellowish brown (10YR 5/4), semi-consolidated ashy tuff which rubs to a clay loam, dark yellowish brown (10YR 3/4) moist; massive; very hard, friable, sticky and plastic; few very fine roots, common fine and very fine pores; few distinct medium and coarse calcium carbonate nodules; strongly effervescent; mildly alkaline (pH 7.6); abrupt smooth boundary.

IIIR–30 plus inches; hard vesicular basalt.

Reference Pedon Location: Siskiyou County, California, about 100 feet east of road and about 700 feet west and 600 feet north of the SE corner of Section 15, T.46N., R.3E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. The mean annual soil temperature at 20 inches is about 48 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 in most years. The 4 to 12 inch soil moisture control section is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1. The clay content in the control section averages 35 to 60 percent.

The A horizons are 3 to 8 inches thick and have dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 3/2, 3/3; 7.5YR 3/2. Texture is loam or clay loam and normally contains less than 15 percent coarse fragments; structure is platy or granular and soil pH is neutral to mildly alkaline.

The B horizons normally make up the rest of the soil and have dry color of 10YR 5/2, 5/3, 5/4, 4/3, 4/4, 6/3, 6/4, 6/6; 7.5YR 5/4, 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/2, 4/4 or 4/6. The upper part of the argillic B horizons are mollic in color. Textures are clay loam, clay silty clay loam or silty clay and normally contain less than 15 percent by volume coarse fragments. Structure is prismatic, subangular or angular blocky and soil pH is neutral to mildly alkaline.

The C horizons, if present, have dry color of 10YR 5/4, 6/3, 6/4 and moist color of 10YR 3/4, 4/3, 4/4, 4/5. Texture is clay loam or clay and contain from 0 to 40 percent by volume coarse fragments. Structure is massive or platy and soil pH is mildly alkaline.

SKALAN FAMILY

The Skalan family consists of moderately deep and deep, well drained soils that formed from basalt. In this survey area it also has a geologically recent pumice deposit on the surface. Permeability is rapid in the pumice overburden and moderately slow below. These soils are on basalt plateaus with 1 to 10 percent slopes. Elevation is 4200 to 4500 feet and annual precipitation is 16 to 20 inches and mostly falls during the winter as snow. Mean annual air temperature is 48 to 50°F. and the frost free season is 90 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Ultic Haploxeralfs.

Reference Pedon: Skalan family gravelly loamy coarse sand on a gently undulating basalt plateau at 4360 foot elevation under a sparce canopy of ponderosa pine with bitterbrush, big sagebrush and bunchgrass understory. Soil was dry throughout when described on 8/14/78. (Colors are for dry soil unless otherwise stated.)

01–1/2 to 0 inches; ponderosa pine and brush needles, leaves and twigs.

A1–0 to 4 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) moist; single grained; loose, non-sticky and non-plastic; 30 percent by volume pumice gravel mainly of the less than 0.6 inch size; many fine, very fine and few medium roots; slightly acid (pH 6.2) clear smooth boundary.

C1–4 to 8 inches; very pale brown (10YR 8/3) extremely gravelly sand, very pale brown (10YR 7/3) moist; single grained; loose, non-sticky and non-plastic; 85 percent pumice gravel by volume mainly of the 0.2 to 1.0 inch size; common very fine, fine and medium roots; slightly acid (pH 6.4); clear smooth boundary.

IIA1b–8 to 20 inches; light yellowish brown (10YR 6/4) extremely cobbly loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure which parts to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; 35 percent cobbles, 15 percent stones and 20 percent gravel by volume of basalt; common fine, very fine and few medium and coarse roots; common fine and medium pores; slightly acid (pH 6.4); gradual wavy boundary.

IIB2tb–20 to 32 inches; light yellowish brown (10YR 6/4) extremely stony clay loam, dark yellowish brown (10YR 3/4) moist; moderate fine subangular blocky structure; hard, friable, sticky and plastic; few to common thin clay films on ped faces; 35 percent stones; 20 percent cobbles and 15 percent gravel by volume of basalt; common very fine and fine and few to common medium and coarse roots; many fine, very fine and few medium pores; neutral (pH 6.6) abrupt wavy boundary.

R–32 plus inches; hard fractured basalt.

Reference Pedon Location: Modoc County, California, about 700 feet west and 1500 feet north of the SE corner of Section 23, T.44N., R.5E.

Range in Characteristics: Depth to a lithic contact is greater then 30 inches. The control section averages 24 to 35 percent clay content and also averages 35 to 80 percent by volume rock fragments. Base saturation is estimated to be 60 to 75 percent, by sum of cations, in at least the upper parts of the argillic horizons. The mean annual soil temperature at 20 inches is about 50 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 15 through November 30 and exceeds 47°F. from May 1 through November 1 in most years. The soil in the moisture control section is usually moist in all parts from December 1 through May 15 and dry in all parts from July 15 through October 30.

The Skalan family soils in this survey have an approximate 900 year old pumice deposit from 8 to 20 inches thick. This pumice deposit is always less than half the thickness of the combined A and B horizons of the underlying soil. The pumice overburden consists of an A-C horizon development. The pumice A horizon is 2 to 5 inches thick and has dry color of 10YR 5/1, 5/2, 5/3, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3. Texture is coarse loamy sand or coarse sand and contains 25 to 45 percent gravel mainly of the less than 0.6 inch size. It is single grained and soil pH is neutral to slightly acid. The pumice overburden C horizon, has dry color of 10YR 7/3, 7/4, 8/3 and moist color of 10YR 6/3 or 7/3. Texture is coarse sand and contains 65 to 90 percent by volume gravel mainly of the 0.2 to 1.0 inch size. It is single grained and soil pH is neutral to slightly acid.

The soil underlying the pumice overburden has an A-B horizon development.

The A horizons are 6 to 12 inches thick and have dry color of 10YR 5/4, 6/3, 6/4; 7.5YR 4/4, 5/4 and moist color of 10YR 3/4, 4/4; 7.5YR 3/4, 4/4. Texture is loam and contains 35 to 70 percent by volume weathered cinder gravels and basalt gravel, cobbles and stones. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

The B horizons have dry color of 10YR 5/4, 6/4, 6/6; 7.5YR 5/4, 5/6. 6/4 and moist colors of 10YR 3/4, 3/6, 4/4, 4/6; 7.5YR 3/4, 4/4, 4/6. Texture is clay loam or loam and contains from 35 to 80 percent by volume rock fragments. Structure is subangular blocky and soil pH is neutral to slightly acid.

SMARTS FAMILY

The Smarts family consists of moderately deep and deep, well drained soils that formed from basalt or tuff. Permeability is moderately slow. These soils are on mountain sideslopes of 2 to 60 percent slope. Elevation ranges from 5300 to 7500 feet. The annual precipitation is 20 to 30 inches most of which falls during the winter as snow. Mean annual air temperature is 40 to 46°F. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Pachic Ultic Argixerolls.

Reference Pedon: Smarts family stony loam on a 47 percent northeast facing sideslope at 5800 foot elevation under a ponderosa pine and white fir forest with an understory of current sp., rabbitbrush, mulesear and grasses. Soil was dry throughout when described on 8/29/79. (Colors are for dry soils unless otherwise noted.)

01–1/2 to 0 inches; Ponderosa pine and white fir needles and twigs.

A11–0 to 14 inches; reddish brown (5YR 4/3) stony loam, dark reddish brown (5YR 2.5/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 30 to 35 percent basalt rock fragments by volume consisting of 20 percent stones and cobbles and 10 to 15 percent gravel; many very fine and fine and common medium roots; neutral (pH 6.6); clear wavy boundary.

A12–14 to 20 inches; reddish brown (5YR 4/3) very cobbly loam, dark reddish brown (5YR 3/2) moist; weak medium and coarse subangular blocky structure; hard, friable, sticky and slightly plastic; 45 percent basalt rock fragments by volume consisting of 25 percent gravel and 20 percent cobbles and stones; many very fine, fine and medium and common coarse roots; many very fine and fine and few medium pores; neutral (pH 6.8); clear wavy boundary.

B21t–20 to 28 inches; reddish brown (5YR 5/3) very gravelly loam, dark reddish brown (5YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and slightly plastic; common thin clay films on ped faces; 50 percent highly weathered basalt gravel and cobbles by volume; many very fine and fine and common medium and coarse roots; many very fine and fine and few medium pores; neutral (pH 6.8); clear wavy boundary.

B22t–28 to 35 inches; brown (7.5YR 5/4) extremely gravelly clay loam, dark brown (7.5YR 3/4) moist; strong fine and medium subangular blocky structure; very hard, friable, sticky and plastic; common thin clay films on ped faces 80 percent highly weathered basalt gravel and few cobbles by volume; common very fine and fine and few medium and coarse roots; few very fine and fine pores; neutral (pH 6.8); gradual wavy boundary.

Cr–35 plus inches; gray (5YR 6/1) highly weathered soft vesicular basalt which can be cut with a shovel.

Reference Pedon Location: Lassen County, California, about 30 feet upslope of road going to Mahogany Ridge and about 1250 feet west and 2050 feet south of the NE corner of Section 32, T.39N., R.15E.

Range in Characteristics: Depth to bedrock is greater than 40 inches in soil map units 129, 148, 149, 194, 195, 196, 254, 255 and 256; both 20 to 40 inches and greater than 40 inches in units 252, 253; and 20 to 40 inches in the other units it is mapped in. The control section averages 24 to 35% clay content and rock fragments average from 35 to 75% by volume. Base saturation by the ammonium acetate method is estimated to be between 50 to 75 percent normally throughout the upper 30 inches of the soil. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizons are 10 to 24 inches thick with dry color of 7.5YR 4/2, 4/3, 4/4; 5YR 4/2, 4/3, 4/4; 10YR 4/3 or 4/4 and moist color of 7.5YR 3/2; 5YR 2.5/2, 3/2, 3/3; 10YR 3/2 or 3/3. Texture is loam and normally contains from 15 to 50 percent by volume cobbles, stones and gravel. Structure is granular or subangular blocky and soil pH is medium acid to neutral.

The B horizons make up the remaining soil and have dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/2, 4/4, 5/4; 5YR 4/3, 4/4, 5/3, 5/4 and moist collor of

10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/4, 4/4; 5YR 3/2, 3/3, 3/4, 4/3 or 4/4. The upper parts of the argillic B horizons have mollic colors and may include the whole soil profile. Texture is loam or clay loam and contains from 35 to 85 percent by volume rock fragments which increase in amount with depth. Structure is subangular blocky and soil pH is medium acid to neutral.

STONEWELL FAMILY

The Stonewell family consists of moderately deep and deep, somewhat excessively drained soils formed from volcanic ash, cinders, pumice, andesite and basalt. Permeability is rapid in the pumice overburden if present, and moderately rapid below. These soils are on 2 to 70 percent slopes and occur on volcanic mountain uplands, and sideslopes of cinder cones. They are often covered by a thick deposit of recent pyroclastic pumice. Elevation ranges from 4600 to 6900 feet. Annual precipitation is 25 to 40 inches, most of which falls during the winter as snow. Mean annual air temperature is 40 to 46°F. The frost free season is 70 to 90 days.

Taxonomic Class: Cindery, frigid, Dystric Xerorthents.

Reference Pedon: Stonewell family gravelly sandy loam on a nearly level lower sideslope at 5580 feet elevation under a mixed ponderosa pine and white fir forest with a greenleaf manzanita understory. Soil was moist throughout when described on 5/22/80. (Colors are for dry soils unless otherwise stated.)

01–1 to 0 inches; white fir and ponderosa pine needles and twigs.

A1–0 to 4 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; weak to moderate fine and medium granular structure; soft, very friable, non-sticky and non-plastic; 20 to 25 percent by volume weathered cinders and pumice gravel; many very fine and fine and common medium roots; slightly acid (pH 6.4); clear smooth boundary.

C1–4 to 12 inches; brown (7.5YR 5/4) very gravelly sandy loam, dark brown (7.5YR 3/4) moist; weak to moderate fine and medium granular structure; soft, very friable, non-sticky and non-plastic; 45 percent by volume weathered pumice and cinder gravel; common to many very fine and fine and common medium and coarse roots; slightly acid (pH 6.4); gradual wavy boundary.

C2–12 to 24 inches; yellowish brown (10YR 5/6) very gravelly sandy loam, brown (7.5YR 4/4) moist; weak fine and medium granular structure; soft, very friable, non-sticky and non-plastic; 45 percent by volume weathered pumice and cindery gravel; common to many very fine and fine and common medium and coarse roots; slightly acid (pH 6.4); abrupt smooth boundary.

IIC3–24 to 31 inches; strong brown (7.5YR 5/6) extremely gravelly loamy sand, yellowish red (5YR 4/6) moist; single grained; loose, non-sticky and non-plastic; 90 percent by volume cinder gravel; few very fine, fine, medium and coarse roots; neutral (pH 6.6); abrupt smooth boundary.

IIC4–31 to 42 inches; yellowish red (5YR 5/6) extremely gravelly coarse sand, yellowish red (5YR 4/6) moist; single grained; loose, non-sticky and non-plastic; 85 percent by volume cinder gravel; few very fine, fine, medium, and coarse roots; slightly acid (pH 6.5); abrupt smooth boundary.

IIIC5–42 to 51 inches; light yellowish brown (10YR 6/4) 1 to 3 inch thick stratified lenses of very fine sandy loam, silt loam and very gravelly coarse sand, dark yellowish brown (10YR 4/4) moist; soft, very friable, non-sticky and non-plastic; 50 percent by volume cinder gravel; common very fine and fine and few to common medium roots; medium acid (pH 6.0); abrupt smooth boundary.

IVC6–51 to 60 inches; brown (7.5YR 5/4) extremely gravelly coarse sand, dark reddish brown (5YR 3/4) moist; single grained; loose, non-sticky and non-plastic; 90 percent cinder gravel by volume; few very fine and fine roots; neutral (pH 6.0).

Reference Pedon Location: Siskiyou County, California, about 100 feet northwest of road intersection and about 2300 feet east and 1100 feet north of the SW corner of Section 33, T.43N., R.7E.

Range in Characteristics: Depth to a contact of basalt, andesite or unweathered cinders is greater than 30 inches. The mean annual soil temperature at a depth of 20 inches is about 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The soil in the moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20. The control section averages 35 to 95 percent mainly less than 1 inch gravel size pumice and/or weathered cinders by volume. The bulk density of the soil fine earth fraction is estimated to be less than

0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 in all parts of the soil. It is estimated that more than 60 percent of the whole soil by weight is volcanic ash, cinders and/or pumice throughout the soil. It is estimated that these soils have less than 60 percent base saturation by the ammonium acetate method normally throughout the whole soil depth.

There are three Stonewell family soil phases recognized in this survey. They consist of Stonewell family pumice phase; Stonewell family pumice overburden phase; and Stonewell family without pumice.

The Stonewell family, pumice phase consists of a geologically recent pumice deposition of 35 to greater than 60 inches in depth. This pumice material may be over a loamy textured cindery material, or is directly over basalt flow rock. The A horizon is 1 to 6 inches thick and ranges in color from 10YR 5/4, 5/3, 5/2 or 4/2 dry, and 10YR 3/4, 3/3, 3/2 or 2/2 moist. Texture is loamy sand or sand with 35 to 60 percent pumice gravel. The C horizon has colors of 10YR 8/3, 7/2, 6/3 or 6/2 dry, and 10YR 7/3, 6/3, 6/2, 5/3, 5/2, 4/3 moist. Texture in the pumice C material is coarse sand and contains from 70 to 95 percent pumice gravel mainly of the less than 3/4 inch size.

The Stonewell family, pumice overburden phase where mapped consists of geologically recent pumice deposition 6 to 20 inches in depth over a loamier textured cindery material below this pumice overburden. The pumice overburden consists of an A horizion 2 to 6 inches in depth and is gravelly coarse loamy sand with 15 to 35 percent gravel mainly of the less than 0.6 inch size. Colors are 10YR 5/4, 5/3, 5/2 dry and 10YR 4/3, 4/2, 3/3 or 3/2 moist. The pumice C horizon is coarse sand with 60 to 90 percent gravel mainly of the 0.2 to 1.0 inch size. Colors are 10YR 8/3, 7/3 or 7/2 dry and 10YR 7/3 or 6/3 moist. The burried IIAb horizon below the pumice mantle is 4 to 14 inches thick and are fine sandy loam or sandy loam in texture with 10 to 50 percent weathered cinder gravel mainly of the less than 0.6 inch size. Colors are 10YR 6/4 or 5/4 dry, 10YR 4/4 or 3/4 moist. The C horizon is sandy loam, loamy sand or sand. Gravel content ranges from 40 to 85 percent and are mainly less than 3/4 inch in size and consist of older weathered pumice and cinder material. Colors are 10YR 7/4, 6/6, 6/4, 6/3 dry and 10YR 6/6, 4/6, 4/4 moist.

The Stonewell family without the recent pumice deposition has an A horizon 2 to 9 inches in depth. Textures range from sandy loam to fine sandy loam. Gravel content is 20 to 50 percent by volume and mainly of the less than 0.4 inch size. Colors are 10YR 5/4, 5/3, 4/2, 4/2 dry and 10YR 3/4, 3/3, 3/2 or 2/2 moist. The C horizon has textures of sandy loam, or coarse sandy loam and grades to loamy coarse sand or coarse sand with depth. Gravel content is 40 to 90 percent by volume and mainly of the less than 1 inch size. The gravel consists of older weathering cinders and pumice. Dry colors are 10YR 5/4, 5/6, 6/4, 6/6; 7.5YR 5/4, 5/6, 6/4, 6/6; 5YR 5/4, 5/6, 6/4, 6/6 and moist colors are 5YR 3/4, 4/4, 4/6; 7.5YR 3/4, 4/4, 4/6; 10YR 4/4, 4/6, 5/6.

STUKEL FAMILY

The Stukel family consists of shallow, well drained soils formed in material weathered from basalt. Permeability is moderate. These soils are on 1 to 10 percent slopes and occur on basalt plateaus at 4200 to 5200 feet elevation. The annual precipitation is 10 to 16 inches which mostly falls during the winter as snow. The mean annual air temperature is 45 to 50°F. The frost free season is 90 to 110 days.

Taxonomic Class: Loamy, mixed, mesic, Lithic Haploxerolls.

Reference Pedon: Stukel family very cobbly loam on a nearly level basalt plateau of 4360 feet elevation under rabbitbrush, big sagebrush, bitterbrush, Idaho fescue, sandberg bluegrass and wheatgrass rangeland. Soil was moist throughout when described on 5/6/80. (Colors are for dry soil unless otherwise noted.)

A11–0 to 3 inches; grayish brown (10YR 5/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium platy structure which parts to moderate fine and medium granular; soft, very friable, slightly sticky and nonplastic; 15 percent gravel and 30 percent cobbles by volume; many very fine and fine and few medium roots; many very fine and fine pores; slightly acid (pH 6.2); abrupt smooth boundary.

A12–3 to 6 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium platy structure and which parts to moderate fine and medium granular; soft very friable, slightly sticky and slightly plastic; 10 to 15 percent gravel and cobbles by volume; many very fine and fine, and few medium roots; many very fine and fine pores; neutral (pH 6.8); clear wavy boundary.

A13–6 to 11 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 10 percent gravel and cobbles by volume; common very fine and fine, and few medium roots; common fine pores; neutral (pH 7.2); abrupt wavy boundary.

R–11 plus inches; hard vesicular basalt.

Reference Pedon Location: Siskiyou County, California, about 1250 feet east and 1400 feet south of the NW corner of Section 35, T.46N., R.3E.

Range in Characteristics: Depth to the lithic contact ranges from 8 to 20 inches. The mean annual soil temperature at the lithic contact is about 47 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at the lithic contact exceeds 41°F. from April 1 through December 1. Where this soil is mapped in map units 122 and 266 the soil between depths of about 4 to 12 inches, or lithic contact if shallower, is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1. Where this soil is mapped with map unit 267 the soil at the 4 to 12 inch depth, or lithic contact if shallower, is usually dry in all parts from July 1 through October 30, and moist in all parts from December 1 through May 1. The coarse fragment content of the control section averages 5 to 35 percent by volume and clay content averages 16 to 24 percent.

The A horizon normally makes up the whole soil depth with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4,; 7/5YR 4/2, 4/4, 5/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam or sandy loam and contains from 0 to 40 percent surface rock fragments. Structure is granular or subangular blocky and soil pH is neutral to slightly acid.

SUPAN FAMILY

The Supan family consists of moderately deep and deep, well drained soils formed from basalt. Permeability is moderately slow. The soils are on basalt plateaus and mid to lower sideslopes of mountain uplands and are on 1 to 20 percent slopes. They occur at elevations of 4300 to 6000 feet. The annual precipitation is 14 to 16 inches which mostly falls during the winter as snow. Mean annual air temperature is 44 to 49°F. The frost free seaon is 80 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Pachic Argixerolls.

Reference Pedon: Supan family loam on a 5 percent north facing sideslope at 5200 feet elevation under western juniper and mountain mahogany with an understory of big sagebrush, chickweed, arrowleaf balsomroot, Sandberg bluegrass and cheatgrass. Soil was moist throughout when described on 4/16/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 15 inches; brown (10YR 4/3) loam, dark brown (7.5YR 3/2) moist; weak medium and coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; 5 percent gravel by volume; many very fine, fine, common medium and coarse roots; neutral (pH 6.8); gradual smooth boundary.

A12–15 to 23 inches; brown (10YR 4/3) loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 5 percent gravel by volume; many very fine, fine, common medium and coarse roots; neutral (pH 6.8); gradual smooth boundary.

B21t–23 to 34 inches; dark yellowish brown (10YR 4/4) gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces; 15 percent gravel and 10 percent cobbles by volume; common very fine and fine and few medium and coarse roots; many very fine and few fine pores; neutral (pH 6.8); clear wavy boundary.

B22t–34 to 44 inches; brown (10YR 4/3) gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces and pores; 20 percent gravel and 10 percent cobbles by volume; common moderately thick clay films on ped faces and pores; 20 percent gravel and 10 percent cobbles by volume; common very fine and fine, few medium and coarse roots; common fine pores; neutral (pH 6.8); clear wavy boundary.

B23t–44 to 59 inches; dark grayish brown (10YR 4/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films on ped faces and pores; 30 percent gravel and 10 percent cobbles by volume; common very fine and fine, few medium and coarse roots; common fine pores; neutral (pH 6.8); clear wavy boundary.

B24t–59 to 69 inches; dark grayish brown (10YR 4/2) extremely cobbly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few to common thin clay films on ped faces and pores; 30 percent gravel and 35 percent cobbles by volume; common very fine and fine, few medium roots; common very fine and fine pores; neutral (ph 6.8); clear wavy boundary.

Cr–69 to 72 inches; moderately weathered soft vesicular basalt which can be cut with a shovel.

Reference Pedon Location: Modoc County, California, about 30 feet east of road and about 700 feet east and 50 feet north of the SW corner of Section 18, T.45N., R.11E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches in some pedons and greater than 40 inches in others. The control section averages 25 to 35 percent clay content and also averages 10 to 35 percent by volume coarse fragments. The mean annual soil temperature at a depth of 20 inches is 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 15 through November 15 in most years. The 4 to 12 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 through October 30.

The A horizon is 11 to 23 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2,/4/4 and moist

color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2; 5YR 3/2, 3/3. Texture is loam and normally contains less than 15 percent by volume coarse fragments. Structure is granular or subangular blocky and soil pH is slightly acid to neutral.

The B horizon normally occupies the remainder of the soil and have dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/2, 4/4, 5/4; 5YR 4/3, 4/4, 5/3, 5/4 and moist color of 10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/4, 4/4; 5YR 3/3, 4/3, 4/4. The upper parts of the argillic B horizon has mollic color and may include the whole soil depth. Texture is clay loam or loam and contains from 10 to 65 percent by volume coarse fragments which become greater in percent with depth. Structure is prismatic or subangular blocky, and soil pH is slightly acid to neutral.

SUPERVISOR FAMILY

The Supervisor family consists of moderately deep, well drained soils that formed in andesite or tuff. Permeability is moderate. These soils are on 10 to 80 percent slopes and occur on toeslopes and sideslopes of mountain uplands at 7000 to 9800 feet elevation. The climate is cold with 34 to 40°F mean annual air temperature and 25 to 35 inches annual precipitation which falls mostly as snow during the winter. The frost free season is less than 30 days to 70 days.

Taxonomic Class: Loamy-skeletal, mixed, Typic Cryoborolls.

Reference Pedon: Supervisor family gravelly fine sandy loam on a 40 percent east facing mountain sideslope at 7660 feet elevation under lodgepole pine and western white pine forest with a sparse understory of prostrate manzanita and few grasses. Soil was dry below 5 inches when described on 9/17/80. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; lodgepole pine needles and twigs.

A11–0 to 5 inches; dark grayish brown (10YR 4/2) gravelly fine sandy loam, black (10YR 2/1) moist; weak to moderate fine granular structure; slightly hard, very friable, nonsticky and nonplastic; 20 percent gravel by volume; common very fine, fine and medium roots; slightly acid (pH 6.2); clear smooth boundary.

A12–5 to 12 inches; brown (10YR 5/3) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure which parts into weak to moderate fine granular; slightly hard, very friable, nonsticky and nonplastic; 30 percent gravel by volume; common very fine, fine, medium and coarse roots; medium acid (pH 6.0); gradual wavy boundary.

B21–12 to 18 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; slightly hard, very friable; nonsticky and nonplastic; 35 to 40 percent gravel by volume; common very fine, fine and medium and few coarse roots; few to common very fine, fine and medium pores; medium acid (pH 5.8); gradual wavy boundary.

B22–18 to 26 inches; yellowish brown (10YR 5/4) very gravelly sandy loam; dark yellowish brown (10YR 3/4) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; 55 to 60 percent gravel by volume; common very fine, fine and medium and few coarse roots; few to common very fine and fine pores; medium acid (pH 5.8); clear smooth boundary.

Cr–26 to 37 inches; very pale brown (10YR 7/3) and strong brown (7.5YR 4/6) weathered in place tuff conglomerate which can be dug with a spade.

R–37 plus inches; slightly weathered andesite and conglomerated tuff.

Reference Pedon Location: Modoc County, California, about 40 feet upslope from road and about 700 feet east and 100 feet south of the NW corner of Section 4, T.44N., R.15E.

Range in Characteristics: Depth to a lithic or paralithic contact ranges from 20 to 40 inches. The mean annual soil temperature at the 20 inch depth is about 36 to 42°F. The soil temperature at the 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10. The coarse fragment content of the control section averages 35 to 70 percent by volume and the clay content averages 12 to 18 percent.

The A horizon is 8 to 16 inches in depth and have dry color of 10YR 4/2, 4/3, 5/3 or 5/4 and moist color of 10YR 2/1, 2/2, 3/2 or 3/3. Texture is fine sandy loam or sandy loam with 15 to 50 percent by volume coarse fragments consisting mainly of gravel size with lesser amounts of cobbles. Structure is granular or subangular blocky and soil pH is medium acid to slightly acid.

The B horizon normally occupies the remainder of the soil with dry color of 10YR 5/4, 5/6, 6/3, 6/4; 7.5YR 5/4, 5/6 and moist color of 10YR 3/4, 4/3, 4/4, 4/6; 7.5YR 3/4, 4/4 or 4/6. Texture is sandy loam or fine sandy loam and contains from 35 to 75 percent by volume coarse fragments predominately of gravel size. Structure is subangular blocky and soil pH is medium acid to slightly acid.

VIPONT FAMILY

The Vipont family consists of moderately deep, well drained soils that formed from andesite and basalt. permeability is moderately slow. These soils are on 15 to 35 percent slopes and occur on mid to lower sideslopes, toeslopes and drainageways of mountain uplands at 5500 to 7000 feet elevation. The climate is cool with 40 to 46°F mean annual air temperature and 20 to 22 inches annual precipitation which mostly falls as snow during the winter. The frost free season is 60 to 90 days.

Taxonomic Class: Loamy-skeletal, mixed, frigid, Pachic Argixerolls.

Reference Pedon: Vipont family very gravelly loam on a 20 percent east facing mountain sideslope at 6300 feet elevation under mountain mahogany, big sagebrush, squawcarpet, greenleaf manzanita, mule ears and various bunchgrasses and a few encroaching white fir and ponderosa pine. Soil was dry below 9 inches when described on 11/4/81. (Colors are for dry soil unless otherwise noted.)

A11-0 to 9 inches; brown (7.5YR 4/2) very gravelly loam, dark brown (7.5YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 35 percent gravel by volume; many very fine, fine and medium and common coarse roots; neutral (pH 6.8); gradual wavy boundary.

A12-9 to 16 inches; brown (7.5YR 4/2) very gravelly loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure which parts into weak to moderate granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 30 percent gravel and 10 percent cobbles by volume; many very fine and fine and common medium and coarse roots; common to many very fine and fine and common medium and coarse pores; neutral (pH 6.8); clear smooth boundary.

B21t–16 to 21 inches; brown (7.5YR 4/4) very gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky stucture; slightly hard, friable, sticky and plastic; few thin clay films on ped faces and pores; 10 percent cobbles and 45 percent gravel by volume; common very fine and fine and few coarse roots; common very fine and fine and few coarse pores; neutral (pH 6.8); clear wavy boundary.

B22t–21 to 27 inches; brown (7.5YR 5/4) very cobbly clay loam, dark brown (7.5YR 3/4) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; few to common thin clay films on ped faces and pores; 35 percent cobbles and 20 percent gravel by volume; common medium and fine and few coarse roots; common medium and fine pores; neutral (pH 6.8); gradual wavy boundary.

B23t–27 to 32 inches; brown (7.5YR 5/4) extremely cobbly clay loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common thin clay films on ped faces and pores; 35 percent cobbles and 35 percent gravel by volume; few to common very fine and fine and few medium roots; common to many very fine and fine continuous tubular pores; neutral (pH 6.6); abrupt smooth boundary.

Cr–32 plus inches; reddish gray (5YR 5/2) weathered soft vesicular basalt which can be dug with a spade.

Reference Pedon Location: Lassen County, California, about 1700 feet east and 110 feet south of the NW corner of Section 11, T.38N., R.11E.

Range in Characteristics: Depth to a lithic contact of fractured basalt or andesite is 20 to 40 inches. The mean annual soil temperature at a depth of 20 inches is about 42 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 20 through May 15, and dry in all parts from July 20 through October 20. The average coarse fragment content of the control section is 35 to 70 percent by volume, and also averages 24 to 35 percent clay.

The A horizon is 10 to 20 inches thick with dry color of 10YR 4/2, 4/3, 5/2, 5/3; 7.5YR 4/2, 4/4 and moist color of 10YR 2/2, 3/2, 3/3; 7.5YR 3/2. Texture is loam and contains 15 to 40 percent by volume rock fragments. Structure is granular to subangular blocky and soil pH is neutral to slightly acid.

The B horizon makes up the remainder of the soil depth with dry color of 10YR 4/2, 4/3, 4/4, 5/3, 5/4; 7.5YR 4/4, 5/4 and moist color of 10YR 3/2, 3/3, 3/4; 7.5YR 3/2, 3/4, 4/4. The upper parts of the argillic B horizon has mollic color and may include the whole soil depth. Texture is loam or clay loam and contains from 35 to 70 percent by volume rock fragments. Structure is subangular blocky and soil pH is neutral to slightly acid.

WAPAL FAMILY

The Wapal family consists of deep, somewhat excessively drained soils derived from andesite, tuff and obsidian. Permeability is moderately rapid. These soils are on 20 to 90 percent slopes and occur on upper sideslopes, ridges, knolls and deeply incised drainages of mountain uplands at 5500 to 7000 feet elevation. The climate is cool with 40 to 46°F mean annual air temperature and 20 to 30 inches annual precipitation which mainly falls as snow during winter. The frost free season is 60 to 90 days.

Taxonomic Class: Sandy-skeletal, mixed, frigid, Typic Xerorthents.

Reference Pedon: Wapal family gravelly fine sandy loam on a 30 percent north facing mountain sideslope at 5680 foot elevation under a young open stand of ponderosa pine with an understory of Ceonothus, rabbitbrush, big sagebrush and bunchgrass. Soil was dry throughout when described on 9/22/80. (Colors are for dry soil unless otherwise stated.)

01–1/2 to 0 inches; ponderosa pine needles and twigs.

A1–0 to 2 inches; gray (10YR 5/1) gravelly fine sandy loam, very dark gray (10YR 3/1) moist; single grain and weak fine granular structure; loose, non-sticky and non-plastic; 20 percent gravel by volume; many very fine and fine, common medium and coarse roots; neutral (pH 6.6); clear smooth boundary.

AC–2 to 6 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, dark grayish brown (10YR 4/2) moist; single grain and weak fine granular structure; loose, non-sticky and non-plastic; 20 percent gravel by volume; many very fine and fine and common medium and coarse roots; neutral (pH 6.6); clear smooth boundary.

C1–6 to 24 inches; light gray (10YR 7/2) very gravelly loamy fine sand, brown (10YR 5/3) moist; weak fine subangular blocky structure parting to single grain; loose, non-sticky and non-plastic; 35 percent gravel by volume; common very fine, fine, medium and coarse roots; neutral (pH 6.8); gradual wavy boundary.

C2–24 to 35 inches; light gray (10YR 7/2) very gravelly loamy fine sand, grayish brown (10YR 5/2) moist; single grained to massive structure; loose, non-sticky and non-plastic; 55 percent gravel by volume; common very fine, fine and medium and few coarse roots; neutral (pH 6.8); gradual wavy boundary.

C3–35 to 60 inches; white (10YR 8/2) very gravelly loamy sand, light brownish gray (10YR 6/2) moist; single grained; loose, non-sticky and non-plastic; 40 percent gravel and 15 percent cobbles by volume; few very fine, fine and medium roots; neutral (pH 6.8).

Reference Pedon Location: Modoc County, California, about 40 feet upslope from road and about 2000 feet east and 2500 feet south of the NW corner of Section 14, T.45N., R.14E.

Range in Characteristics: Depth to bedrock is greater than 40 inches. Coarse fragments in the 10 to 40 inch control section average 35 to 60 percent by volume. The mean annual soil temperature at a depth of 20 inches is 41 to 47°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from June 15 through October 15 in most years. The 6 to 18 inch soil moisture control section is usually moist in all parts from November 15 through May 30 and dry in all parts from August 1 through October 20.

The A horizons are 2 to 6 inches thick with dry color of 10YR 5/1, 5/2, 5/3, 6/2 and moist color of 10YR 3/1, 3/2, 3/3, 4/2, 4/2. Texture is fine sandy loam or sandy loam and contains from 15 to 45 percent by volume gravel size coarse fragments. Structure is granular and soil pH is neutral to slightly acid.

The C horizons make up the remainder of the soil with dry color of 10YR 6/3, 6/4, 7/2, 7/3, 8/2 and moist color of 10YR 4/2, 5/2, 5/3, 6/2, 6/3. Texture is loamy fine sand or loamy sand or sand and becomes sandier with depth and contains from 35 to 70 percent by volume coarse fragments primarily of the gravel size. It is massive or single grained and soil pH is neutral to slightly acid.

WENATCHEE FAMILY

The Wenatchee family consists of moderately deep, well drained soils that formed from material derived from ash, basalt and geologically recent pyroclastic pumice. Permeability is moderate. These soils are on 1 to 40 percent slopes and occur on gentle concave areas on basalt plateaus, basalt plateaus scarp breaks, or on sideslopes of mountain uplands at 4200 to 5500 feet elevation. The climate is cool with 45 to 50°F mean annual air temperature and 10 to 16 inches annual precipitation which mostly falls as snow during winter. The frost free season is 90 to 110 days.

Taxonomic Class: Fine-loamy, mixed, mesic, Xerollic Haplargids.

Reference Pedon: Wenatchee family gravelly coarse sandy loam on a nearly level basalt plateau at 4240 feet elevation under big sagebrush, rabbitbrush, and bunchgrass rangeland with a few scattered western juniper. Soil was moist below 9 inches when described on 5/22/80. (Colors are for dry soil unless otherwise stated.)

A1–0 to 5 inches; brown (10YR 5/2) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, non-sticky and non-plastic; 30 percent less than 3/4 inch size gravel by volume, gravels are pumice; few very fine and fine roots; neutral (pH 6.6); abrupt smooth boundary.

C1–5 to 9 inches; very pale brown (10YR 7/3) extremely gravelly coarse loamy sand, light yellowish brown (10YR 6/4) moist; single grained; loose, non-sticky and non-plastic; 60 percent less than 3/4 inch size pumice gravel by volume; common very fine and fine roots; neutral (pH 6.8); abrupt smooth boundary.

IIA1b–9 to 15 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; soft, friable, slightly sticky and non-plastic; 10 percent gravel by volume; few fine roots; many very fine and fine pores; neutral (pH 6.8); gradual wavy boundary.

IIB2tb–15 to 27 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on ped faces; 5 percent gravel by volume; common very fine roots; common very fine and fine, and few medium pores; neutral (pH 6.8); abrupt smooth boundary.

R–27 plus inches; hard fractured vesicular basalt.

Reference Pedon Location: Modoc County, California, about 500 feet south of the center of Section 7, T.45N., R.5E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. Clay content increases with depth and the control section averages 22 to 28 percent clay. Coarse fragments range from 5 to 35 percent by volume in the control section. The mean annual soil temperature at the 20 inch depth is about 47 to 53°F. and fluctuates by more than 9°F. during the year. The soil temperature at the 20 inch depth exceeds 41°F. from April 1 through December 1. The soils 4 to 12 inch moisture control section is usually dry in all parts from June 15 through November 15, and moist in all parts from December 15 through May 1.

A thin relatively undisturbed pumice overburden is present in soil map unit 140 and some pedons in unit 121 and 239. The pumice overburden consists of an approximate 900 year old pumice deposit of up to 12 inches and normally has an A and sometimes an A-C horizon development in the deeper deposits. The A horizon is 2 to 8 inches thick and has dry color of 10YR 5/2, 5/3, 6/2, 6/3, 6/4 and moist color of 10YR 3/2, 3/3, 4/2, 4/3. Texture is sandy loam, coarse sandy loam or coarse loamy sand and contains 30 to 60 percent by volume pumice gravel mainly of the less than 0.6 inch size. The pumice overburden C horizon, if present, has dry color of 10YR 6/3, 6/4, 7/2, 7/3, 8/2 or 8/3 and moist color of 10YR 5/4, 6/3, 6/4, 7/2 or 7/3. Texture is coarse sand or coarse loamy sand and contains 60 to 90 percent by volume pumice gravel mainly of the less than 1 inch size. The shallower pumice overburden areas are usually mixed with the older buried soil material. The pumice overburden pH is neutral to slightly acid.

The loamy textured mixed minerology soil beneath the pumice overburden, if present, has an A-B horizon development.

The A horizon is 3 to 6 inches thick and has dry color of 10YR 5/4, 6/3, 6/4; 7.5YR 5/4, 5/6 and moist color of 10YR 3/4, 4/2, 4/3; 7.5YR 3/4, 4/2. Texture is loam or fine sandy loam and contains 5 to 20 percent by volume

basalt gravel. Structure is subangular blocky and soil pH is neutral.

The B horizon has dry color of 10YR 5/4, 6/2, 6/3, 6/4 and moist color of 10YR 3/4, 4/2, 4/3, 4/4. Texture is loam or clay loam and contains from 5 to 35 percent by volume coarse fragments of basalt. Structure is subangular blocky and soil pH is neutral.

WOODHURST FAMILY

The Woodhurst family consists of deep, well drained soils formed in material derived from basalt. Permeability is moderate. These soils are on 10 to 30 percent slopes and occur on toeslopes and sideslopes of mountain uplands at 7000 to 8000 feet elevation. The climate is cold with 36 to 40°F mean annual air temperature and 25 to 35 inches annual precipitation which mostly falls as snow during winter. The frost free season is 40 to 70 days.

Taxonomic Class: Loamy-skeletal, mixed, Argic Pachic Cryoborolls.

Reference Pedon: Woodhurst family cobbly fine sandy loam on a 14 percent north facing sideslope at 7680 feet elevation under white fir and lodgepole pine forest. Soil was dry when described on 8/11/80. (Colors are for dry soil unless otherwise stated.)

01–3 to 0 inches; white fir and lodgepole pine needles, twigs and duff.

A11–0 to 5 inches; brown (10YR 4/3) cobbly fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky and non-plastic, 30 percent cobbles, stones and gravel by volume; many very fine and fine, common coarse and medium roots; neutral (pH 6.8); clear smooth boundary.

A12–5 to 14 inches; brown (10YR 4/3) very stony loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and non-plastic; 20 percent stones; 20 percent cobbles and 15 percent gravel by volume; many very fine, fine, medium and coarse roots; neutral (pH 6.6); gradual wavy boundary.

A13-14 to 25 inches; yellowish brown (10YR 5/4) extremely stony loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and non-plastic 25 percent stones, 30 percent cobbles and 10 percent gravel by volume; common to many very fine, fine, medium and coarse roots; common very fine and fine and few medium pores; slightly acid (pH 6.4); gradual wavy boundary.

B21t–25 to 34 inches; yellowish brown (10YR 5/4) very stony loam, dark brown (10YR 3/3) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; few thin clay films on ped faces; 20 percent stones; 15 percent cobbles, and 15 percent gravel by volume; common very fine, fine, medium and coarse roots; few to common very fine and fine and few medium pores; slightly acid (pH 6.2); gradual wavy boundary.

B22t–34 to 60 inches; yellowish brown (10YR 5/4) very cobbly loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, sticky and slightly plastic; few to common thin clay films on ped faces and pores; 25 percent cobbles, 10 percent stones and 10 percent gravel by volume; common very fine and fine and few to common medium and coarse roots; few to common very fine and fine and few medium pores; medium acid (pH 6.0).

Reference Pedon Location: Modoc County, California, about 30 feet east of log landing and about 2500 feet west and 600 feet north of the SE corner of Section 3, T.40N., R.15E.

Range in Characteristics: Depth to a lithic contact is greater than 40 inches. The mean annual soil temperature at the 20 inch depth is about 36 to 42°F. The soil temperature at 20 inch depth exceeds 41°F. from July 1 through October 30 and exceeds 47°F. from July 20 through September 20 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 5 to 15 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 15 through October 10. The rock fragment content of the control section averages 35 to 65 percent by volume and the clay content averages 20 to 30 percent.

The A horizon is 20 to 34 inches thick. Soil color is 10YR 3/2, 3/3, 4/2, 4/3, 5/3, 5/4 dry and 10YR 2/2, 3/2, 3/3 moist. Texture is loam or fine sandy loam and contain 20 to 50 percent by volume rock fragments of basalt gravel, cobble or stone size fragments. Structure is granular or subangular blocky and soil pH is moderately acid to neutral.

The B horizon normally occupies the remainder to the soil with dry color of 10YR 4/4, 5/4, 5/6; 7.5YR 4/4, 5/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/3, 4/4; 7.5YR 3/2, 3/4, 4/4; 5YR 3/3, 3/4. Texture is loam or clay loam and contains from 35 to 75 percent by volume rock fragments. Structure is subangular blocky and soil pH is medium acid to slightly acid.

WRENTHAM FAMILY

The Wrentham family consists of moderately deep, well drained soils formed in andesite and basalt. Permeability is moderate. These soils are on 10 to 35 0ercent slopes and occur on sideslopes and toeslopes of mountain uplands at 4600 to 5600 feet elevation. The mean annual air temperature is 44 to 49°F. The annual precipitation is 12 to 14 inches which mostly falls during winter as snow. The frost free season is 80 to 110 days.

Taxonomic Class: Loamy-skeletal, mixed, mesic, Pachic Haploxerolls.

Reference Pedon: Wrentham family very gravelly loam on an 18 percent southwest facing mountain sideslope at 5300 feet elevation under crested wheatgrass, Idaho fescue, cheatgrass and sandberg bluegrass rangeland. Soil was moist throughout when described on 4/7/81. (Colors are for dry soil unless otherwise stated.)

A11–0 to 4 inches; dark grayish brown (10YR 4/2) very gravelly loam, black (10YR 2/1) moist; weak to moderate medium and coarse granular structure; slightly hard, very friable, sticky and slightly plastic; 50 percent gravel by volume; many very fine and fine roots; neutral (pH 6.8); gradual wavy boundary.

A12–4 to 14 inches; grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak to moderate medium and coarse granular structure; slightly hard, friable, sticky and slightly plastic; 40 percent gravel by volume; many very fine and common fine roots; neutral (pH 6.8); clear wavy boundary.

A13–14 to 23 inches; brown (10YR 5/3) very gravelly loam, dark brown (10YR 3/3) moist; moderate coarse granular to massive structure; slightly hard, friable, sticky and slightly plastic; 45 percent gravel by volume; common very fine and fine roots; few to common very fine and fine pores; neutral (pH 6.6); clear wavy boundary.

C1–23 to 33 inches; pale brown (10YR 6/3) very gravelly loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, sticky and slightly plastic; 55 percent gravel by volume; few to common very fine roots; few to common very fine and fine pores; slightly acid (pH 6.4); abrupt wavy boundary.

R–33 plus inches; fractured platy andesite.

Reference Pedon Location: Modoc County, California, about 2000 feet west and 800 feet north of the SE corner of Section 13, T.46N., R.6E.

Range in Characteristics: Depth to bedrock of platy andesite or basalt is 20 to 40 inches. The control section averages 20 to 24 percent clay and also averages 35 to 65 percent coarse fragments by volume. The mean annual soil temperature at 20 inches is about 47 to 52°F. and fluctuates by more than 9°F. during the year. The soil temperature at 20 inches exceeds 41°F. from April 1 through December 1 in most years. The 5 to 15 inch soil moisture control section is usually dry in all parts from June 15 through November 15 and moist in all parts from December 15 through May 1.

The A horizon is 20 to 32 inches thick and may include the whole soil depth with dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4 and moist color of 10YR 2/1, 2/2, 3/2, 3/3. Texture is loam or fine sandy loam and contains from 20 to 60 percent by volume coarse fragments primarily of the gravel size. Structure is granular of subangular blocky and soil pH is neutral.

The C horizon, if present, has dry color of 10YR 6/3, 6/4, 7/2, 7/3 and moist color of 10YR 4/3, 5/2, 5/3 or 5/4. Texture is loam or sandy loam and contains from 45 to 80 percent by volume coarse fragments primarily of gravel size. It is massive and soil pH is neutral to slightly acid.

WUKSI FAMILY

The Wuksi family consists of moderately deep, somewhat excessively drained soils formed from ash, cinders, andesite, basalt and geologically recent pyroclastic pumice. Permeability is rapid. These soils are on 5 to 30 percent slopes and occur along the contact of cinder cones and basalt flows in the caldera area of the Medicine Lake Highlands at 6600 to 7000 feet elevation. The climate is cold with 38 to 40°F mean annual air temperature and 40 to 45 inches annual precipitation which mostly falls during winter as snow. The frost free season is 40 to 80 days.

Taxonomic Class: Ashy-skeletal, Typic Cryorthents.

Reference Pedon: Wuksi family gravelly coarse sand on a 6 percent south facing slope at 7000 feet elevation under red fir, lodgepole pine and western white pine forest with an understory of prostrate manzanita. (Colors are for dry soil unless otherwise stated.)

01–1 to 0 inches; fir and pine needles, twigs and duff.

C1–0 to 8 inches; light gray (10YR 7/2) gravelly coarse sand, light brownish gray (10YR 6/2) moist; single grained; loose, non-sticky and non-plastic; 20 percent pumice gravel by volume slightly acid; (pH 6.2) abrupt smooth boundary.

IIA1b–8 to 18 inches; pale brown (10YR 6/3) extremely gravelly loamy coarse sand, brown (10YR 4/3) moist; single grained; loose, non-sticky and non-plastic; 60 percent scoriacious andesite and pumice gravel by volume; slightly acid (pH 6.2); clear smooth boundary.

IIC1–18 to 32 inches; yellowish brown (10YR 5/4) extremely cobbly loamy coarse sand, dark yellowish brown (10YR 4/4) moist; single grained; loose, non-sticky and non-plastic; 30 percent cobbles and 50 percent gravel by volume of red scoriacious andesite; medium acid (pH 6.0).

R–32 plus inches; weathering in place fractured andesite and cinder rock.

Reference Pedon Location: Siskiyou County, California, about 40 feet north of road and about 600 feet west and 2400 feet south of the NE worner of Section 18, T.43N., R.4E.

Range in Characteristics: Depth to bedrock is 20 to 40 inches. Coarse fragments average 40 to 80 percent by volume in the control section. The mean annual soil temperature at a depth of 20 inches is about 40 to 42°F. and exceeds 41°F. from July 1 through October 30, and exceeds 47°F. from July 20 through September 25 in most years. The mean summer soil temperature at 20 inches is less than 47°F. The 6 to 18 inch soil moisture control section is usually moist in all parts from November 1 through June 15 and dry in all parts from August 20 through October 10 in most years.

The Wuksi family commonly has an approximate 900 year old pumice deposit of up to 8 inches in thickness. If present, the pumice deposit has dry color of 10YR 5/2, 5/3, 6/3, 6/4, 7/2, 7/3, 8/2, 8/3 and moist color of 10YR 4/2, 4/3, 4/4, 5/3, 6/2, 6/3, 7/2. Texture is loamy coarse sand or coarse sand and contains 20 to 50 percent by volume pumice gravel. It is single grained and soil pH is slightly acid to moderately acid.

The A horizon is 4 to 10 inches thick with dry color of 10YR 5/3, 5/4, 6/3, 6/4 and moist color of 10YR 3/4, 4/3, 4/4. Texture is loamy coarse sand or loamy sand and contains 35 to 70 percent by volume coarse fragments. It is single grained and soil pH is slightly acid to medium acid.

The C horizon has dry color of 10YR 5/4, 6/3, 6/4 and moist color of 10YR 4/4, 4/6, 5/3, 5/4. Texture is loamy coarse sand or coarse sand and contains 50 to 90 percent by volume coarse fragments. It is single grained and soil pH is slightly acid to medium acid.

XEROFLUVENTS

The Xerofluvents soils consist of moderately deep and deep, well drained soils that formed in alluvium on flood plains and fans and are normally adjacent to drainageways of intermittent or perennial streams. Slopes range from 1 to 10 percent and elevation ranges from 4,400 to 5,500 feet. Annual precipitation is 14 to 18 inches which falls mostly as snow during the winter and the mean annual air temperature is 45 to 50°F. The frost free season is 80 to 110 days.

Taxonomic Class: Xerofluvents

Reference Pedon: NOTE: The following pedon description is not necessarily intended to be the modal concept, but only as a reference pedon. Xerofluvents silty clay loam on a nearly level alluvial fan at 4,750 feet elevation under big sagebrush, rabbitbrush and bunchgrass rangeland. Soil was moist below 11 inches when described on 5/31/79. (Colors are for dry soil unless otherwise stated.)

A11-0 to 6 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium prismatic structure which parts to moderate fine and medium angular blocky; hard, friable, sticky and plastic; many fine, very fine and few medium roots; common to many fine and very fine pores; neutral (pH 6.8); abrupt smooth boundary.

IIA12–6 to 11 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky and nonplastic; 5 percent gravel by volume; common to many fine, very fine and common medium roots; common fine and very fine pores; neutral (pH 7.2) abrupt smooth boundary.

IIA13–11 to 16 inches; grayish brown (2.5Y 5/2) coarse sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable, non-sticky and nonplastic; 5 percent gravel by volume; common fine, very fine and medium roots; mildly alkaline (pH 7.4); abrupt smooth boundary.

IIIA14–16 to 26 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, non-sticky and non-plastic; common to many fine, very fine and common medium roots; common fine and very fine pores; mildly alkaline (pH 7.6); clear wavy boundary.

IIIA15–26 to 37 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine, very fine and medium roots; common fine and very fine pores; moderately alkaline (pH 8.0); abrupt smooth boundary.

IVC–37 to 60 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; moderate medium and coarse platy structure; slightly hard, friable, non-sticky and non-plastic; few fine and very fine roots; mildly alkaline (pH 7.4).

Reference Pedon Location: Modoc County, California, about 30 feet east of road and about 1,000 feet west and 2,300 feet south of the NE corner of Section 18, T.47N., R.13E.

Range in Characteristics: Depth to bedrock is greater than 20 inches. The control section averages 12 to 35 percent clay content and coarse fragments average 0 to 45 percent by volume. The mean annual soil temperature at a depth of 20 inches is about 47 to 52°F. and exceeds 41°F. from April 1 through December 1 and exceeds 47°F. from April 15 through November 15 in most years. The 5 to 15 inch soil moisture control section is usually moist in all parts from December 1 through May 1 and dry in all parts from July 1 through October 30. This soil is subject to spring flooding. The organic carbon content of the soil decreases irregularly with depth.

The A horizon may make up the whole soil depth with dry color of 10YR 4/1, 4/2, 4/3, 5/2, 5/3, 5/4, 6/2, 6/3; 2.5Y 5/2, 5/4 and moist color of 10YR 3/1, 3/2, 3/3, 3/4, 4/2, 4/3; 2.5Y 4/2. Texture is loamy sand, coarse sandy loam, sandy loam, loam, silt loam, silty clay loam, clay loam or clay and commonly occur in stratified lenses of 1 to 6 inches in thickness. Coarse fragments range from 0 to 60 percent by volume and are predominately of gravel size. Structure is platy, blocky, prismatic, massive or singly grained and soil pH is neutral to moderately alkaline.

The C horizon, if present, has dry color of 10YR 6/3, 6/4, 7/2, 7/3, 7/4; 2.5Y 6/4, 7/4 and moist color of 10YR 5/2, 5/3, 5/4, 6/3, 6/4; 2.5Y 5/2, 5/4, 6/4. Texture is sandy loam, coarse sandy loam, or loam and contains 0 to 40 percent by volume coarse fragments mainly of the gravel size. It is massive and soil pH is neutral to moderately alkaline.

YALLANI FAMILY

The Yallani family consists of deep, well drained soils formed from ash, cinder, andesite, basalt and geologically recent pumice. Permeability is moderately rapid, or, rapid over moderately rapid if a pumice overburden is present. These soils are on 5 to 60 percent slopes and occur on toeslopes, sideslopes, ridges and knolls of cinder cones and volcanic mountain uplands at 5300 to 7000 feet elevation. The climate is cool with 40 to 46°F mean annual air temperature and 20 to 45 inches annual precipitation which mostly falls as snow during winter. The frost free season is 60 to 90 days.

Taxonomic Class: Medial-skeletal, frigid, Andic Xerochrepts.

Reference Pedon: Yallani family gravelly sandy loam on a 5 percent south facing toeslope at 6440 foot elevation under a dense white fir forest with a sparce understory of current sp., and bunchgrasses. Soil was moist below about 10 inches when described on 7/10/80. (Colors are for dry soil unless otherwise stated.)

01–3 to 0 inches; mostly decomposed white fir needles and twigs.

A1–0 to 4 inches; brown (10YR 4/3) gravelly sandy loam, dark brown (10YR 3/3) moist; fine granular; soft, loose, non-sticky and non-plastic; 20 to 25 percent mixed pumice and basalt gravel by volume; common very fine, fine, and medium roots; weakly smeary; slightly acid (pH 6.4); clear smooth boundary.

B21–4 to 18 inches; brown (10YR 5/3) extremely cobbly fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable non-sticky and non-plastic; 5 to 10 percent cinder gravel, 20 percent basalt gravel and 40 percent basalt cobbles by volume; common very fine, fine, medium and coarse roots; few fine pores; weakly to moderately smeary; slightly acid (pH 6.4); gradual wavy boundary.

B22–18 to 39 inches; yellowish brown (10YR 5/4) extremely cobbly loam, dark yellowish brown (10YR 4/4) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and non-plastic; very few thin clay films on pores and ped faces; 20 percent cinder gravel, 20 percent basalt gravel and 30 percent basalt cobbles by volume; common very fine, fine, medium and coarse roots; few fine pores; weakly to moderately smeary; neutral (pH 6.6); clear wavy boundary.

B3–39 to 60 inches; light olive brown (2.5Y 5/4) extremely cobbly loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and non-plastic; very few thin clay films on pores and ped faces; 20 percent cinder gravel, 20 percent basalt gravel, and 40 percent basalt cobbles by volume; common very fine and fine and few medium and coarse roots; weakly to moderately smeary; neutral (pH 6.6).

Reference Pedon Location: Siskiyou County, California, about 1800 feet west and 2500 feet south of the NE corner of Section 26, T.43N., R3E.

Range in Characteristics: Depth to bedrock is greater than 40 inches. The mean annual soil temperature at a depth of 20 inches is about 42 to 47°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The 5 to 15 inch soil moisture control section is moist in all parts from about November 15 through May 30 and dry in all parts from about August 1 through October 20 in most years. The average rock fragment content in the 10 to 40 inch control section is 35 to 80 percent by volume and consists predominately of gravel and cobble size with few stones. The bulk density of the soil fine earth fraction is estimated to be between 0.50 and 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally in all parts of the upper 30 inches of soil.

In some units where the soil is mapped it has an approximate 900 year old pumice deposit of 6 to 20 inches thick. This deposit is always less than half the thickness of the underlying combined A and B horizons. The pumice overburden, if present, consists of an A, or an A-C horizon development in the deeper deposits. If present the pumice A horizon has dry color of 10YR 5/1, 5/2, 5/3, 6/2, 6/3 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3 and may be up to 8 inches thick. Texture is coarse loamy sand or coarse sandy loam and contains from 35 to 60 percent by volume pumice gravel. It is single grained and soil pH is moderately acid to slightly acid. The pumice overburden C horizon, if present,

has dry color of 10YR 7/2, 7/3, 8/2, 8/3 and moist color of 10YR 5/2, 6/2, 6/3, 7/2. Texture is coarse loamy sand or coarse sand and contains from 50 to 90 percent by volume pumice gravel. It is single grained and soil pH is moderately acid to slightly acid.

The more loamy textured soil beneath the pumice overburden, if present, has an A-B horizon development.

The A horizons are 4 to 9 inches thick and have dry color of 10YR 4/2, 4/3, 5/2, 5/3, 5/4, 6/3; 7.5YR 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/2, 4/3; 7.5YR 3/4, 4/2, 4/4. Textures are coarse sandy loam or sandy loam and contain 20 to 50 percent by volume cobbles and gravel. Mollic colors do not extend beyond 6 inches from the soil surface. Structure is granular or subangular blocky and soil pH is medium acid to slightly acid.

The B horizons have dry color of 10YR 5/3, 5/4, 6/4, 6/6; 7.5YR 6/4; 2.5Y 5/4, 6/4 moist color of 10YR 3/4, 4/4, 4/6, 5/4; 7.5YR 4/4. Textures are sandy loam, coarse sandy loam or loam and contain from 40 to 80 percent by volume cobble, stone and gravel size rock fragments. Structure is subangular blocky and soil pH is medium acid to neutral.

ZYNBAR FAMILY

The Zynbar family consists of moderately deep and deep, well drained soils derived from ash, cinder, andesite and basalt. Permeability is moderately rapid. These soils are on 2 to 35 percent slopes and occur on toeslopes and sideslopes of cinder cones, and volcanic mountain uplands at 5500 to 6600 feet elevation. The climate is cool with 42 to 46°F mean annual air temperature and 30 to 40 inches annual precipitation which mostly falls as snow during winter. The frost free season is 70 to 100 days.

Taxonomic Class: Medial, frigid, Entic Dystrandepts.

Reference Pedon: Zynbar family gravelly coarse sandy loam on a 32 percent southwest facing smooth mountain sideslope at 5780 feet elevation under dense buckbrush, greenleaf manzanita and chinquapin and a few scattered encroaching white fir and ponderosa pine. Soil was moist below 11 inches when described on 7/24/80. (Colors are for dry soil unless otherwise stated.)

A11–0 to 5 inches; brown (10YR 4/3) gravelly coarse sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, non-sticky and non-plastic; 25 percent gravel by volume of cinder with some pumice; common very fine and fine roots; weakly smeary and weakly thixotropic; neutral (pH 6.6); gradual smooth boundary.

A12–5 to 11 inches; dark yellowish brown (10YR 4/4) gravelly coarse sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine granular structure; soft, very friable, non-sticky and non-plastic; 20 percent cinder gravel by volume; common fine and medium roots; moderately smeary and moderately thixotropic; neutral (pH 7.0); clear smooth boundary.

B21–11 to 16 inches; yellowish brown (10YR 5/6) gravelly coarse sandy loam, dark yellowish brown (10YR 3/6) moist; weak fine and medium granular and subangular blocky structure; soft, very friable, non-sticky and non-plastic; 15 percent gravel by volume; few fine and medium roots; moderately smeary; neutral (pH 7.2); clear smooth boundary.

B22–16 to 34 inches; yellowish brown (10YR 5/6) gravelly coarse sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, non-sticky and non-plastic; 15 percent gravel by volume; moderately smeary; neutral (pH 6.8).

R–34 inches; hard fractured basalt.

Reference Pedon Location: Siskiyou County, California, about 450 feet west and 800 feet south of the NE corner of Section 3, T.42N., R.4E.

Range in Characteristics: Depth to bedrock is greater than 30 inches. The mean annual soil temperature at a depth of 20 inches is 43 to 47°F. The 4 to 12 inch soil moisture control section is usually moist in all parts from about November 15 through May 30. It is dry in all parts from about August 1 through October 20. The soil temperature at 20 inches exceeds 41°F. from May 15 through November 15 and exceeds 47°F. from June 15 through October 15 in most years. The average content of coarse fragments in the control section is 15 to 35 percent by volume. The bulk density of the soil fine earth fraction is estimated to be between 0.80 and 0.95 at 1/3 bar water tension and the ratio of measured clay to 15 bar water is less than 1.25 normally in all parts of the upper 30 inches of soil. The estimated base saturation is between 30 and 50 percent by the ammonium acetate method normally throughout the upper 30 inches of soil. The soil has weak to moderate smeary consistence throughout.

The A horizon is 6 to 13 inches thick with dry colors of 10YR 4/3, 4/4, 5/3, 5/4, 6/3; 7.5YR 5/4, 6/4 and moist color of 10YR 3/2, 3/3, 3/4, 4/3, 4/4; 7.5YR 3/4. The mollic color, if present, does not extend below 6 inches. Texture is coarse sandy loam, or sandy loam and contains 10 to 35 percent gravel size coarse fragments. Structure is granular of subangular blocky and soil pH is slightly acid to neutral.

The B horizon makes up the remaining soil and has dry color of 10YR 5/4, 5/6, 6/4, 6/6; 7.5YR 5/4, 5/6, 6/4 and moist color of 10YR 3/4, 4/6, 4/4, 4/6; 7.5YR 3/4, 4/4, 4/6. Texture is coarse sandy loam, sandy loam and commonly grades to a coarse loamy sand with depth and contains from 15 to 45 percent by volume coarse fragments. Structure is subangular blocky or granular and soil pH is medium acid to neutral.

Formation of the Soils

This section discusses the factors of soil formation, relates them to the formation of soils in the survey area, and explains the processes of soil formation.

Soil is a mixture of rocks and minerals, organic matter, and water and air, in varying proportions. The factors that cause soils to differ are (1) the physical and chemical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) biological forces; (4) relief, or lay of the land; and (5) the length of time the forces of development have acted on the soil material. The relative importance of each factor differs from place to place, but generally the interaction of all the factors determines the kind of soil that forms in any given place.

Parent Material

Generally, two types of rock, sedimentary and igneous, are dominant in the Modoc Forest. The sedimentary formations are remnants of prehistoric lake sediments. Volcanic rocks commonly cap these sedimentary formations or have been uplifted to form plateaus and mountains.

Parent material exerts considerable influence on soil formation. The influence of parent material is greatest in recently deposited materials and decreases with weathering and horizon differentiation. Recent alluvium, derived mostly from basalt, andesite, obsidian, and some pyroclastic rocks, is frequently stratified, is commonly poorly drained, is affected by saline or alkali salts, and has little or no horizon differentiation below the surface layer.

Old terraces and alluvial fan deposits, which are the older parts of the landscape, are derived from rocks similar to those contributing to the recent alluvium. Soils that formed in these materials have a clay subsoil and indurated pans or carbonate accumulations. The influence of parent materials on these soils has been modified and lessened by soil genesis.

The high uplands of the Modoc Forest have been dissected, but remnants of old landscapes are still evident. In places where hard tuff bedrock is prominent, there are areas of Tuff outcrop and the shallow, relatively infertile and easily eroded Casuse family soils. In other places where basalt bedrock is prominent there are areas of Rock outcrop and the shallow, clayey Deven family soils. In areas where older, more weathered basalt is prominent, the soils are deeper and have duripans and clay subsoil. The Puls family soils are an example of duripan soils.

Climate

Climate (temperature and precipitation) strongly affects soil formation through its influence on biological activity. Heat and moisture control the kind and amount of vegetation that grows, the rate at which organic matter decomposes, and the rate at which minerals weather. Moisture controls the removal or accumulation of soil material in the different soil horizons and the removal from the soil.

Temperature and precipitation in the survey area vary according to elevation. In general, temperatures are warmer at the lower elevations in valleys and are colder at the higher elevations on uplands. The amount of rainfall is higher in the upland areas and lower in the valleys. The valleys also receive some runoff from the uplands.

The distribution of moisture and temperature affects the kind of soils in the area. The climate of the Modoc Forest is characterized by cold, moist winters and dry, warm summers. A typical sequence of moisture and temperature is as follows: The first autumn rains wet the soil. Then snow falls before the ground freezes to any appreciable depth. Temperatures are too cold for plant growth. Precipitation is stored in the form of snow. The accumulated snow melts gradually in spring and combines with spring rain to produce a period of maximum moisture and soil leaching. In some years, rains and high temperatures early in spring result in rapid snow melt and high runoff. As temperatures increase, plant growth becomes rapid. Plants soon require more water that is supplied by precipitation, and the moisture stored in the soil is used. When this stored moisture is depleted, about June 20th to July 10th, most plant growth stops. From this date until the next autumn rains, little plant growth takes place. Detailed climatic data for the area are in the section "General Nature of the Area."

The depth to a zone of carbonate accumulation represents the depth to which the soil has been leached. This varies from year to year. The zone of maximum weathering and translocation of clay occurs where there is sufficient moisture. This is generally where the clayey subsoil horizon occurs. The depth to a silica cemented hardpan also generally represents the depth of leaching. Many

hardpans are just above a gravelly or cobbly layer. The difference in pore size between the gravelly or cobbly layers and the layers above affects the movement and retention of moisture. Most of the soils in the survey area have had relatively little leaching throughout the profile. The base saturation values tend to be high, and the exchangeable bases are mainly calcium, magnesium, sodium, and potassium.

Freezing and thawing generally occur late in fall, in winter, and early in spring, except when the ground is covered by snow. The effects of frost action are evidenced by heaving of plants, formation of thin surface cracks, segregation of coarse particles, and movement of saturated surface soil.

Biological Activity

Plants, animals, insects, bacteria, and fungi are important in the formation of soils. Vegetation is of particular importance. It affects the accumulation of organic matter in the surface layer and, through the penetration and decay of roots, throughout the soil. Organic matter is the energy source for the biological activity in the soil.

In the poorly drained soils the water-tolerant vegetation produces a large amount of organic matter. These soils have a thick, dark surface layer. Areas of sagebrush and grass or juniper, sagebrush, and grass produce less organic matter than other areas and the soils have a thinner surface layer.

The north slopes are protected from direct sunlight. Water utilization by plants is more efficient because evaporation is less. The soils on north exposures support more vegetation. The vegetation adds organic material to the soil and influences the color, structure, and physical condition of the soil. In this survey area, soils forming on north aspects are more prone to have mollic epipedon.

The kind of vegetation, by its influence on organic-matter content, has a strong influence on soil formation. Soils that formed under conifers, such as the Gleason and Lyonman Family soils, have a thin layer of undercomposed leaf litter on top of the mineral soil. This leaf litter, which provides a large proportion of the organic-matter content of these soils is low in bases.

Well drained soils generally have an abundant population of burrowing animals such as ground squirrels. These animals are active in mixing organic matter into the soil, and through their burrowing activities, they disturb soil horizon formation and increase the movement of air and water in the soil.

Shrubs on Packwood Family soils grow mostly on small mounds. These mounds are a result of soil blowing and the accumulation of organic matter under the shrubs.

Time

Soil formation needs time. The soils in the survey area differ in both age and maturity. Age refers to the length of time the soil has been forming; maturity refers to the degree that well defined genetically related horizons have formed and are approaching equilibrium with the environment. A soil may be old in years but young in development, if the parent material is very resistant to weathering. The geologic age of the parent rock, therefore, is not necessarily related to the age of the soil

The relationship between soil profiles and the relative age of the landscape on which they are located gives us some idea of how long it takes horizons to form. The recent landscapes, such as lake or basin deposits, stream alluvium, and recent alluvial fans, have soils which are mostly young in years and immature. These soils have had only enough time for organic matter to accumulate in their surface layer. The older landscapes like the intermediate alluvial fans, older alluvial fans, near-shore deposits, and lake deposits of Plio-pleistocene age have had time to weather and to form a clay subsoil. Profiles of the older soils are more mature. Some of the soils have had time to form a hardpan or zones of lime accumulation. Upland soils, which are mostly on the oldest landforms, almost all have some degree of horizon formation and a clay subsoil or hardpan. An exception is the Gleason soils. The Puls soils are the most mature of the soils on uplands.

A few soils in the survey area are on older landscapes but can be considered relatively immature. These soils have high shrink-swell properties. They have formed only a deep surface layer with accumulations of organic matter, and their cracking and churning has prevented the formation of other horizons. These soils are in horizon genesis, although they are mature in one sense by being in equilibrium with their environment (17).

Relief

Relief, or the shape of the landscape, influences formation of soils through its effect on drainage, erosion, plant cover, and soil temperature. Soils in depressional areas or along the borders of the Pit River have increased amounts of water and are somewhat poorly drained. The higher areas within the valley lack this additional water and are better drained. The upland areas are either flat plateaus or mountainous uplands. The flat plateaus have less runoff than the mountainous areas and are less

easily eroded. North-facing slopes receive less radiant energy from the sun and are cooler than south-facing slopes. This affects the vegetation and frequently results in formation of a different soil. Microrelief in the form of mounds and intermounds is common in certain parts of the Modoc Forest. These mounds occur at random on slopes of less than about 5 percent. There is marked orientation of the mounds up and down slopes that are much more than 15 percent.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. Soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Amorphous material. Noncrystalline constituents that either do not fit the definition of allophane or it is not certain if the constituent meets allophane criteria.

Andesite. A dark-colored, fine-grained extrusive rock that, when porphyritic, contains phenocrysts composed primarily of zoned sodic plagioclase (esp. andesine) and one or more of the mafic minerals (e.g., biotite, hornblende, pyroxene), with a groundmass composed generally of the same minerals as the phenocrysts, although the plagioclase may be more sodic and quartz is generally present; the extrusive equivalent of diorite. Andesite grades into latite with increasing alkali feldspar content, and into dacite with more alkali feldspar and quartz.

Animal-unit-month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Ash. Uncemented volcanic ejecta less than 4.0 mm in diameter.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Basalt [ign]. A general term for dark-colored mafic igneous rocks, commonly extrusive but locally intrusive (e.g. as dikes), composed chiefly of calcic plagioclase and clinopyroxene; the fine-grained equivalent of gabbro. Nepheline, olivine, orthopyroxene, and quartz may be present in the CIPW norm, but not all simultaneously: nepheline and olivine can occur together, as can olivine and orthopyroxene, and orthopyroxene and quartz, but nepheline does not coexist with orthopyroxene or quartz, nor quartz with nepheline or olivine.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep to very steep broken land at the border of an upland summit that is dissected by ravines.

Bulk density. The mass of dry soil per unit bulk volume; usually measured as grams per cubic centimeter.

Caldera. A large, basin-shaped volcanic depression, more or less circular in form. Two basic types are from explosion or collapse.

Canopy. The leafy crown of trees or shrubs (See Crown).

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Cinder. A juvenile vetric vesicular pyroclastic fragment that falls to the ground in an essentially solid condition.

Cinder cone. A conical hill formed by the accumulation of cinders and other pyroclasts, normally of basaltic or andesitic composition. Steepness of the slopes depends on coarseness of the ejecta, height of eruption, wind velocity, and other factors, but is normally greater than 10 degrees.

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

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

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

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

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

Compaction. The packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

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 resistence is distinctly noticeable.

Plastic. Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky. Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

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

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

Cemented. Hard; little affected by moistening.

Continental climate. Climate, as that in the interior of a continent, characterized by considerable variation in temperature and in other weather conditions.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 inches.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Drainage, surface. Runoff, or surface flow of water, from an area.

Durinodes. Silica-cemented soil aggregates.

Duripan. A subsurface horizon that is so cemented by silica that fragments from this horizon will not slake after prolonged soaking in water or hydrochloric acid. A duripan can also contain accessory cements, for example, calcium carbonate.

Effervescence. The fizz that results when diluted hydrochloric acid is applied to soil material that contains free carbonates.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents.

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

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

Evapotranspiration. Water transpired by vegetation plus that evaporated from the soil.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fault. A fracture or fracture zone along which there has been displacement on one side with respect to the other.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artifically.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (or 300 meters) and fringes a mountain range or high-plateau escarpment.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Geomorphology. The study of landforms as they relate to geologic composition and history.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 milimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons.

An explanation of the subdivisions is given in the Soil Survey Manual. The major horizons of mineral soil are as follows:

O horizon. An organic layer of fresh and decaying plant residue.

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

B horizon. The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon. The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the number 2 precedes the letter C.

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

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

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.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in iches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Lava flow. A lateral, surficial outpouring of molten lava from a vent or a fissure; also, the solidified body of rock that is so formed.

Lava plateau. A broad, elevated tableland or flat-topped highland, usually many hundreds or thousands of square kilometers in extent, underlain by a thick succession of lava flows, most of which are tholeiitic basalts and the product of fissure eruption. Syn: basaltic plateau.

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

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Microrelief. Minor surface irregularities in the land surface, for example, low mounds or shallow depressions.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence,

color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

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

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Munsell notation. A designation of color by degrees of the three simple variables hue, value, and chroma. For example, a notation of 10YR 6/4 is color in hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil).

Nurtient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Obsidian. A black or dark-colored volcanic glass, usually of rhyolite composition, characterized by conchoidal fracture. It is sometimes banded or has microlites.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Overburden. In this survey area relates to a relatively recent deposit of pyroclastic volcanic pumice of 2 to 40 inches of thickness which has been deposited over an older more developed soil.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, hardpan, fragipan, claypan, plowpan, and traffic pan.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material).

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil". A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 20 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil.

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

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

Physiographic position. Broad landforms based on the physical features of the landscape.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

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

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Potential native plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed. (See climax plant community).

Potential rooting depth (effecitve rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

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

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This increases the vigor and reproduction of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Pumice. A light-colored vesicular glassy rock commonly having the composition of rhyolite. It is often sufficiently buoyant to float on water and is economically useful as a lightweight aggregate and as an abrasive. The adjectival form, pumiceous, is usually applied to pyroclastic ejecta.

Pyroclastic. A general term applied to rocks formed from volcanic material that has been explosively or aerially ejected from a volcanic vent.

Rangeland. Land on which the potential natural vegetation is predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

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

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

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

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

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

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

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

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shield volcano. A volcano in the shape of a flattened dome, broad and low, built by flows of very fluid basaltic lava or by rhyolitic ash flows. Cf: lava shield; ignimbrite shield. Syn: lava dome; basaltic dome.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

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

Site class. A grouping of site indexes into 5 to 7 production capability levels. Each level can be represented by a site curve.

Site curve (100-year). A set of related curves on a graph that show the average height of dominant and codominate trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage. Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distnace, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Smeariness. The extent to which a soil exhibits smeariness determines whether or not it is thixotropic. Thixotrophy is the property exhibited by various gels of becoming fluid when disturbed and of setting again to a gel when allowed to stand. Thixotrophy apparently is the result of structure that, if broken down, can rebuild itself. The breakdown may be caused by any of several actions - agitation, shearing, even ultrasonic waves. In evaluating thixotropic soil material, force is applied to a standard test specimen at field moisture capacity until it smears. Classes are based on the degree of force applied.

> **Weakly smeary**: Under moderately strong force between thumb and forefinger, the soil material changes suddenly to fluid, the fingers skid, and the soil smears. After the soil smears, little or no free water remains on the fingers.
>
> **Moderately smeary**: Under moderate force between thumb and forefinger, the soil material changes suddenly to fluid, the fingers skid, and the soil smears. After the soil smears, little or no free water remains on the fingers.
>
> **Strongly smeary**: Under slight force between thumb and forefinger, the soil material suddenly changes to fluid, the fingers skid, and the soil smears and is very slippery. After the soil smears, free water is easily seen on the fingers

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

Soil separates. Mineral particles less than two millimeters (mms) in equivalent diameter and ranging between specified size limits. The names and sizes of

separates recognized in the United States are as follows:

Very coarse sand 2.0 to 1.0 mms
Coarse sand 1.0 to 0.5
Medium sand 0.5 to 0.25
Fine sand 0.25 to 0.10
Very fine sand 0.10 to 0.05
Silt 0.05 to 0.002
Clay less than 0.002

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

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

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

Substratum. The part of the soil below the solum.

Surface layer. As used in this survey refers to the a horizon and the organic layer if present.

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep, rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

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

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Upland (geology). Land at higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Vesicular crust. A dense, structureless, and highly porous surface soil layer from 1 to 3 inches thick, normally light in color and usually associated with arid or semiarid rangelands.

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

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

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

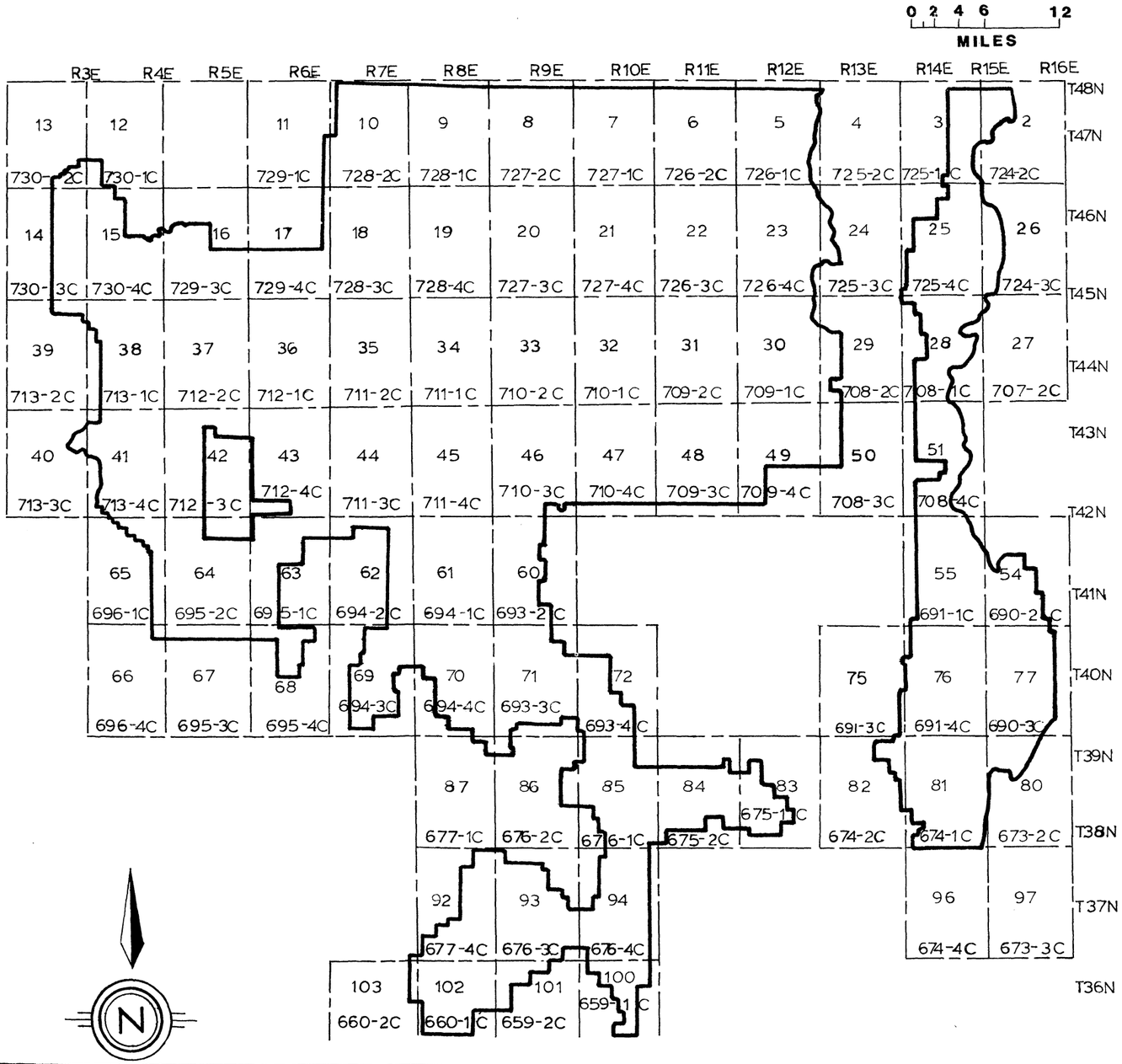
Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

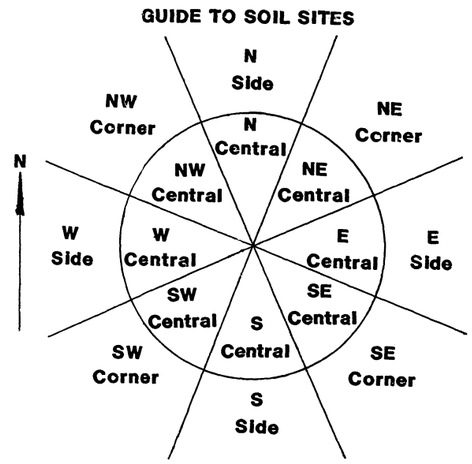
Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

INDEX TO MAP SHEETS

MODOC NATIONAL FOREST, CALIF.

(703 SOIL SURVEY AREA)





LOCATION OF REPRESENTATIVE SOIL PROFILES
(for precise location - refer to the reference pedon location of the detailed soil description)

SOIL FAMILY, or TAXONOMIC NAME	MAP SHEET	LOCATION	SOIL FAMILY, or TAXONOMIC NAME	MAP SHEET	LOCATION
Ahart	41 (713-4C)	S. Side	Kinzel	41 (713-4C)	N.W. Corner
Aikman	6 (726-2C)	E. Central	Lamondi	28 (708-1C)	S. Central
Alcot	37 (712-2C)	S.E. Corner	Lapine	42 (712-3C)	W. Side
Alicel	18 (728-3C)	S.W. Corner	Lawyer	63 (695-1C)	S.W. Corner
Anatone	84 (675-2C)	S. Side	Lithic Cryochrepts	28 (708-1C)	S.E. Corner
Aquolls	68 (695-4C)	W. Central	Lithic Xerorthents	69 (694-3C)	N. Side
Bakeoven	15 (730-4C)	S. Side	Lithic Xerumbrepts	64 (695-2C)	N.E. Corner
Barnard	81 (674-1C)	N.W. Central	Loberg	2 (724-2C)	N. Side
Bearskin	76 (691-4C)	S. Side	Los Gatos	35 (711-2C)	W. Side
Behanin	28 (708-1C)	S. Side	Manilla	55 (691-1C)	W. Side
Bertag	76 (691-4C)	E. Central	Mascamp	84 (675-2C)	S. Central
Bieber	31 (709-2C)	N.E. Central	Menzel	37 (712-2C)	S.E. Corner
Cardon	55 (691-1C)	S. Central	Merkel	81 (674-1C)	N.E. Corner
Castlevale	36 (712-1C)	W. Side	Merlin	55 (691-1C)	E. Side
Casuse	82 (674-2C)	E. Side	Neer	37 (712-2C)	S. Side
Cavanaugh	55 (691-1C)	E. Side	Packwood	31 (709-2C)	S. Side
Cheadle	28 (708-1C)	S. Side	Pass Canyon	20 (727-3C)	E. Side
Cowiche	10 (728-2C)	N.W. Corner	Patio	81 (674-1C)	E. Side
Cryoborolls, wet	77 (690-3C)	S. Side	Puls	25 (725-4C)	N. Side
DeMasters	76 (691-4C)	S.E. Central	Ridd	25 (725-4C)	W. Central
Deven	48 (709-3C)	S.E. Corner	Roval	31 (709-2C)	N.W. Corner
Dishner	15 (730-4C)	S. Center	Ruckles	81 (674-1C)	N.W. Corner
Ditchcamp	31 (709-2C)	S. Side	Sadie	64 (695-2C)	W. Central
Divers	40 (713-3C)	E. Side	Saprists	81 (674-1C)	N. Central
Duncom	28 (708-1C)	E. Side	Searles	38 (713-1C)	N.E. Corner
Elmore	62 (694-2C)	S.E. Corner	Sheld	41 (713-4C)	S. Side
Fordice	28 (708-1C)	N.W. Corner	Simpson	15 (730-4C)	W. Side
Friana	2 (724-2C)	W. Side	Skalan	36 (712-1C)	S.W. Corner
Gallatin	81 (674-1C)	E. Side	Smarts	81 (674-1C)	S. Central
Germany	63 (695-1C)	S.W. Corner	Stonewell	41 (713-4C)	S.E. Corner
Ginser	28 (708-1C)	N. Central	Stukel	15 (730-4C)	S.W. Corner
Gleason	25 (725-4C)	N.W. Central	Supan	31 (709-2C)	N.W. Corner
Gralic	28 (708-1C)	N.E. Corner	Supervisor	28 (708-1C)	E. Side
Gwin	38 (713-1C)	N.E. Corner	Vipont	84 (675-2C)	S. Central
Hades	84 (675-2C)	S.E. Corner	Wapal	28 (708-1C)	N. Side
Hiibner	60 (693-2C)	S.W. Corner	Wenatchee	16 (729-3C)	S. Side
Holland	36 (712-1C)	S.W. Corner	Woodhurst	76 (691-4C)	E. Side
Indian Creek	31 (709-2C)	S. Central	Wrentham	18 (728-3C)	W. Side
Inville	38 (713-1C)	S.W. Central	Wuksi	41 (713-4C)	E. Central
Jacket	69 (694-3C)	N. Side	Xerofluvents	5 (726-1C)	E. Side
Jacknife	44 (711-3C)	S.E. Corner	Yallani	41 (713-4C)	W. Side
Keating	9 (728-1C)	S. Central	Zynbar	42 (712-3C)	S.W. Corner

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

FT BIDWELL NW
7.5 MINUTE SERIES

FREMONT NATIONAL FOREST
MODOC NATIONAL FOREST
NATIONAL FOREST
FORT BIDWELL INDIAN RESERVATION
WILLAMETTE MERIDIAN
MT DIABLO MERIDIAN
OREGON
CALIFORNIA
LAKE CO
MODOC CO
Rock Lake
Cave Lake
Cave Lake Campground
Lily Lake
Lily Lake Picnic Area
Mineral Spring
Yellow Mtn
Poison Lake
Little Lily Lake
CONSOLIDATED MINES
BLUE BELL MINE
MODOC MINES
MOONLIGHT MINES
KLONDYKE MINES
Dismal Swamp
Dismal Creek
Twelvemile Cr
South Fork
Mt Bidwell
Bidwell Mtn
O'Connors Flat
Mt Vida
Mt Vida Vista
MORREL MINE
North Star Basin
N Fk Cottonwood Cr
Highgrade Spring
WARNER MOUNTAINS
NATIONAL RECREATION TRAIL
BOUNDARY
Larry Flat Campground
Bidwell Creek
Coyote Flat
Gaging Station
STORAGE BINS
BM
AIRSTRIP
SCHAEFER RD
(CRANE CREEK)
(CRANE MTN)
(COLLINS RIM)
(WILLOW RANCH NE)
(FORT BIDWELL NE)
(WILLOW RANCH SE)
(FORT BIDWELL SE)
(FORT BIDWELL SW)

Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

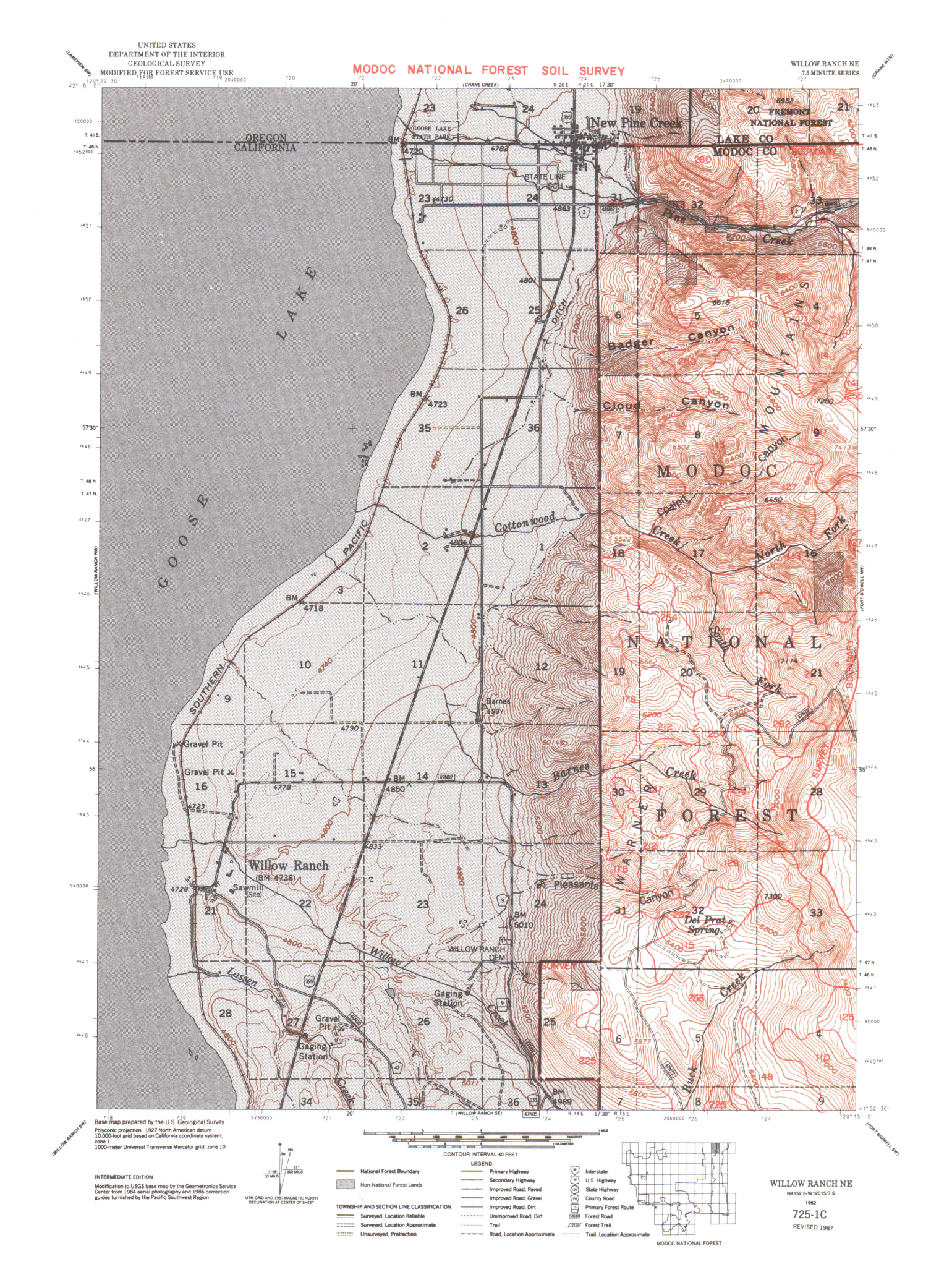
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

FT BIDWELL NW
N4152.5-W12007.5/7.5
1962
724-2C
REVISED 1987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WILLOW RANCH NE
7.5 MINUTE SERIES
OREGON
CALIFORNIA
LAKE
GOOSE
New Pine Creek
LAKE CO
MODOC CO
FREMONT
NATIONAL FOREST
MODOC
NATIONAL
FOREST
Willow Ranch
(BM 4738)
Sawmill
(Site)
Gravel Pit
Gaging Station
Cottonwood
Barnes
Pleasants
Cloud
Canyon
Badger
Pine
Creek
Willow
Lassen
Del Prat
Spring
WILLOW RANCH CEM
GOOSE LAKE STATE PARK
STATE LINE
PACIFIC
SOUTHERN
DITCH
SURVEY
(CRANE CREEK)
(WILLOW RANCH SE)
(WILLOW RANCH NW)
(FORT BIDWELL NW)
(LAKEVIEW SW)
(CRANE MTN)
(WILLOW RANCH SW)
(FORT BIDWELL SW)
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Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
CONTOUR INTERVAL 40 FEET
LEGEND
National Forest Boundary
Non-National Forest Lands
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate
MODOC NATIONAL FOREST
WILLOW RANCH NE
N4152.5-W12015/7.5
1962
725-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

WILLOW RANCH NW
7.5 MINUTE SERIES

Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

National Forest Boundary
Non-National Forest Lands

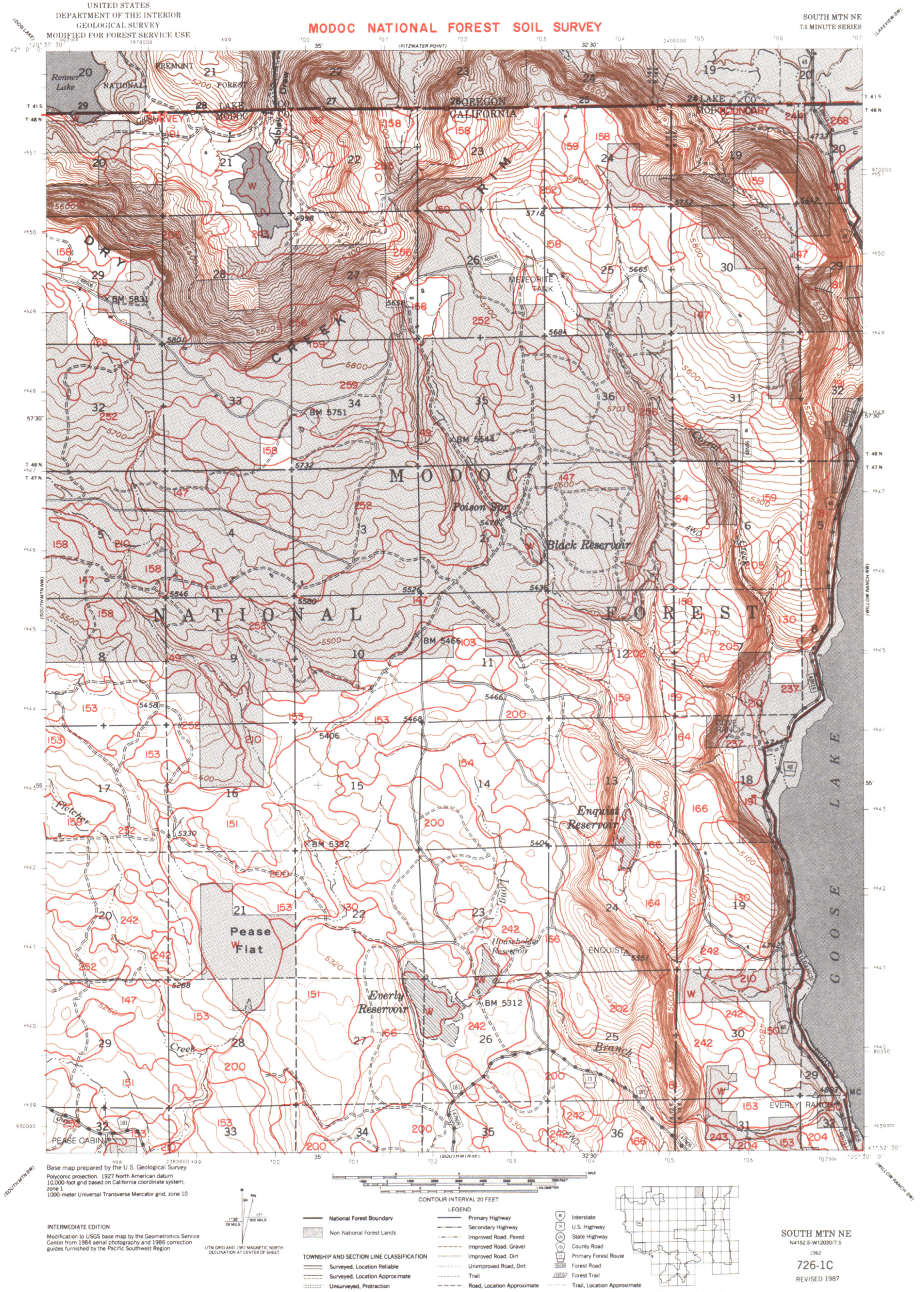
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction

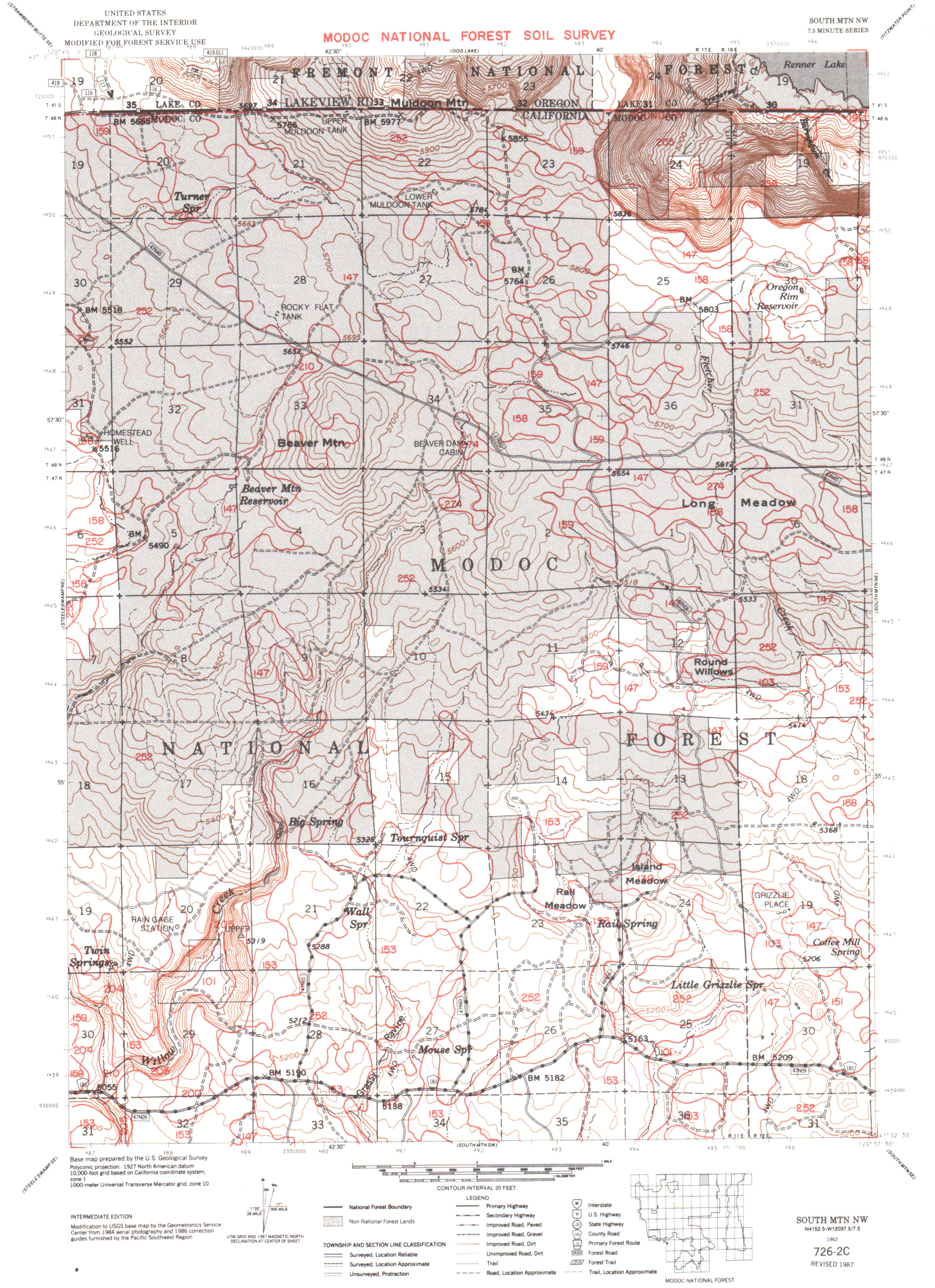
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate

Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate

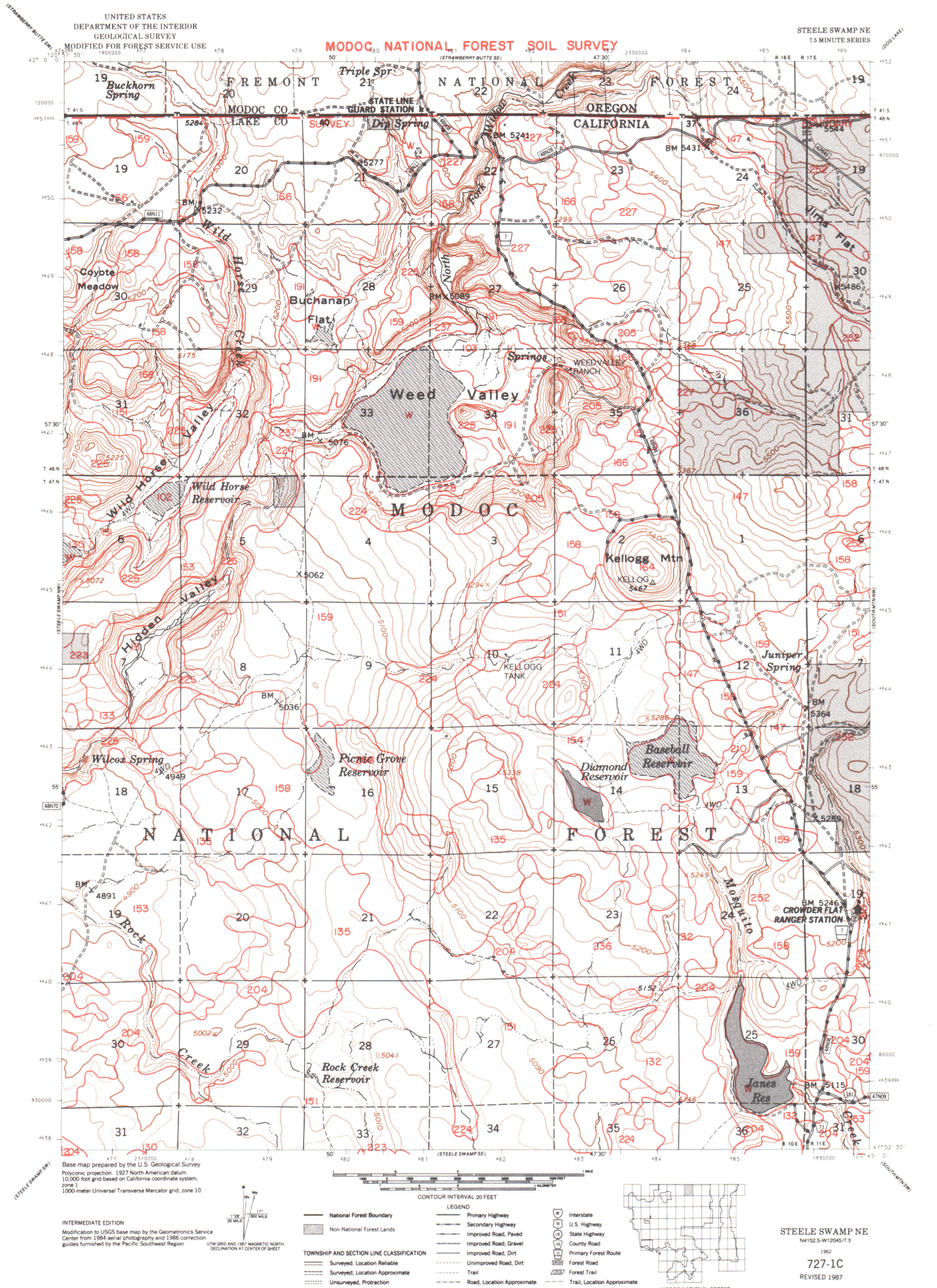
MODOC NATIONAL FOREST

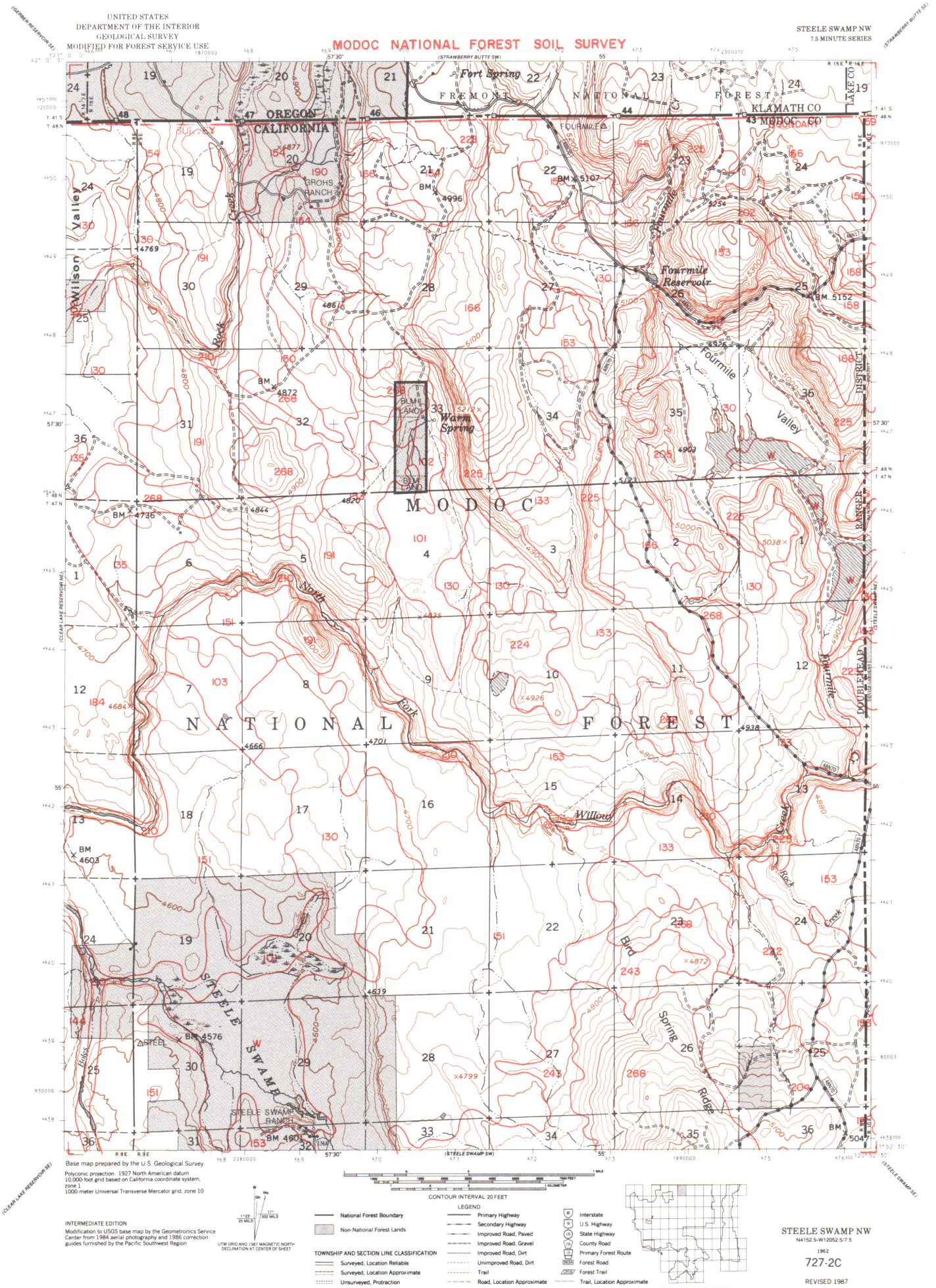
WILLOW RANCH NW
N4152.5-W12022.5/7.5
1962
725-2C
REVISED 1987

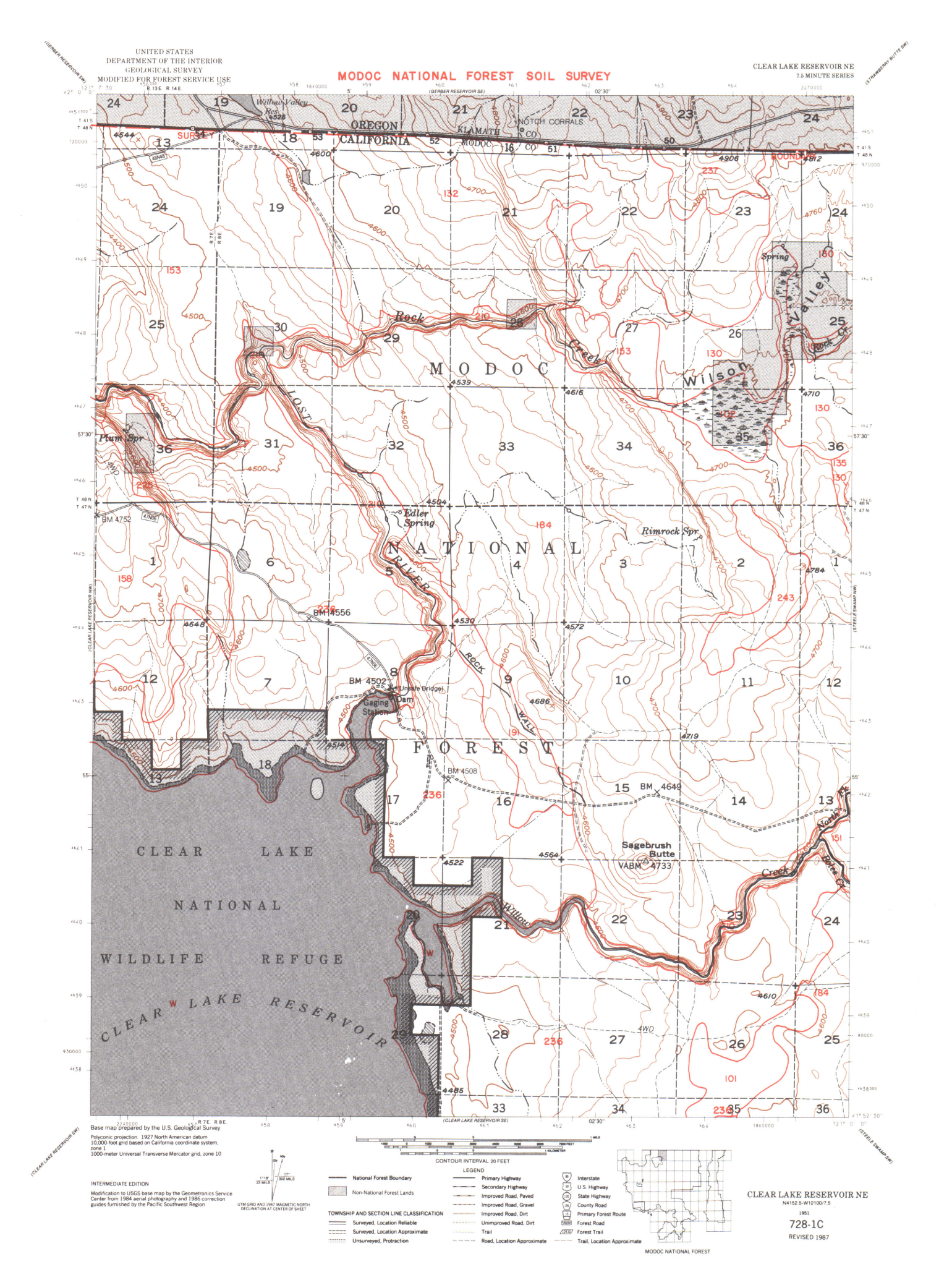

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE
MODOC NATIONAL FOREST SOIL SURVEY
SOUTH MTN NE
7.5 MINUTE SERIES
Renner Lake
FREMONT NATIONAL FOREST
LAKE CO.
MODOC CO.
OREGON
CALIFORNIA
LAKE CO.
MODOC CO.
DRY CREEK
METEORITE TANK
BM 5831
BM 5751
BM 5544
M O D O C
N A T I O N A L F O R E S T
Poison Spr.
Black Reservoir
Enquist Reservoir
Pease Flat
Everly Reservoir
Hackenbush Reservoir
ENQUIST
EVERLY RANCH
PEASE CABIN
BM 5332
BM 5466
BM 5312
GOOSE LAKE
Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
CONTOUR INTERVAL 20 FEET
LEGEND
National Forest Boundary
Non-National Forest Lands
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
MODOC NATIONAL FOREST
SOUTH MTN NE
N4152.5-W12030/7.5
1962
726-1C
REVISED 1987

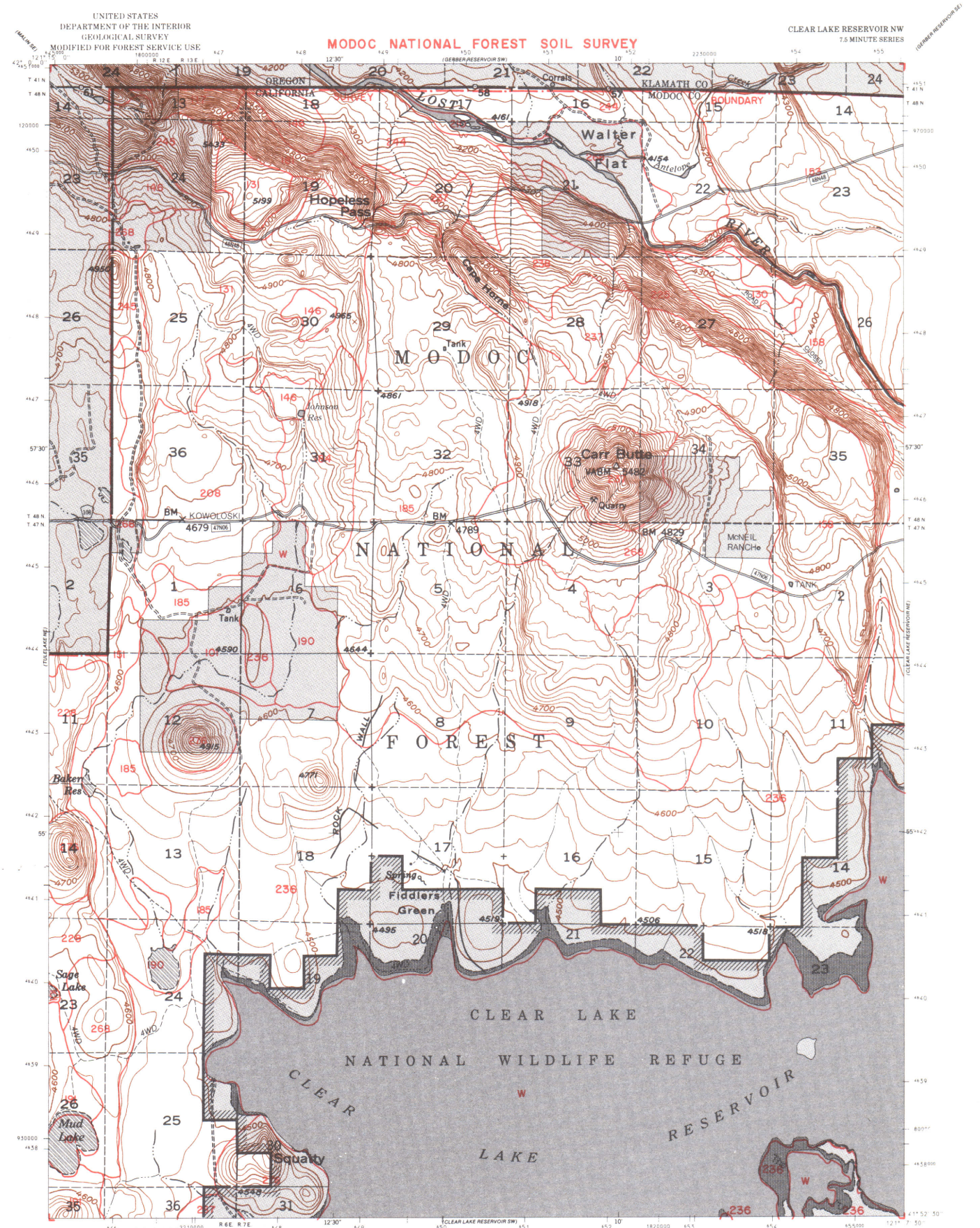


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE
MODOC NATIONAL FOREST SOIL SURVEY
SOUTH MTN NW
7.5 MINUTE SERIES
FREMONT NATIONAL FOREST
Renner Lake
LAKEVIEW RD
Muldoon Mtn
LAKE CO
MODOC CO
OREGON
CALIFORNIA
UPPER MULDOON TANK
LOWER MULDOON TANK
Turner Spr
ROCKY FLAT TANK
Oregon Rim Reservoir
Fletcher
HOMESTEAD WELL
Beaver Mtn
BEAVER DAM CABIN
Beaver Mtn Reservoir
Long Meadow
MODOC
Round Willows
NATIONAL
FOREST
Big Spring
Tournquist Spr
Island Meadow
Rail Meadow
Rail Spring
Wall Spr
GRIZZLIE PLACE
Coffee Mill Spring
RAIN GAGE STATION
Twin Springs
UPPER
Willow Creek
Little Grizzlie Spr
Mouse Spr
Grassy Ravine
Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
CONTOUR INTERVAL 20 FEET
INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
LEGEND
National Forest Boundary
Non-National Forest Lands
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate
MODOC NATIONAL FOREST
SOUTH MTN NW
N4152.5-W12037.5/7.5
1962
726-2C
REVISED 1987


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE
MODOC NATIONAL FOREST SOIL SURVEY
STEELE SWAMP NE
7.5 MINUTE SERIES
FREMONT NATIONAL FOREST
MODOC CO
LAKE CO
SURVEY
OREGON
CALIFORNIA
STATE LINE GUARD STATION
Triple Spr
Buckhorn Spring
Dry Spring
Willard Creek
BM 5241
BM 5431
BM 5232
Wild Horse Creek
North Fork
Virms Flat
Coyote Meadow
Buchanan Flat
BM X 5089
Springs
WEED VALLEY BRANCH
Weed Valley
Wild Horse Reservoir
MODOC
Kellogg Mtn
KELLOG 5467
Hidden Valley
KELLOGG TANK
Juniper Spring
BM 5364
Wilcox Spring
Picnic Grove Reservoir
Diamond Reservoir
Baseball Reservoir
BM 5289
BM 5246
CROWDER FLAT RANGER STATION
Mosquito
Rock Creek
Rock Creek Reservoir
Janes Res
BM 5115
Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
CONTOUR INTERVAL 20 FEET
INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
LEGEND
National Forest Boundary
Non-National Forest Lands
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate
MODOC NATIONAL FOREST
STEELE SWAMP NE
N4152.5-W12045/7.5
1962
727-1C
REVISED 1987


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE
MODOC NATIONAL FOREST SOIL SURVEY
STEELE SWAMP NW
7.5 MINUTE SERIES
Fort Spring
FREMONT NATIONAL FOREST
KLAMATH CO
MODOC CO
OREGON
CALIFORNIA
Wilson Valley
Grohs Ranch
Fourmile Reservoir
Fourmile Valley
Ranger District
Warm Spring
BLM LAND
MODOC
NATIONAL FOREST
North Fork
Willow Creek
Rock Creek
Bird Spring Ridge
STEELE SWAMP
STEELE SWAMP RANCH
BM 4996
BM 5107
BM 5152
BM 4872
BM 4736
BM 4603
BM 4576
BM 4901
BM 5047
(GERBER RESERVOIR SE)
(STRAWBERRY BUTTE SW)
(STRAWBERRY BUTTE SE)
(CLEAR LAKE RESERVOIR NE)
(STEELE SWAMP NE)
(CLEAR LAKE RESERVOIR SE)
(STEELE SWAMP SW)
(STEELE SWAMP SE)
Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
CONTOUR INTERVAL 20 FEET
INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
LEGEND
National Forest Boundary
Non-National Forest Lands
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate
MODOC NATIONAL FOREST
STEELE SWAMP NW
N4152.5-W12052.5/7.5
1962
727-2C
REVISED 1987


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE
MODOC NATIONAL FOREST SOIL SURVEY
CLEAR LAKE RESERVOIR NE
7.5 MINUTE SERIES
OREGON
CALIFORNIA
KLAMATH CO.
MODOC CO.
MODOC
NATIONAL
FOREST
CLEAR LAKE
NATIONAL
WILDLIFE REFUGE
CLEAR LAKE RESERVOIR
Willow Valley Res.
NOTCH CORRALS
Rock Creek
Wilson Valley
Spring
Plum Spr
Edler Spring
Rimrock Spr
LOST RIVER
ROCK WALL
Sagebrush Butte
VABM 4733
BM 4752
BM 4556
BM 4502
(Unsafe Bridge)
Gaging Station
Dam
BM 4508
BM 4649
North Fk Rock Cr
Willow Creek
BOUNDARY
(GERBER RESERVOIR SE)
(CLEAR LAKE RESERVOIR SE)
(CLEAR LAKE RESERVOIR NW)
(CLEAR LAKE RESERVOIR SW)
(STEELE SWAMP NW)
(STEELE SWAMP SW)
(STRAWBERRY BUTTE SW)
R 13 E. R 14 E.
R 7 E. R 8 E.
T 41 S
T 48 N
T 47 N
Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
CONTOUR INTERVAL 20 FEET
LEGEND
National Forest Boundary
Non-National Forest Lands
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate
MODOC NATIONAL FOREST
CLEAR LAKE RESERVOIR NE
N4152.5-W12100/7.5
1951
728-1C
REVISED 1987



Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

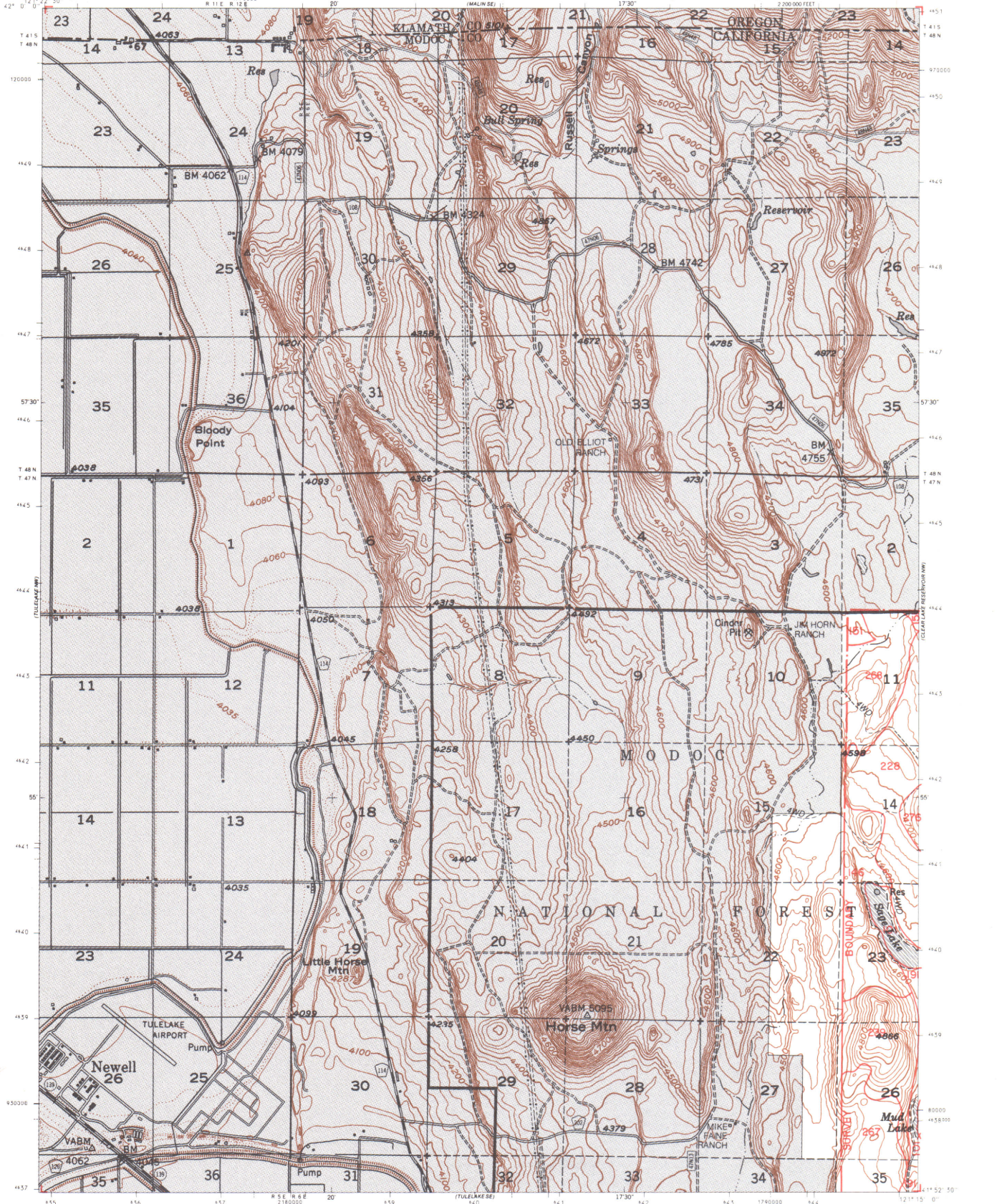
MODOC NATIONAL FOREST

CLEAR LAKE RESERVOIR NW
N4152.5-W12107.5/7.5
1951
728-2C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

TULELAKE NE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse mercator grid, zone 10

CONTOUR INTERVAL 20 FEET

INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

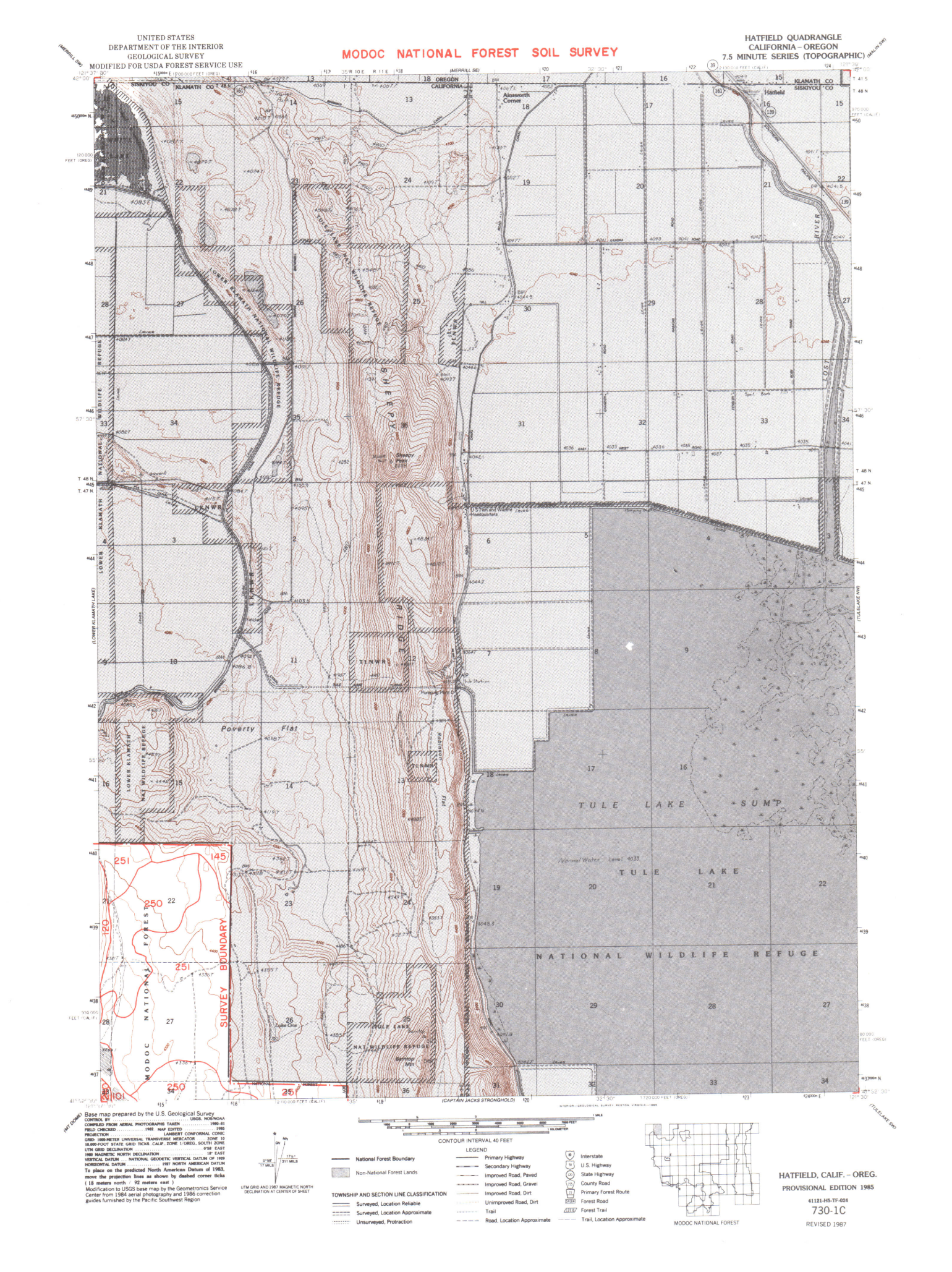
MODOC NATIONAL FOREST

TULELAKE NE
N4152.5-W12115/7.5
1951
729-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

HATFIELD QUADRANGLE
CALIFORNIA – OREGON
7.5 MINUTE SERIES (TOPOGRAPHIC)



Base map prepared by the U.S. Geological Survey

CONTROL BY ..... USGS, NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1980–81
FIELD CHECKED ..... 1982 MAP EDITED 1985
PROJECTION ..... LAMBERT CONFORMAL CONIC
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR ..... ZONE 10
10,000-FOOT STATE GRID TICKS: CALIF., ZONE 1/OREG., SOUTH ZONE
UTM GRID DECLINATION ..... 0°58' EAST
1980 MAGNETIC NORTH DECLINATION ..... 18° EAST
VERTICAL DATUM ..... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM ..... 1927 NORTH AMERICAN DATUM

To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (18 meters north / 92 meters east)

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

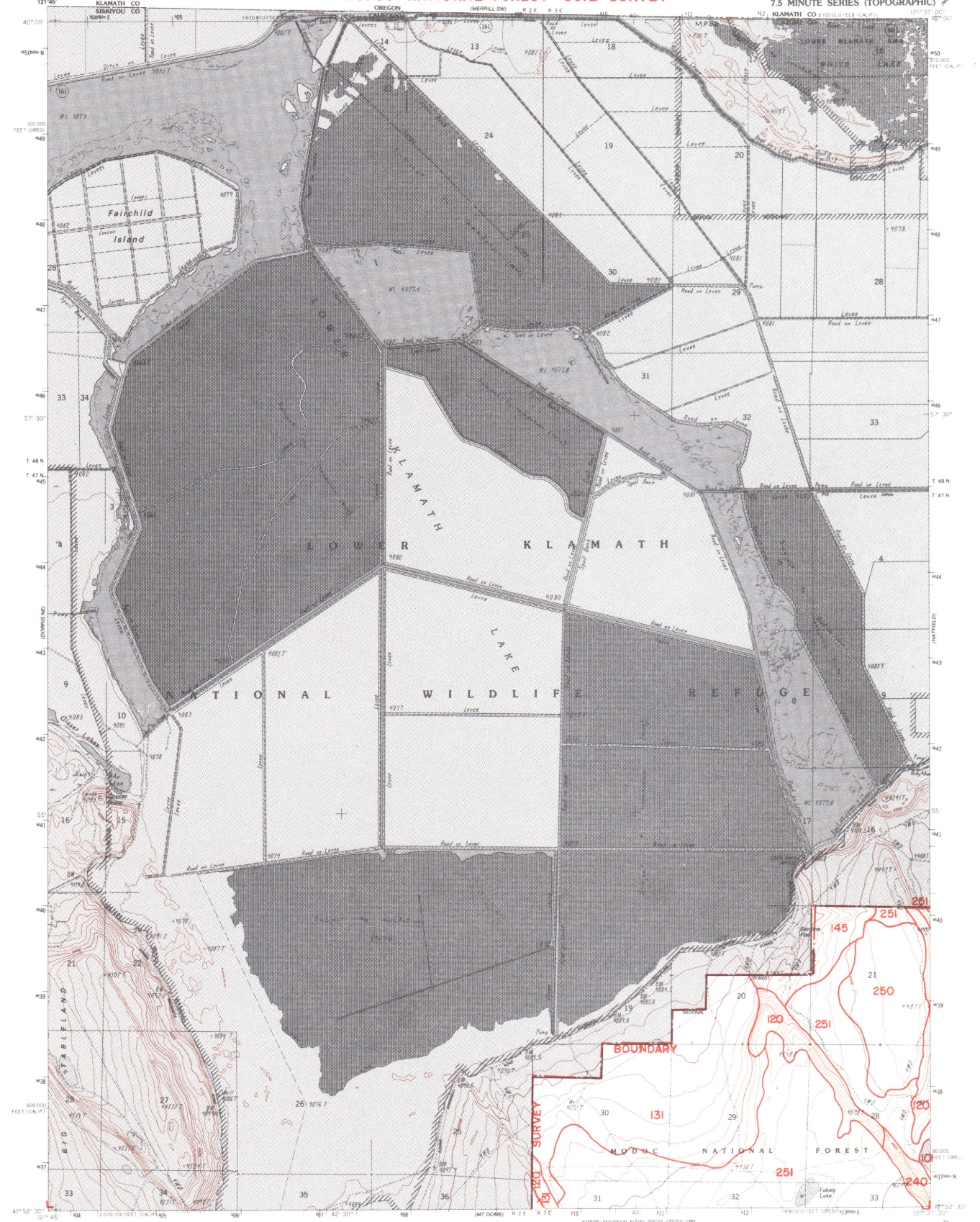
MODOC NATIONAL FOREST

HATFIELD, CALIF. – OREG.
PROVISIONAL EDITION 1985
41121-H5-TF-024
730-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

LOWER KLAMATH LAKE QUADRANGLE
CALIFORNIA – OREGON
7.5 MINUTE SERIES (TOPOGRAPHIC)



Base map prepared by the U.S. Geological Survey
CONTROL BY ..... USGS, NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1980
FIELD CHECKED ..... 1982 MAP EDITED 1985
PROJECTION ..... LAMBERT CONFORMAL CONIC
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR ..... ZONE 10
10,000-FOOT STATE GRID TICKS ..... CALIF., ZONE 1 / OREG., SOUTH ZONE
UTM GRID DECLINATION ..... 0°53' EAST
1980 MAGNETIC NORTH DECLINATION ..... 18° EAST
VERTICAL DATUM ..... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM ..... 1927 NORTH AMERICAN DATUM
To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (18 meters north ∕ 93 meters east)

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

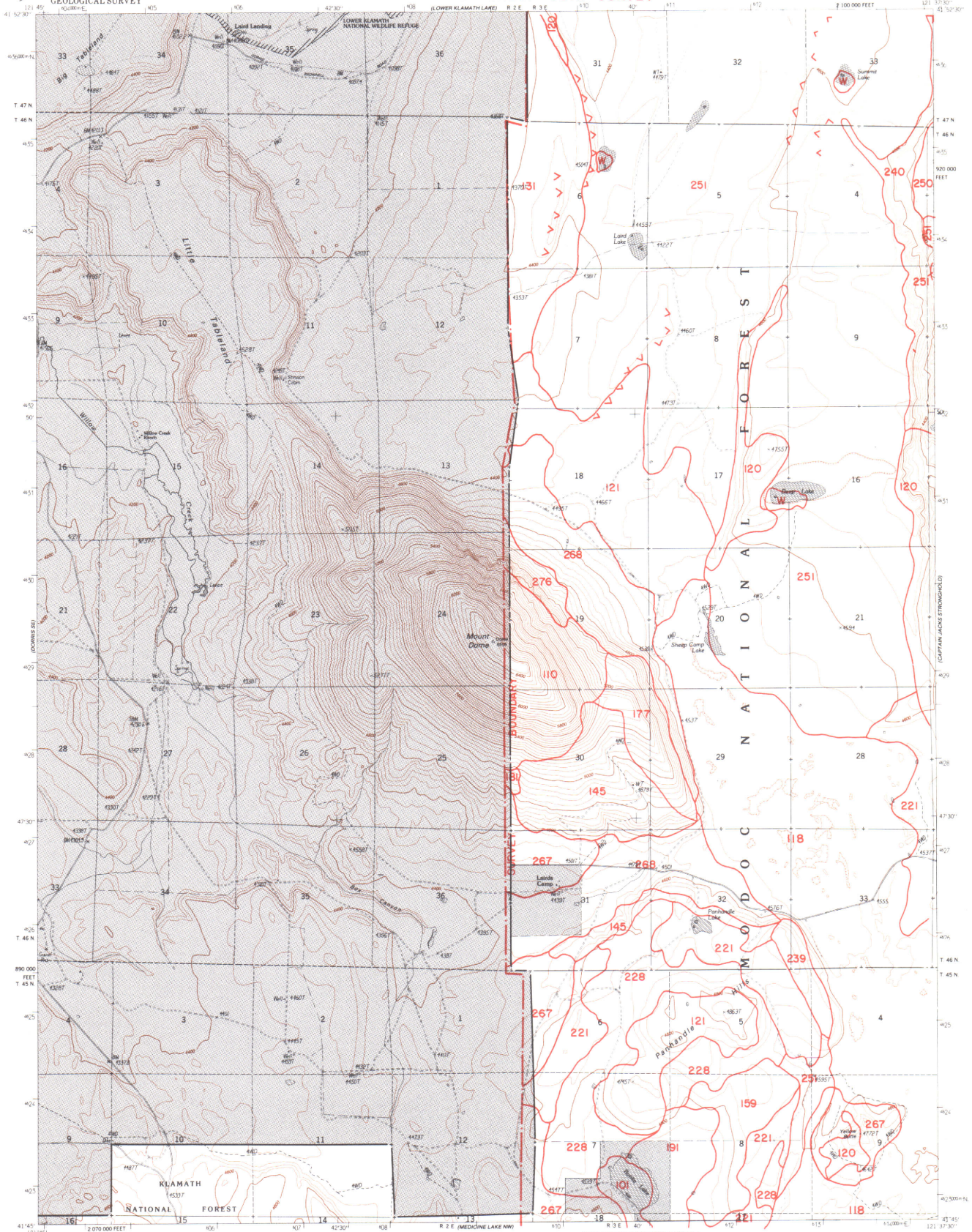
MODOC NATIONAL FOREST

LOWER KLAMATH LAKE, CALIF. - OREG.
PROVISIONAL EDITION 1985
41121-H6-TF-024
730-2C
REVISED 1987

MODIFIED FOR USDA FOREST SERVICE USE
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MODOC NATIONAL FOREST SOIL SURVEY

MOUNT DOME QUADRANGLE
CALIFORNIA—SISKIYOU CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Base map prepared by the U.S. Geological Survey

CONTROL BY ..... USGS, NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1980-81
FIELD CHECKED ..... 1982. MAP EDITED 1985
PROJECTION ..... LAMBERT CONFORMAL CONIC
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR ..... ZONE 10
10,000-FOOT STATE GRID TICKS ..... CALIFORNIA, ZONE 1
UTM GRID DECLINATION ..... 0°53' EAST
1980 MAGNETIC NORTH DECLINATION ..... 18° EAST
VERTICAL DATUM ..... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM ..... 1927 NORTH AMERICAN DATUM

To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (18 meters north / 93 meters east)

There may be private inholdings within the boundaries of any Federal and State Reservations shown on this map

Certain land lines are omitted because of insufficient data

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

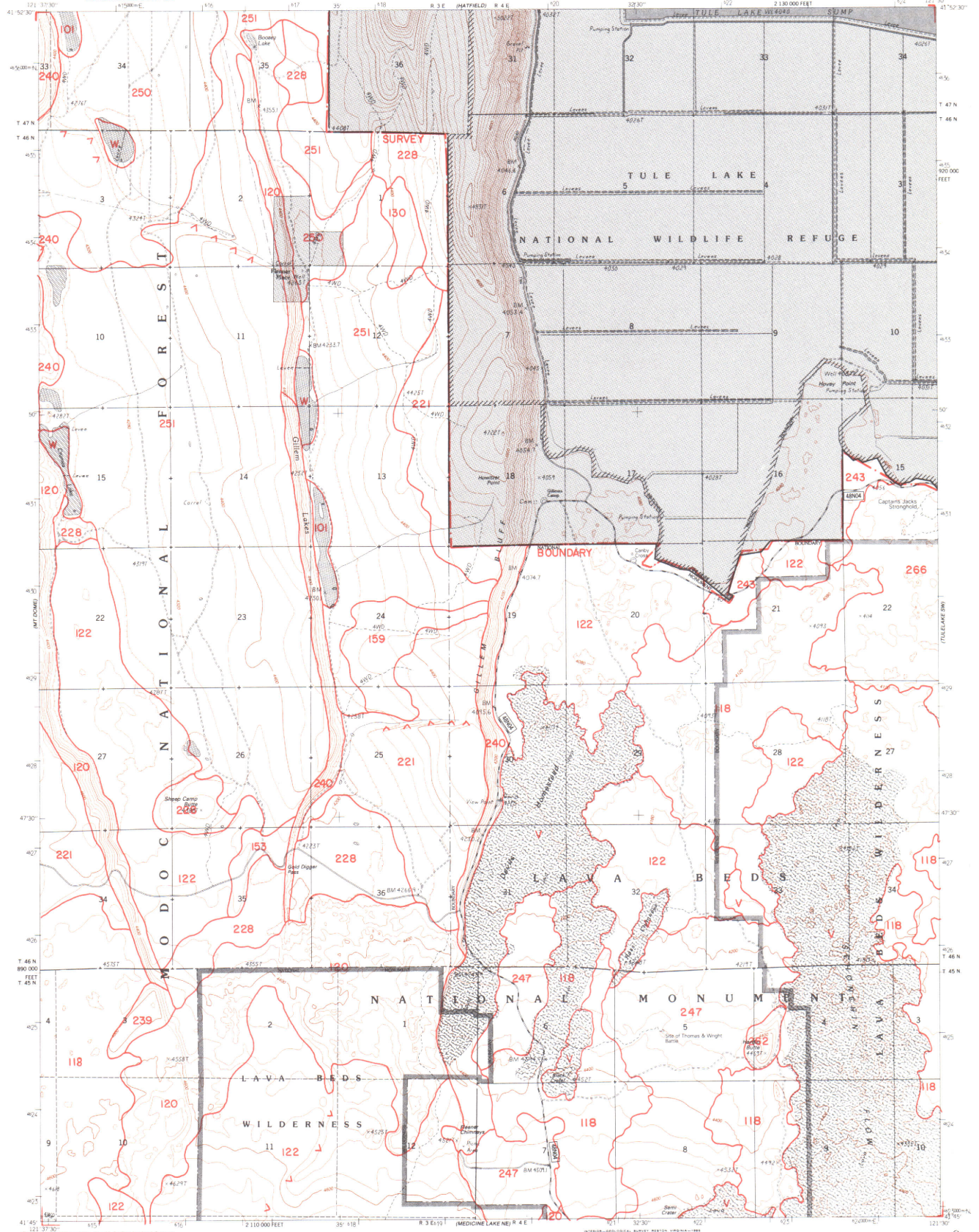
MODOC NATIONAL FOREST

MOUNT DOME, CALIF.
PROVISIONAL EDITION 1985
41121-G6-TF-024
730-3C
REVISED 1987

MODIFIED FOR USDA FOREST SERVICE USE
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MODOC NATIONAL FOREST SOIL SURVEY

CAPTAIN JACKS STRONGHOLD QUADRANGLE
CALIFORNIA—SISKIYOU CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Base map prepared by the U.S. Geological Survey

CONTROL BY ..... USGS, NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1980-81
FIELD CHECKED ..... 1982 MAP EDITED 1983
PROJECTION ..... LAMBERT CONFORMAL CONIC
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR ..... ZONE 10
10,000-FOOT STATE GRID TICKS ..... CALIFORNIA, ZONE 1
UTM GRID DECLINATION ..... 0°58' EAST
1980 MAGNETIC NORTH DECLINATION ..... 18° EAST
VERTICAL DATUM ..... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM ..... 1927 NORTH AMERICAN DATUM

To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (18 meters north / 92 meters east)

There may be private inholdings within the boundaries of any Federal and State Reservations shown on this map

Certain land lines are omitted because of insufficient data

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

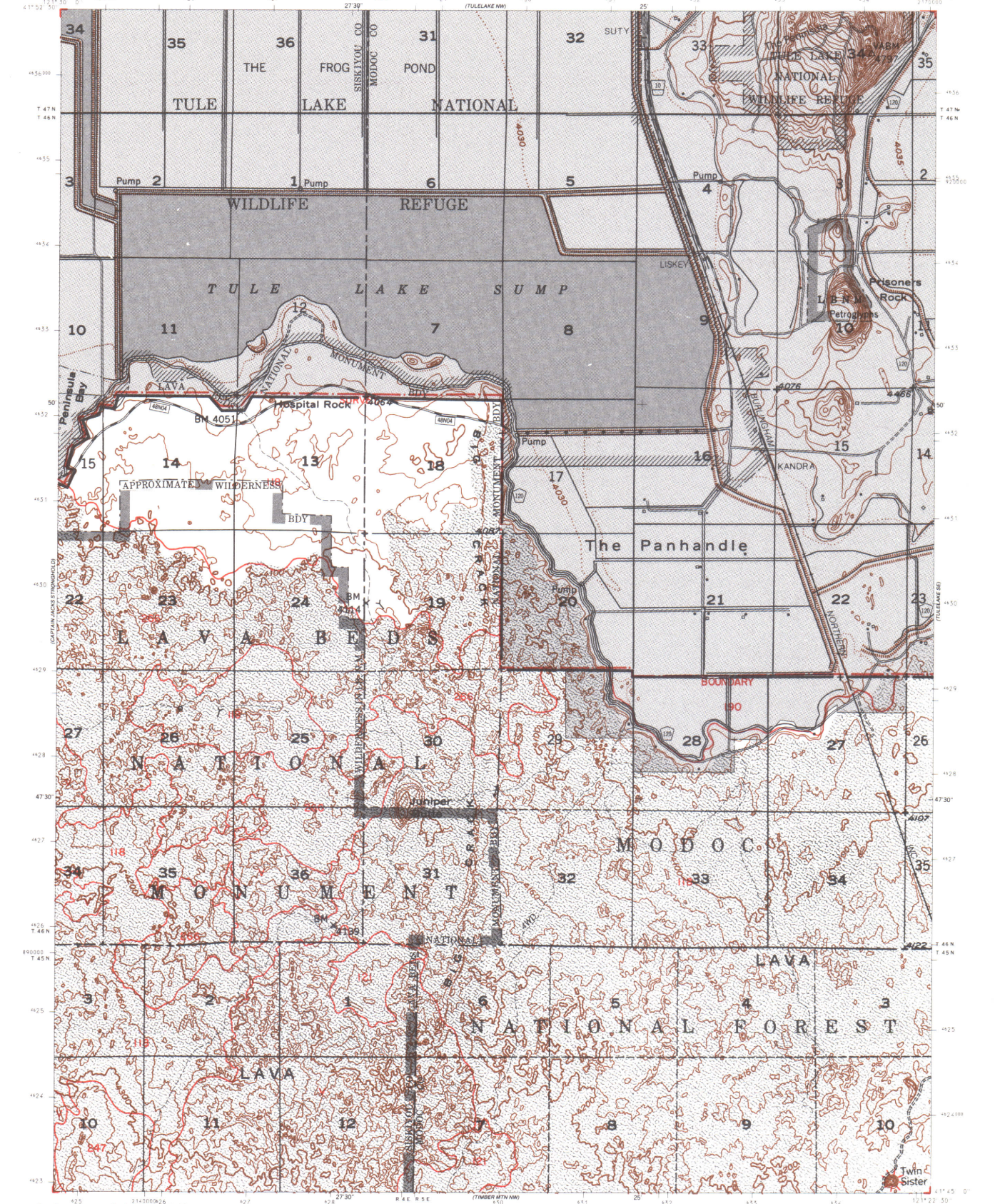
CAPTAIN JACKS STRONGHOLD, CALIF.
PROVISIONAL EDITION 1985
41121-G5-TF-024
730-4C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

TULELAKE SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

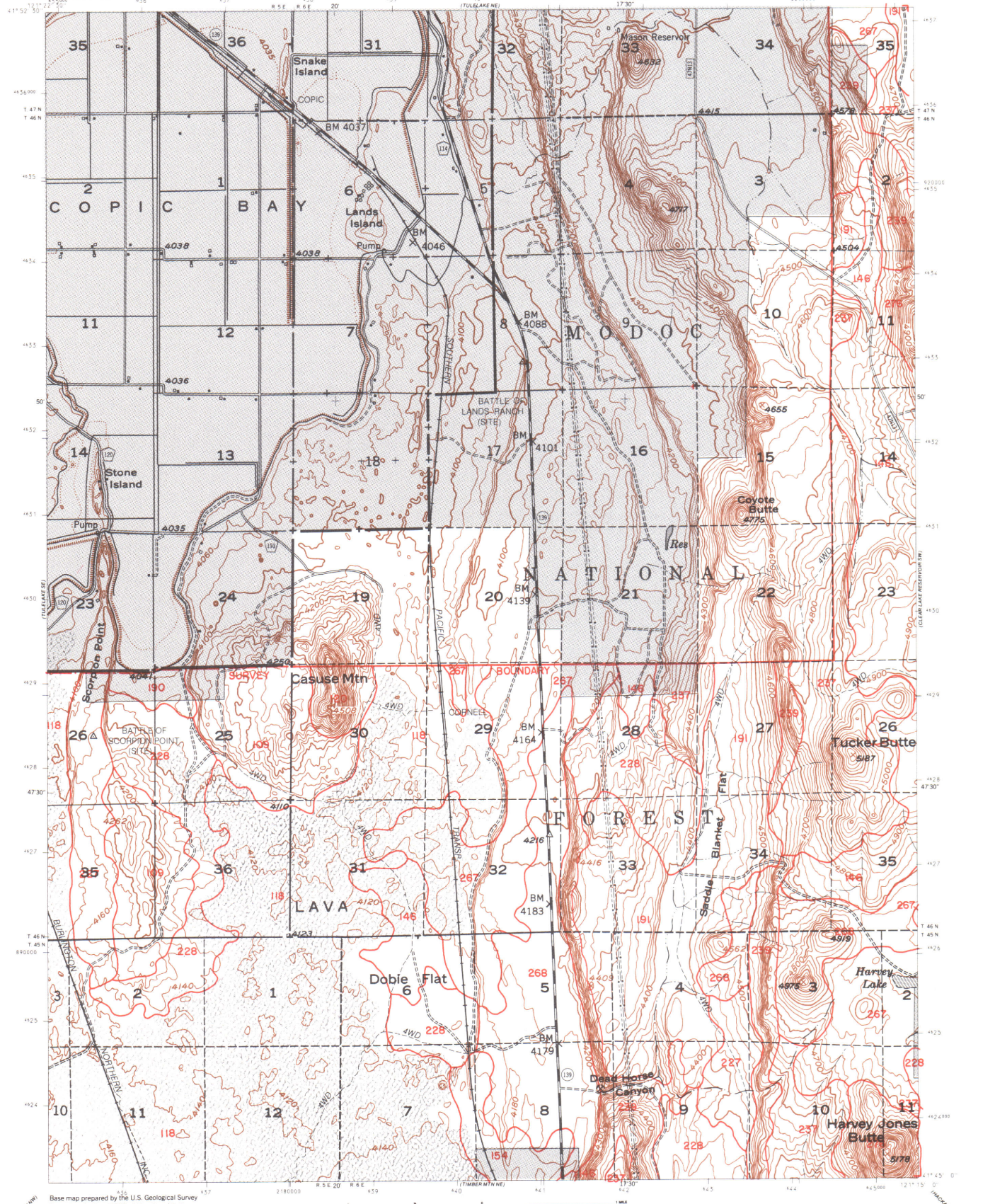
MODOC NATIONAL FOREST

TULELAKE SW
N4145-W12122.5/7.5
1951
729-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

TULELAKE SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 20 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands
- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate
- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

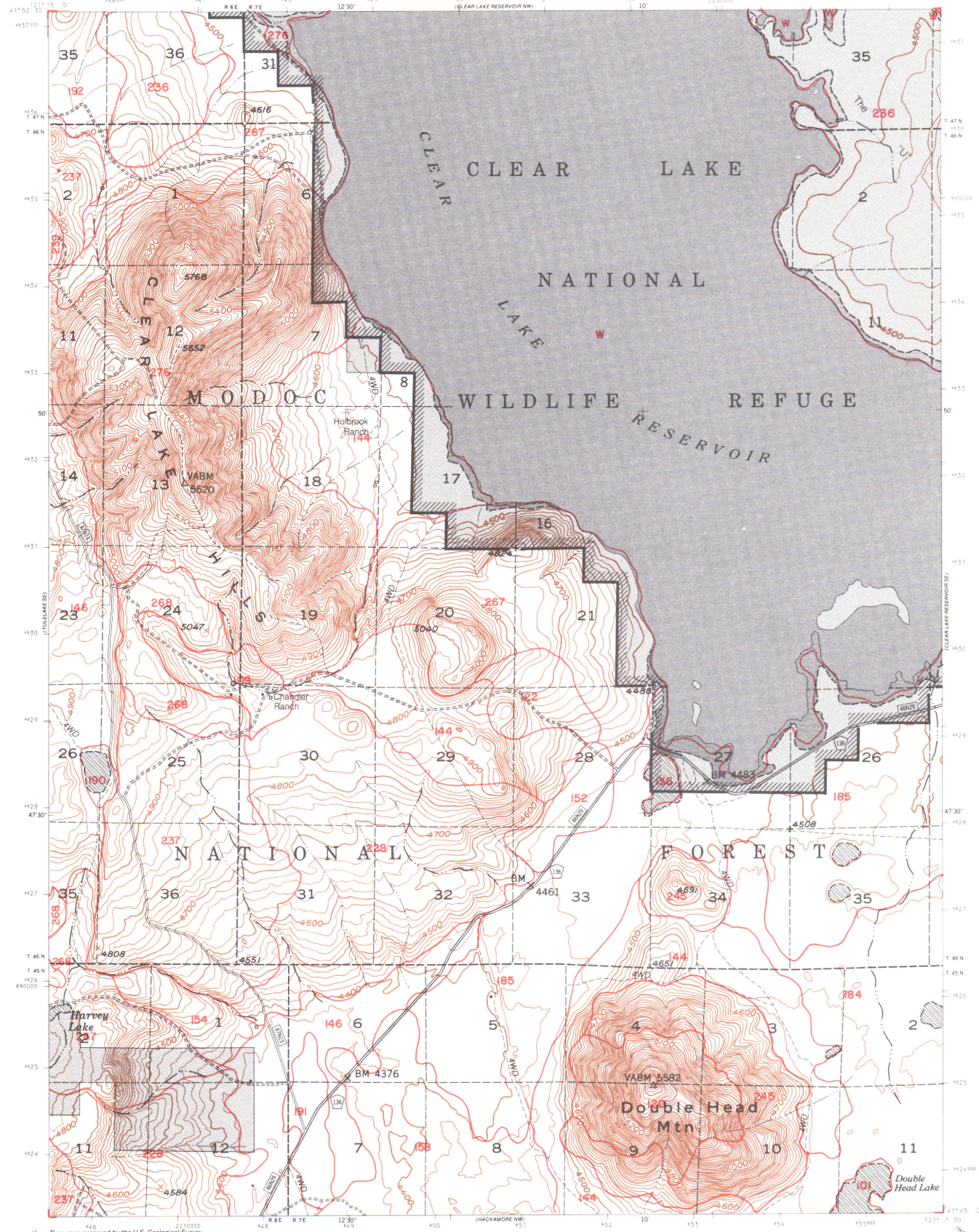
MODOC NATIONAL FOREST

TULELAKE SE
N4145-W12115/7.5
1951
729-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

CLEAR LAKE RESERVOIR SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 20 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

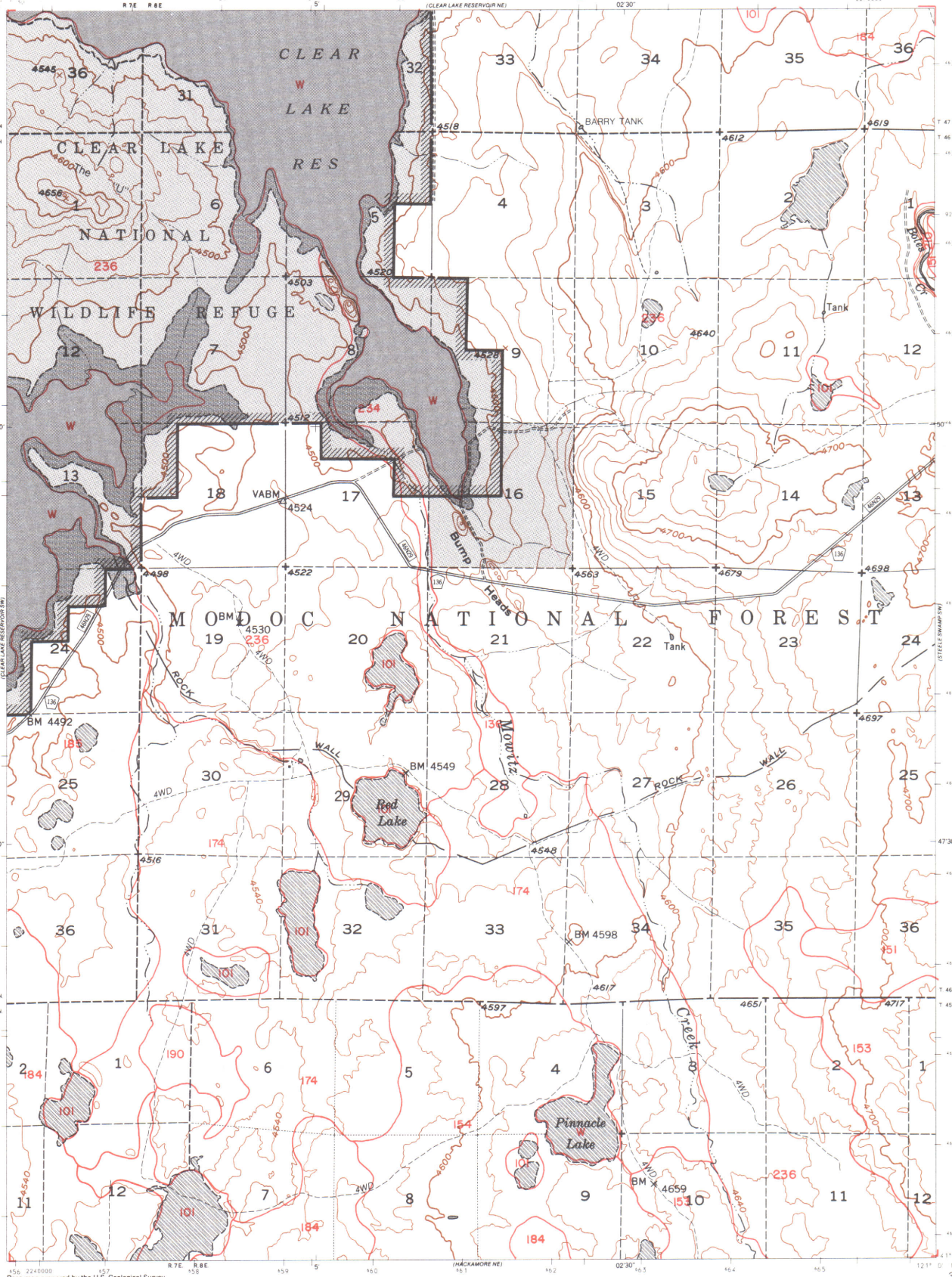
MODOC NATIONAL FOREST

CLEAR LAKE RESERVOIR SW
N4145-W12107.5/7.5
1951
728-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

CLEAR LAKE RESERVOIR SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 20 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

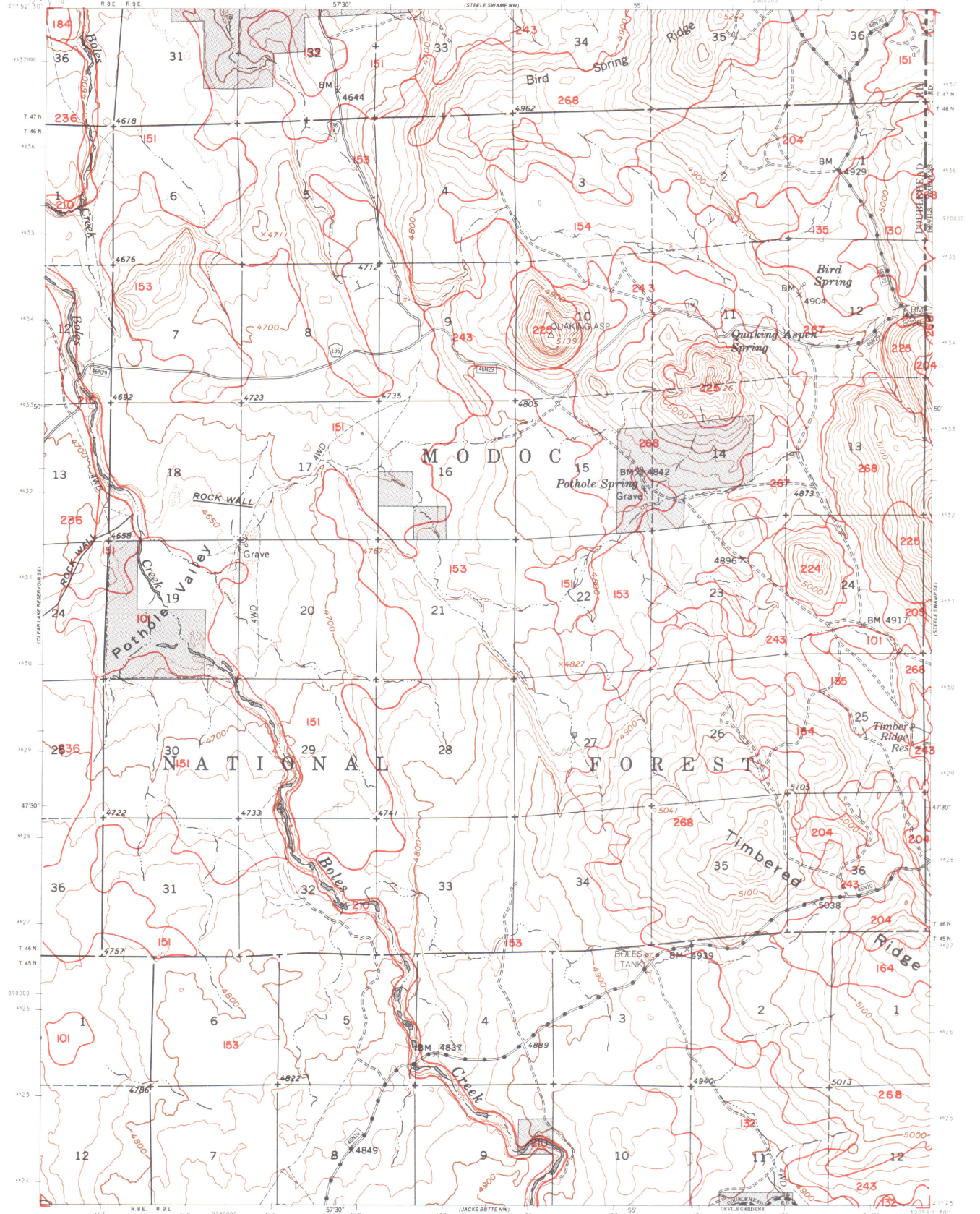
MODOC NATIONAL FOREST

CLEAR LAKE RESERVOIR SE
N4145-W12100/7.5
1951
728-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

STEELE SWAMP SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

Republished by the USFS San Francisco in 1975 by photogrammetric methods.

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands
- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate
- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

MODOC NATIONAL FOREST

STEELE SWAMP SW
N4145-W12052.5/7.5

1962

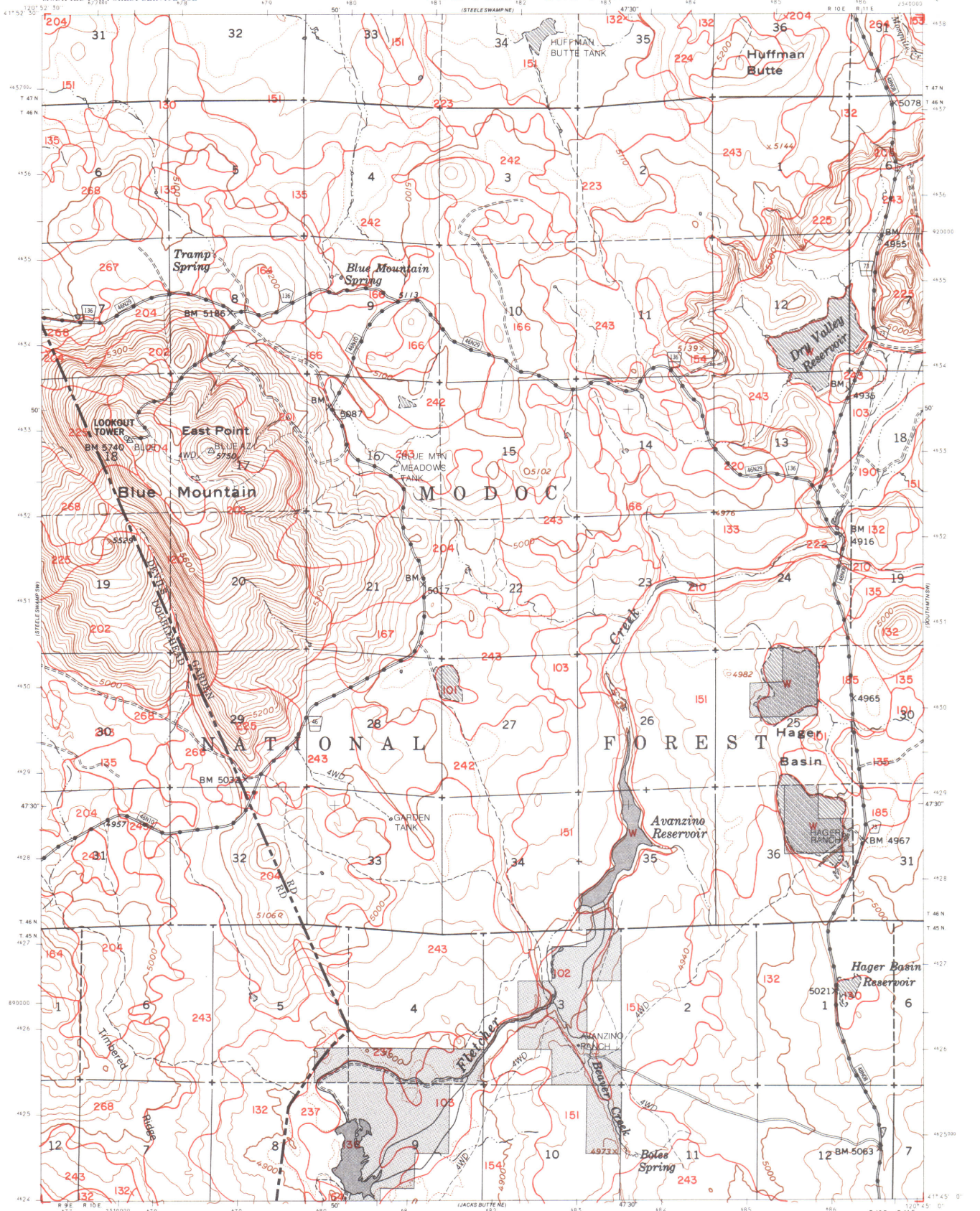
727-3C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

STEELE SWAMP SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
Republished by the USFS San Francisco in 1975 by photogrammetric methods.

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

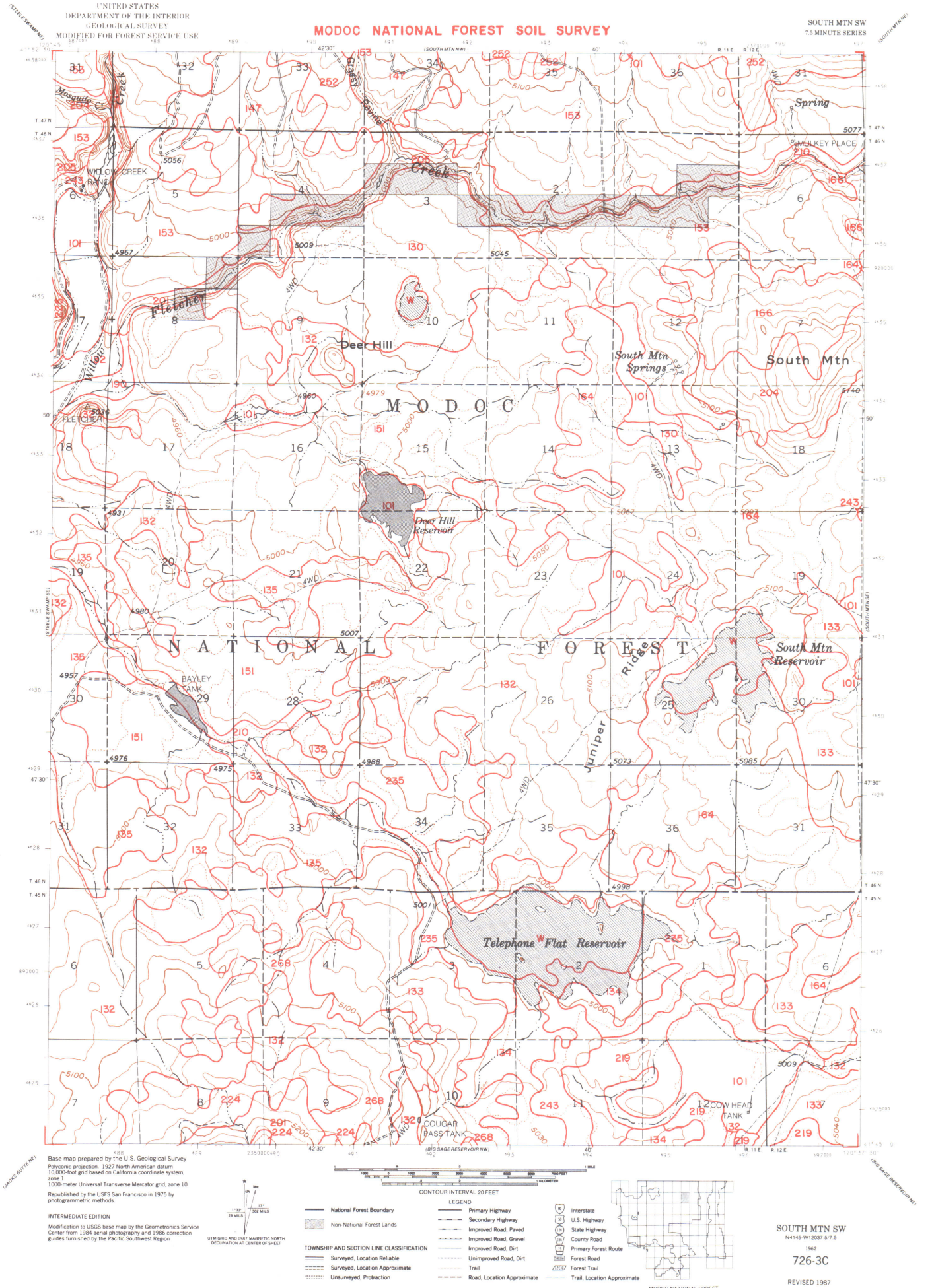
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

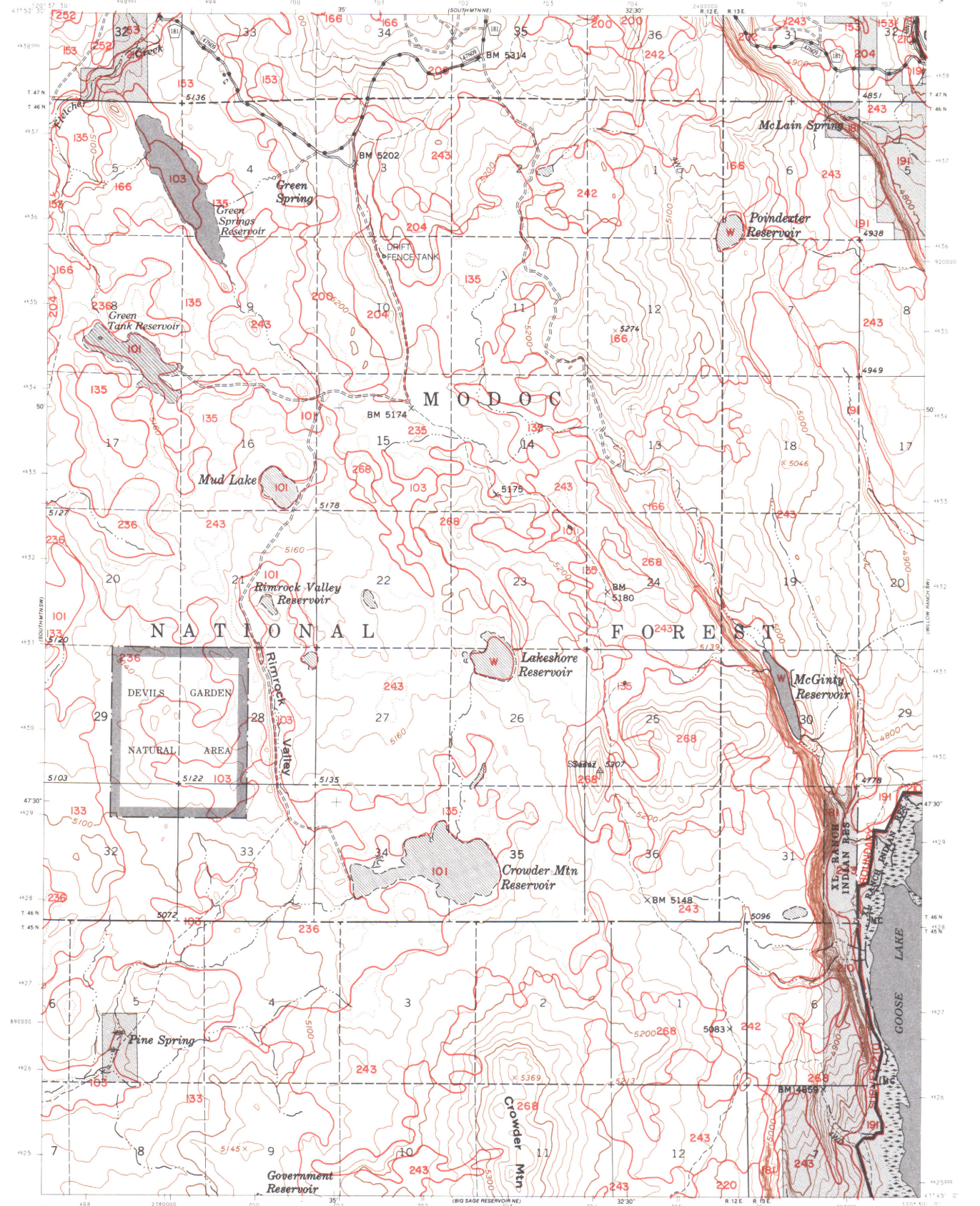
STEELE SWAMP SE
N4145-W12045/7.5
1962
727-4C
REVISED 1987


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE
MODOC NATIONAL FOREST SOIL SURVEY
SOUTH MTN SW
7.5 MINUTE SERIES
(STEELE SWAMP NE)
(SOUTH MTN NW)
(SOUTH MTN NE)
(STEELE SWAMP SE)
(SOUTH MTN SE)
(JACKS BUTTE NE)
(BIG SAGE RESERVOIR NW)
(BIG SAGE RESERVOIR NE)
R 11 E
R 12 E
T. 47 N
T. 46 N
T. 45 N
42'30"
47'30"
40'
MODOC
NATIONAL FOREST
Mosquito Creek
Willow Creek
Fletcher Creek
Fletcher
Willow Creek Ranch
Deer Hill
Deer Hill Reservoir
South Mtn Springs
South Mtn
South Mtn Reservoir
Spring
Mulkey Place
Juniper Ridge
Bayley Tank
Telephone Flat Reservoir
Cow Head Tank
Cougar Pass Tank
Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
Republished by the USFS San Francisco in 1975 by photogrammetric methods.
INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
CONTOUR INTERVAL 20 FEET
LEGEND
National Forest Boundary
Non-National Forest Lands
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate
MODOC NATIONAL FOREST
SOUTH MTN SW
N4145-W12037.5/7.5
1962
726-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

SOUTH MTN SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

Republished by the USFS San Francisco in 1975 by photogrammetric methods.

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

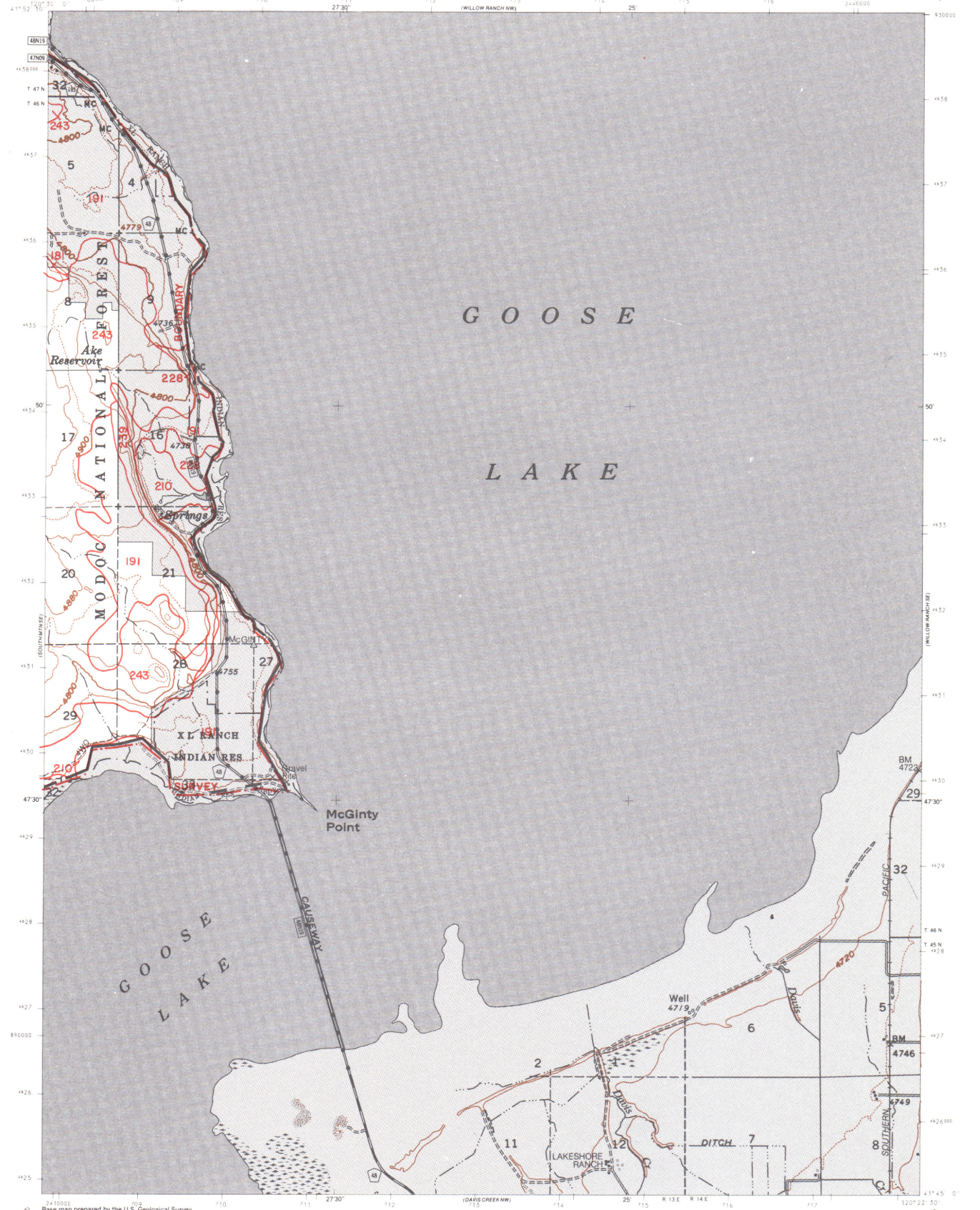
MODOC NATIONAL FOREST

SOUTH MTN SE
N4145-W12030/7.5
1962
726-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

WILLOW RANCH SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone I
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

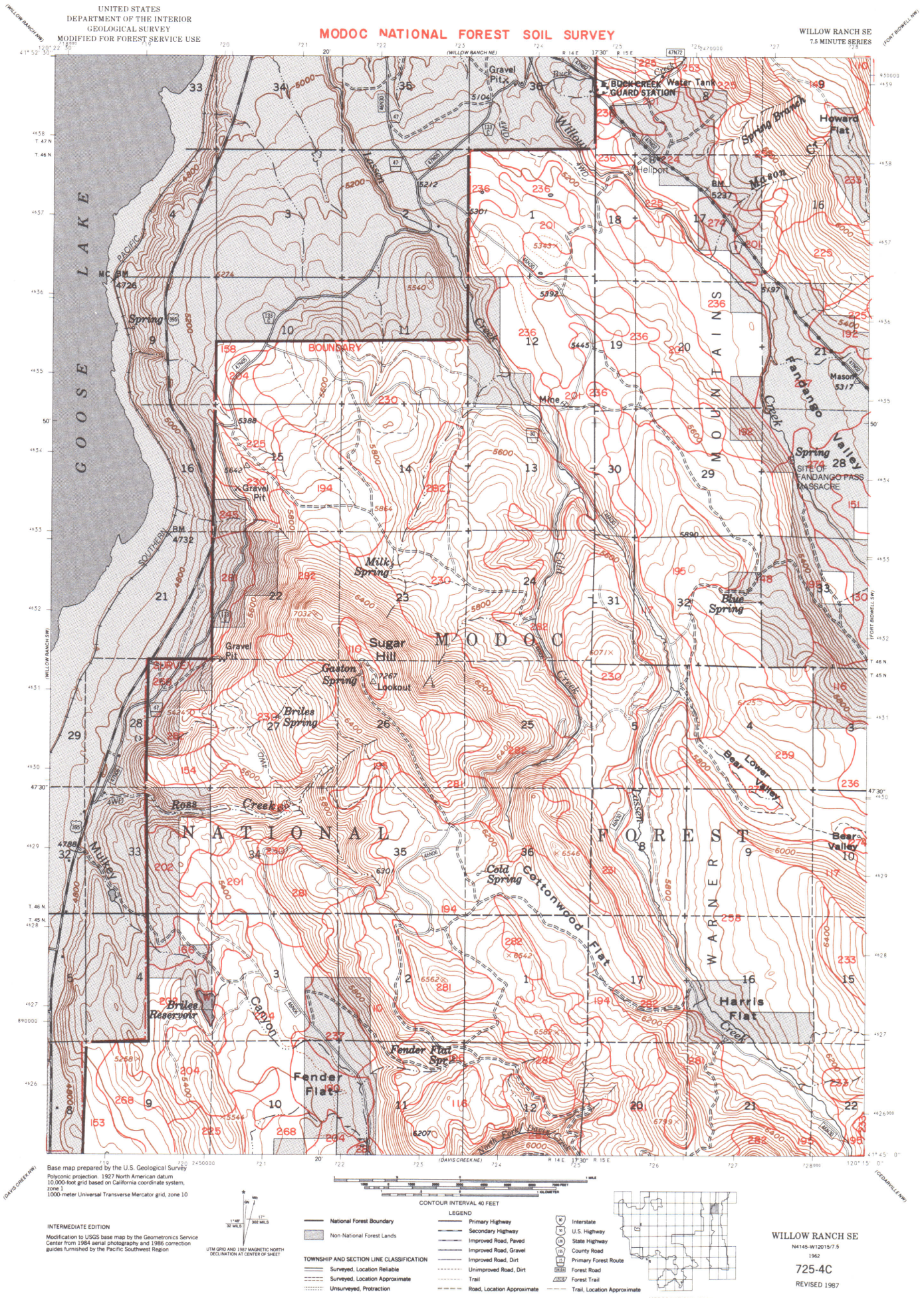
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

WILLOW RANCH SW
N4145-W12022.5/7.5
1962
725-3C
REVISED 1987



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

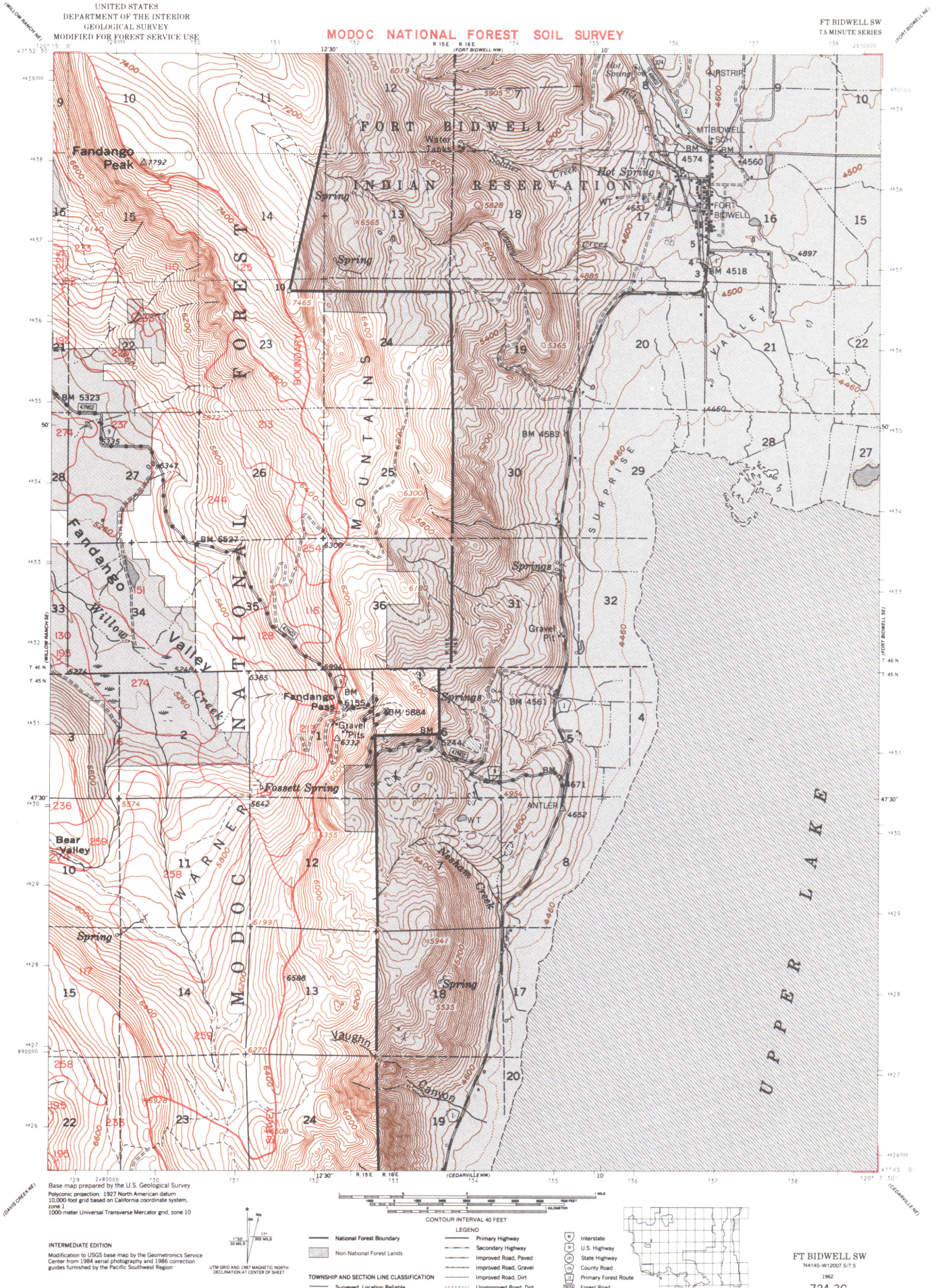
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

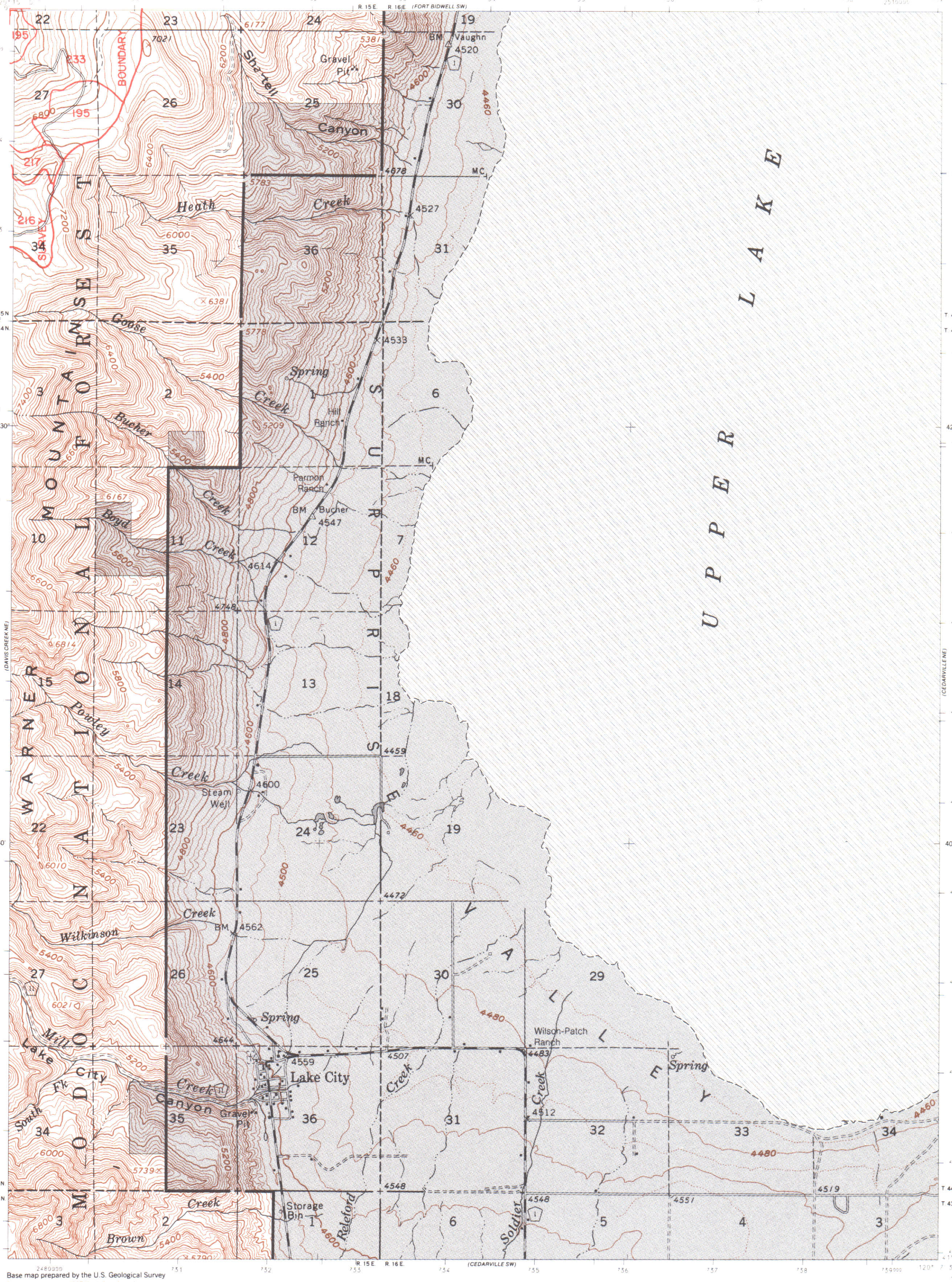
WILLOW RANCH SE
N4145-W12015/7.5
1962
725-4C
REVISED 1987


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE
MODOC NATIONAL FOREST SOIL SURVEY
FT BIDWELL SW
7.5 MINUTE SERIES
FORT BIDWELL INDIAN RESERVATION
MODOC NATIONAL FOREST
WARNER MOUNTAINS
UPPER LAKE
Fandango Peak △7792
Fandango Valley
Willow Creek
Bear Valley
Fandango Pass
Fossett Spring
Vaughn Canyon
Hot Springs
Gravel Pits
AIRSTRIP
MT BIDWELL SCH
FORT BIDWELL
ANTLER
SURPRISE VALLEY
BOUNDARY SURVEY
R 15 E.
R 16 E.
(FORT BIDWELL NW)
(FORT BIDWELL SE)
(WILLOW RANCH NE)
(WILLOW RANCH SE)
(DAVIS CREEK NE)
(CEDARVILLE NW)
(CEDARVILLE NE)
T 46 N
T 45 N
12'30"
47'30"
CONTOUR INTERVAL 40 FEET
LEGEND
National Forest Boundary
Non-National Forest Lands
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate
MODOC NATIONAL FOREST
INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
FT BIDWELL SW
N4145-W12007.5/7.5
1962
724-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

CEDARVILLE NW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

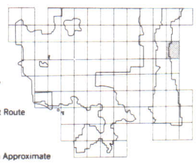
LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate



MODOC NATIONAL FOREST

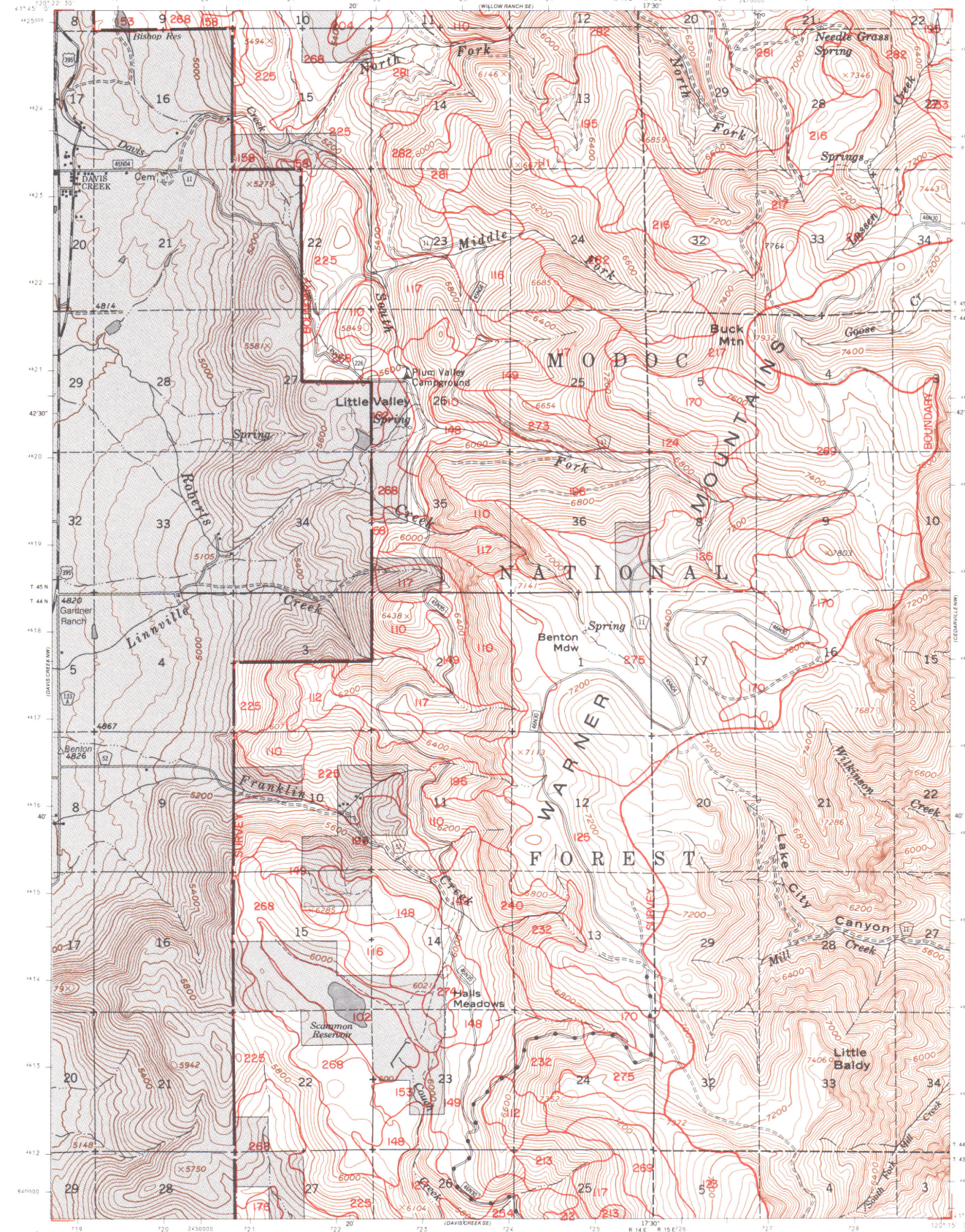
CEDARVILLE NW
N4137.5-W12007.5/7.5
1963

707-2C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

DAVIS CREEK NE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

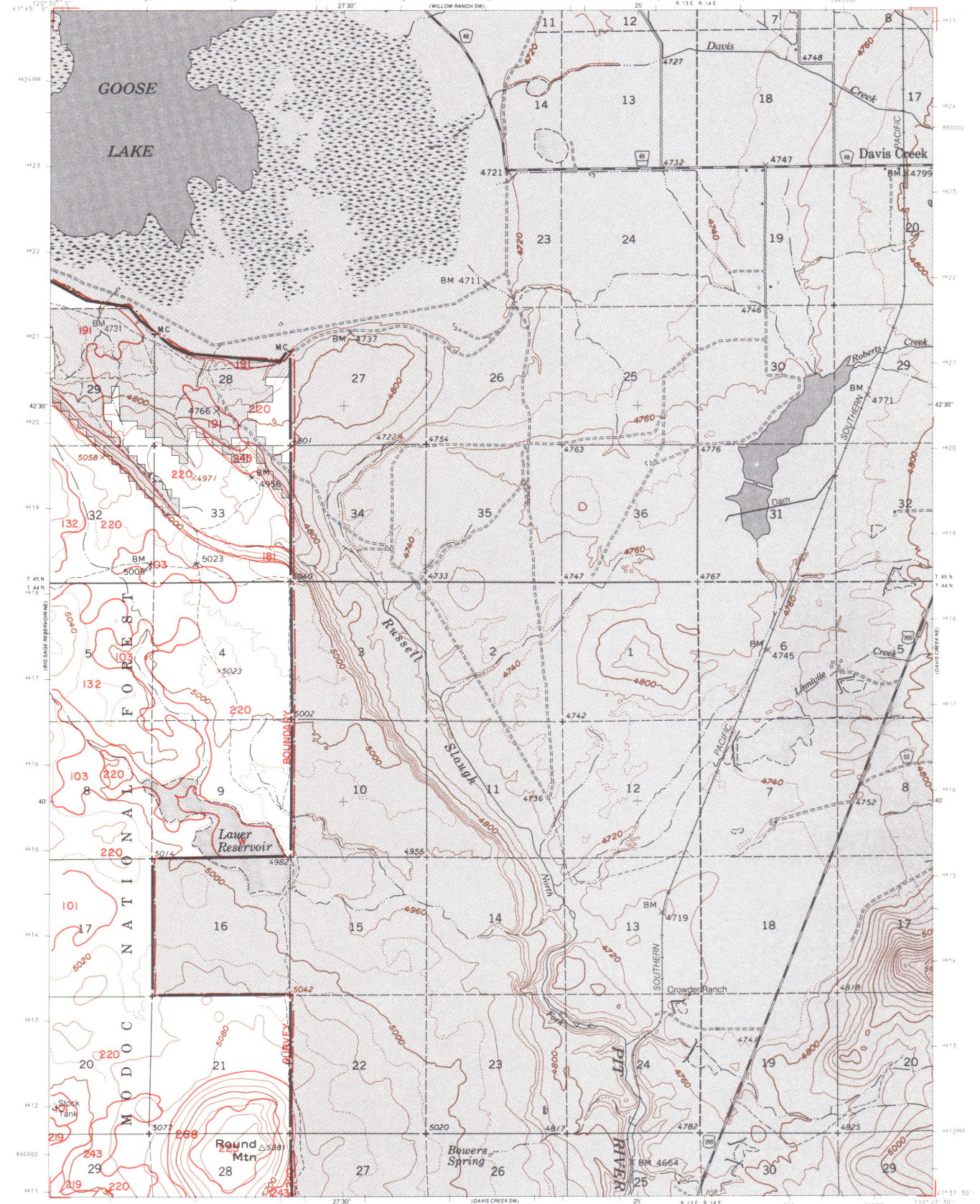
MODOC NATIONAL FOREST

DAVIS CREEK NE
N4137-W12015/7.5
1962
708-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

DAVIS CREEK NW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

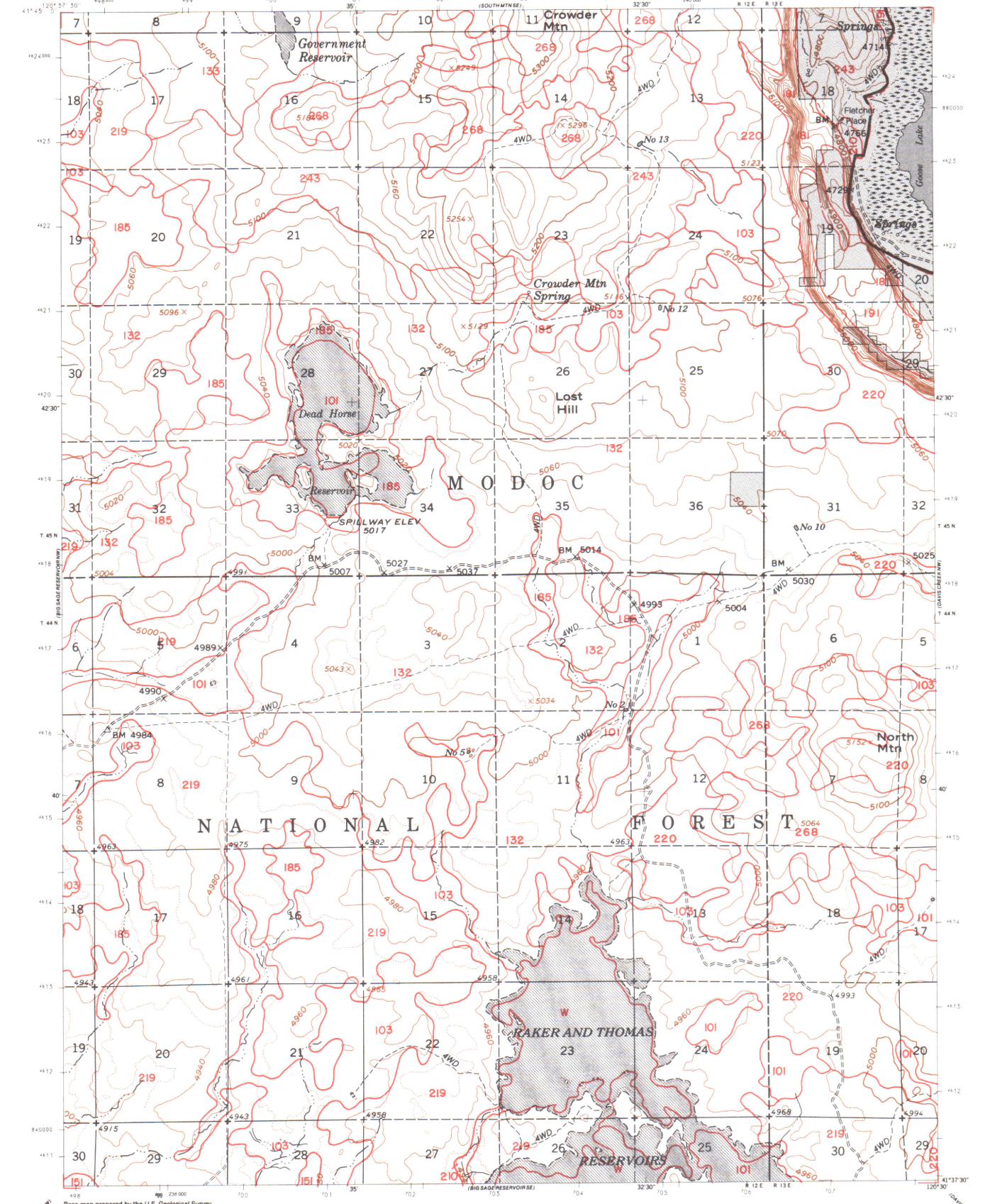
MODOC NATIONAL FOREST

DAVIS CREEK NW
N4137.5-W12022.5/7.5
1962
708-2C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

BIG SAGE RESERVOIR NE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 20 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

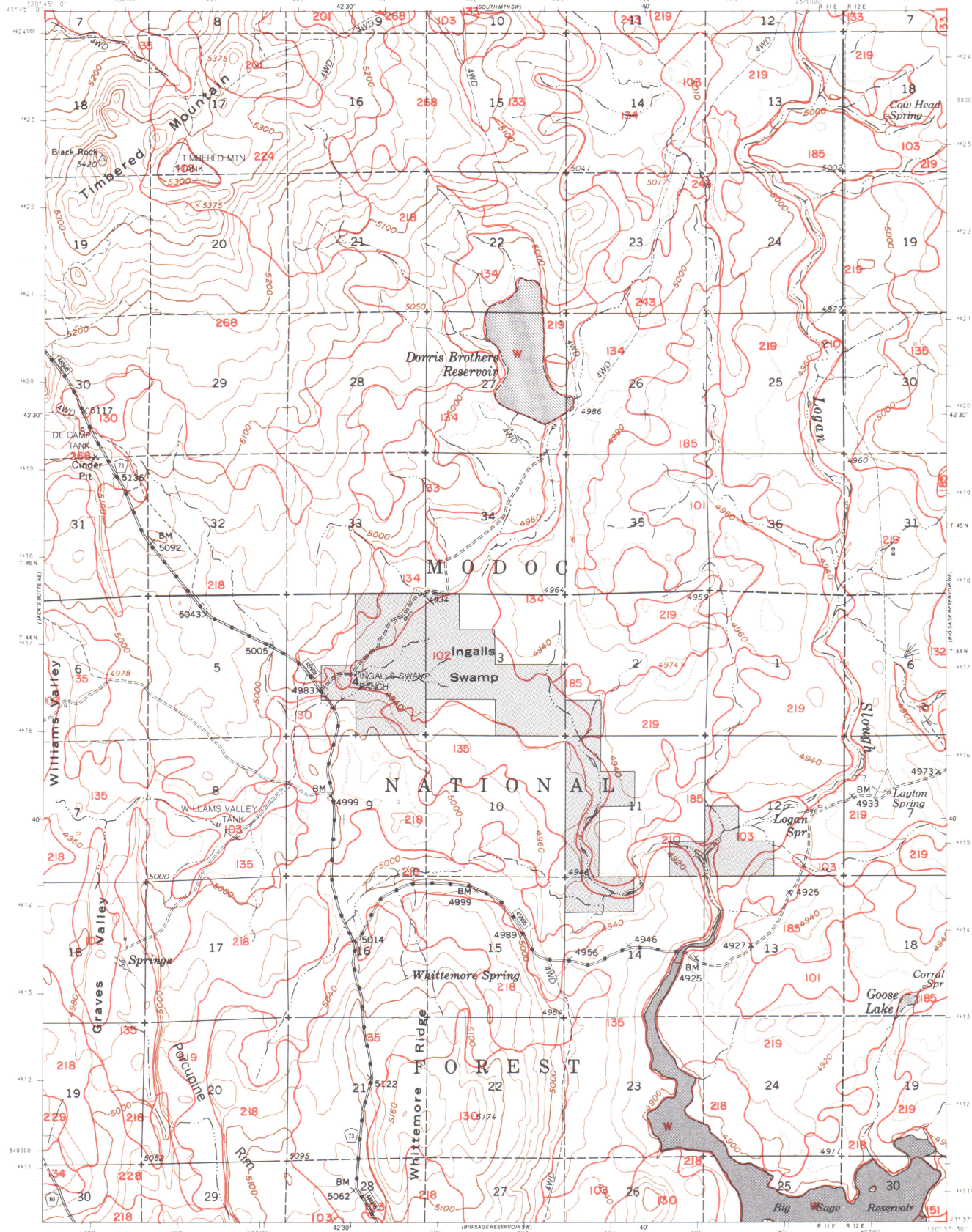
MODOC NATIONAL FOREST

BIG SAGE RESERVOIR NE
N4137.5-W12030/7.5
1962
709-1C
RFVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

BIG SAGE RESERVOIR NW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 20 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

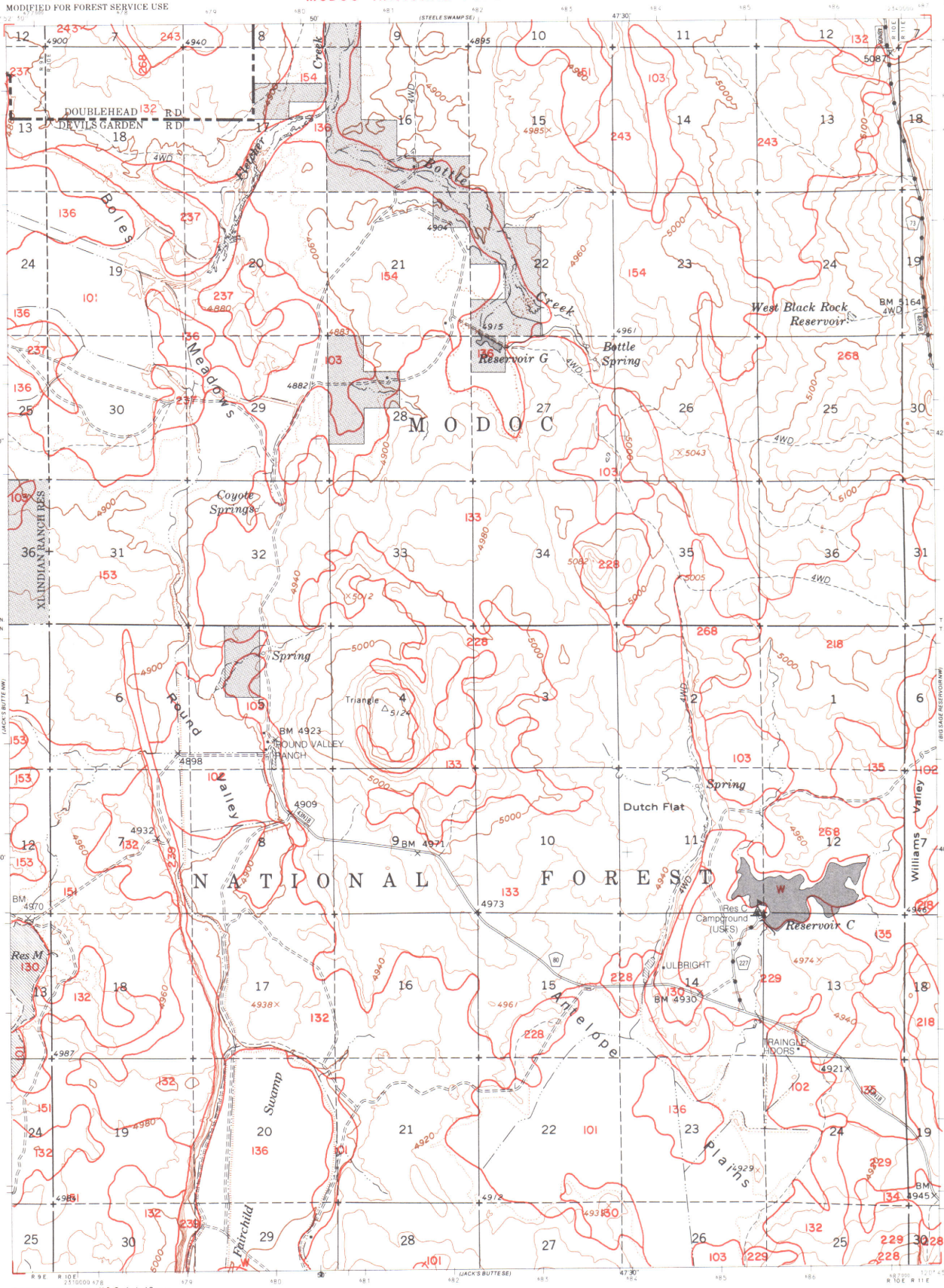
MODOC NATIONAL FOREST

BIG SAGE RESERVOIR NW
N4137.5-W12037.5/7.5
1962
709-2C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

JACK'S BUTTE NE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

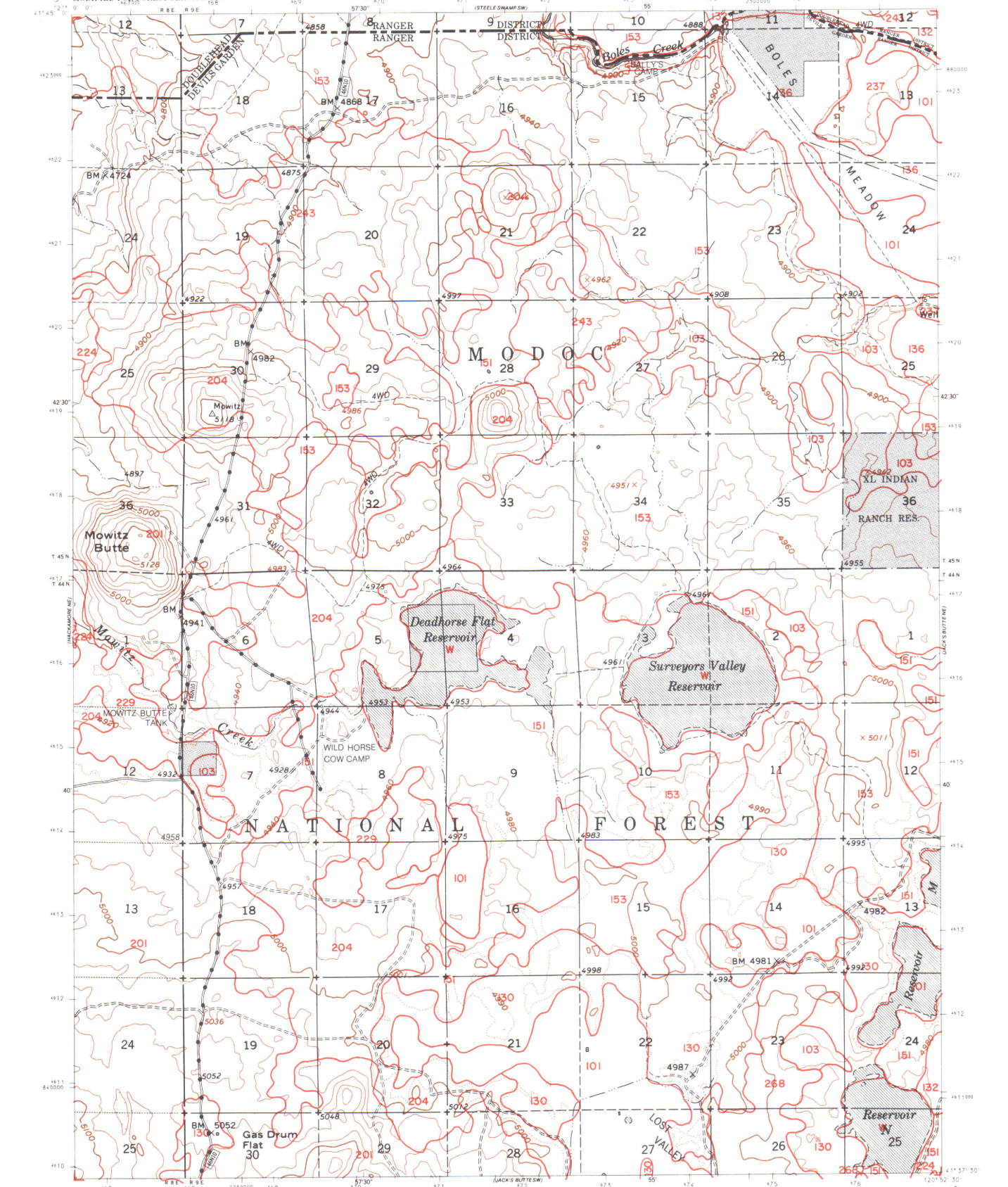
MODOC NATIONAL FOREST

JACK'S BUTTE NE
N4137.5-W12045/7.5
1962
710-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

JACK'S BUTTE NW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 20 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

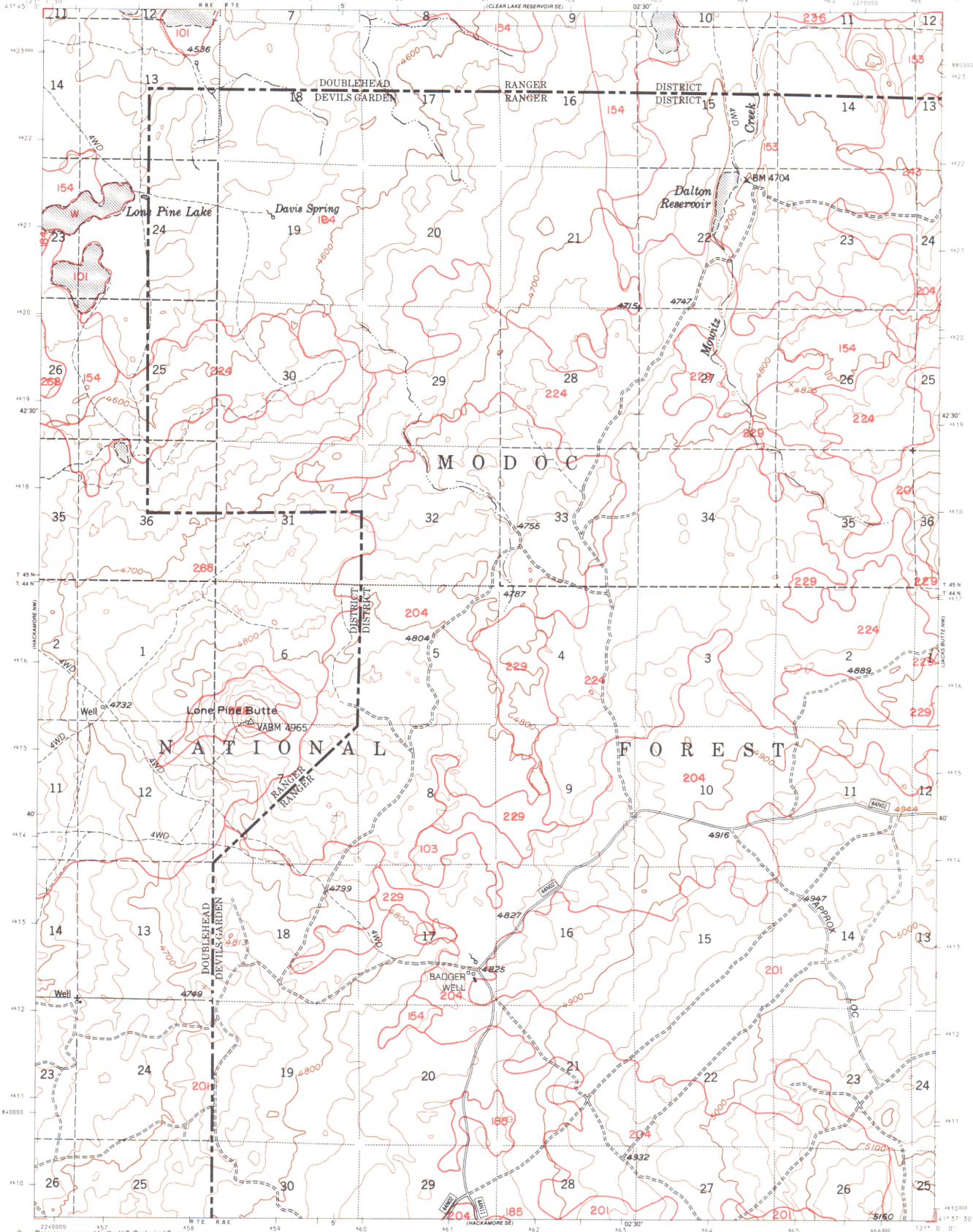
MODOC NATIONAL FOREST

JACK'S BUTTE NW
N4137.5-W12052.5/7.5
1962
710-2C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

HACKAMORE NE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 20 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

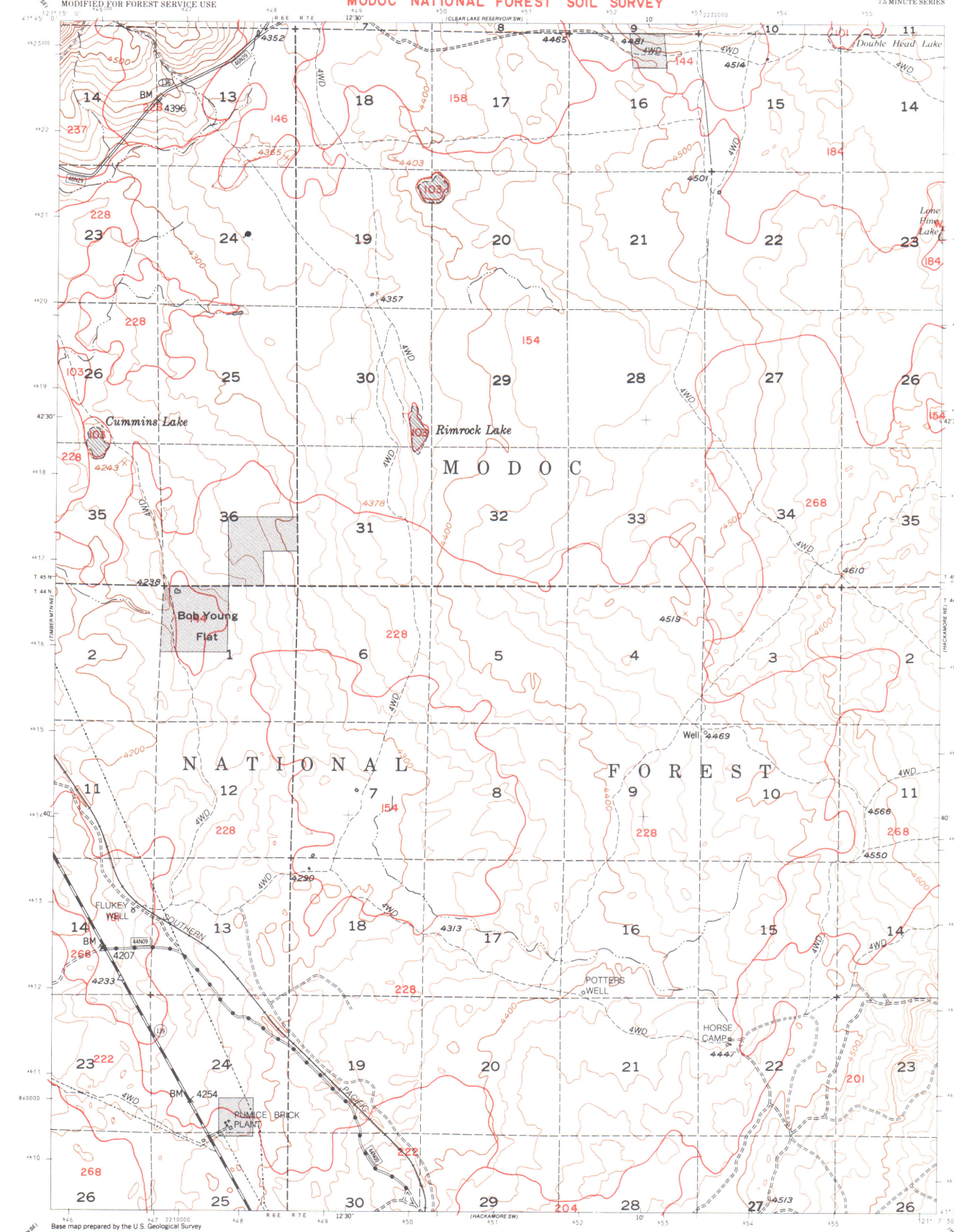
MODOC NATIONAL FOREST

HACKAMORE NE
N4137.5-W12100/7.5
1952
711-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

HACKAMORE NW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 20 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

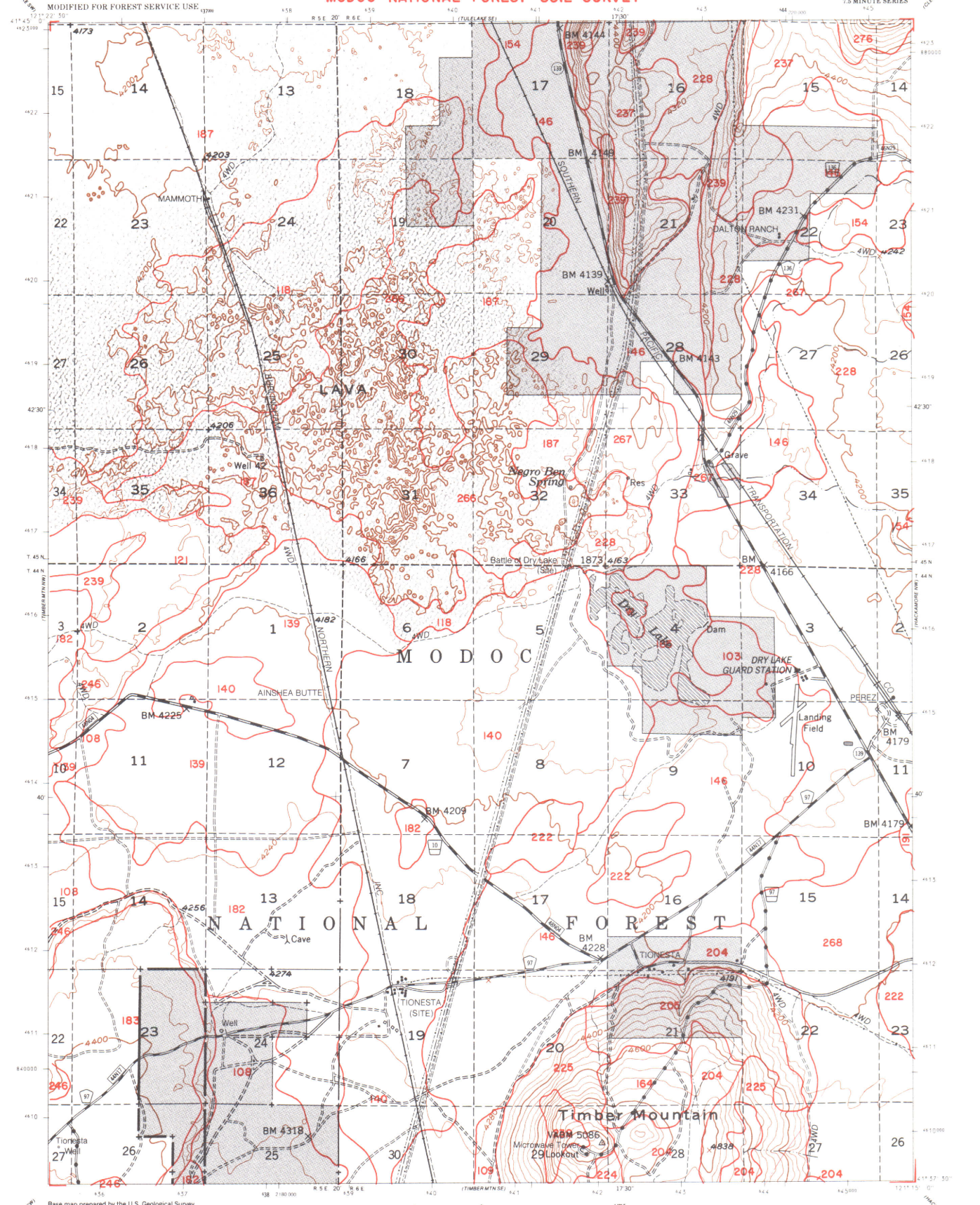
MODOC NATIONAL FOREST

HACKAMORE NW
N4137.5-W12107.5/7.5
1952
711-2C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

TIMBER MTN NE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

TIMBER MTN NE
N4137.5-W12115/7.5
1952
712-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

TIMBER MTN NW
7.5 MINUTE SERIES

(CAPTAIN JACKS STRONGHOLD)

(TULELAKE SW)

(TULELAKE SE)

(MEDICINE LAKE NE)

(TIMBER MTN NW)

(TIMBER MTN SE)

(MEDICINE LAKE SE)

(TIMBER MTN SW)

Three Sisters

LAVA BEDS NATIONAL MONUMENT

LAVA BEDS WILDERNESS

APPROX. WILDERNESS BDY

Valentine Cave

Caldwell Minor

Caldwell Butte

BM 4510

Locked Gate

Locked Gate

Locked Gate

Gravel Pit

Area of Indian Fortifications (Ruins)

Big Sand Butte

VABM 4661

Indian Fortifications (Ruins)

East Sand Butte

Cinder Pit

Little Sand Butte

BM 4359

Cougar Butte

BM 4251

BM 4290

MODOC NATIONAL FOREST

SISKIYOU CO.

MODOC CO.

4WD

Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

TOWNSHIP AND SECTION LINE CLASSIFICATION

- National Forest Boundary
- Non-National Forest Lands
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction
- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate
- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

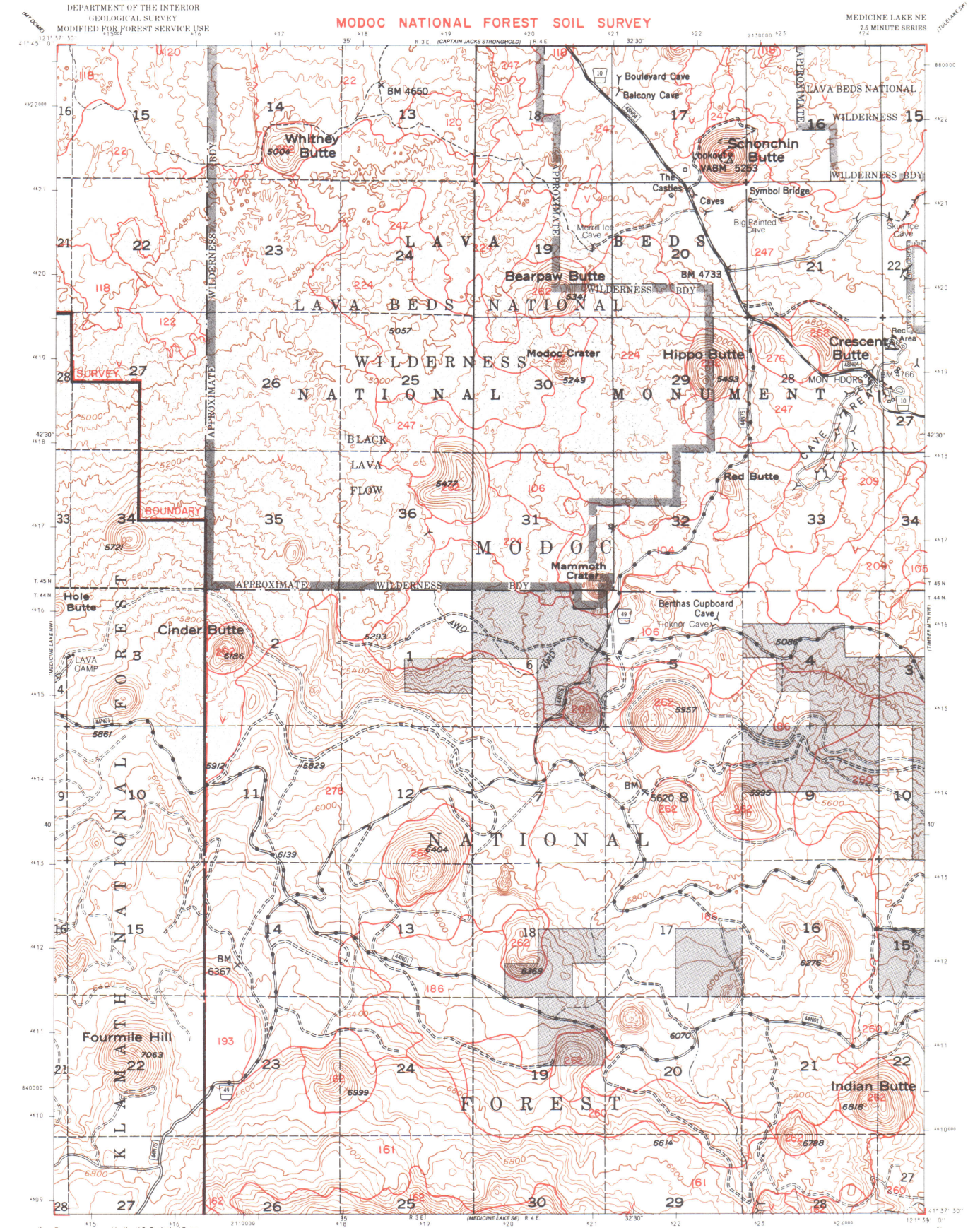
MODOC NATIONAL FOREST

TIMBER MTN NW
N4137.5-W12122.5/7.5
1952
712-2C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

MEDICINE LAKE NE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands
- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate
- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

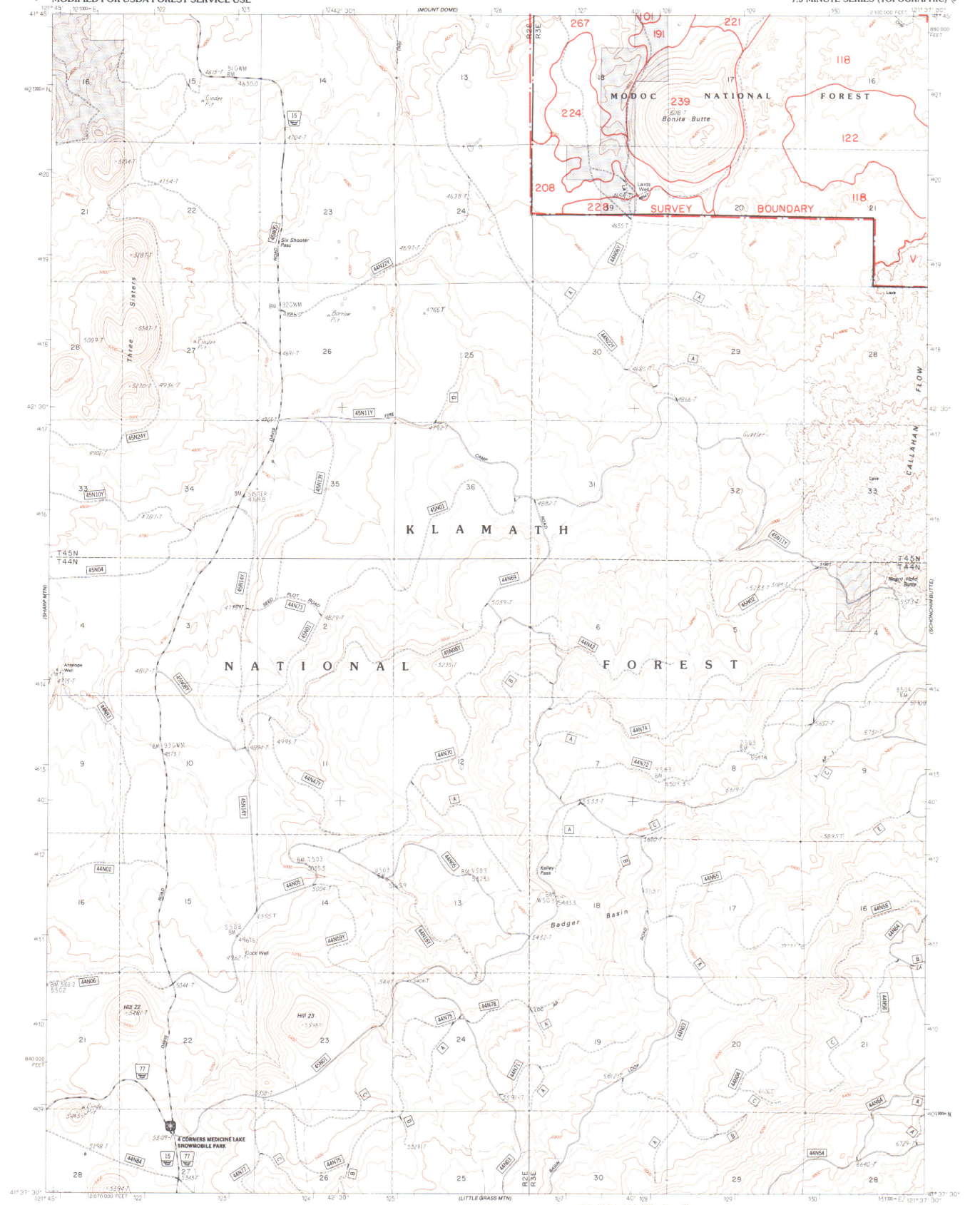
MODOC NATIONAL FOREST

MEDICINE LAKE NE
N4137.5/7.5 -W12030/7.5
1952
713-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

BONITA BUTTE QUADRANGLE
CALIFORNIA—SISKIYOU CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



PROVISIONAL BASE MAP PREPARED BY THE U.S. GEOLOGICAL SURVEY
CONTROL BY ..... USGS, NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN ..... 1981 AND 1984
FIELD CHECKED ..... 1985 MAP EDITED 1988
PROJECTION ..... LAMBERT CONFORMAL CONIC
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR ..... ZONE 10
10,000-FOOT STATE GRID TICKS ..... CALIFORNIA, ZONE 1

VERTICAL DATUM ... NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM ..... 1927 NORTH AMERICAN DATUM
To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (18 meters north ; 93 meters east)
Modification to the USGS provisional base map by the Geometronics Service Center from 1989 aerial photography and 1990 correction guides furnished by the Pacific Southwest Region
Landnet revised according to additional Forest Service evidence

UTM GRID AND 1992 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
SUPPLEMENTARY CONTOUR INTERVAL 10 FEET

- National Forest Boundary
- Non-National Forest System Land as of 1992
- TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Surveyed, Location Questionable
- Unsurveyed
- Locked Gate
- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Unimproved Road, Native Surface (includes 4WD/not maintained for passenger cars)
- Unimproved Road
- Trail

ROUTE MARKERS
- Interstate
- U.S.
- State
- County
- National Forest, Well Maintained for Passenger Cars
- National Forest, Maintained for Passenger Cars
- National Forest, Not Maintained for Passenger Cars
- National Forest Trail

ATTN: Road ticks indicate change between portions photo-identified and portions not visible on the aerial photography. Portions not visible will be labeled 'LOCATION APPROXIMATE.'

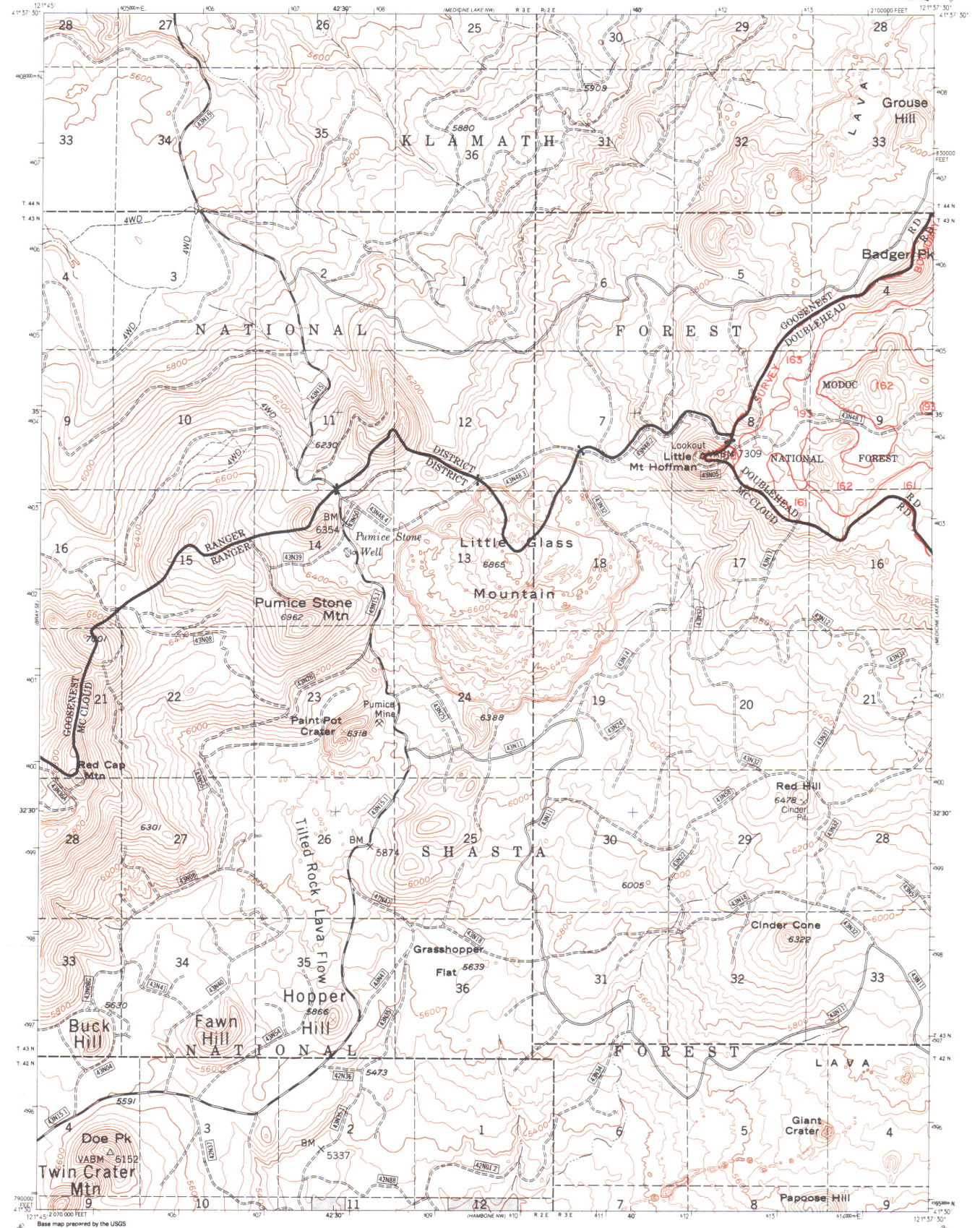
731-4	730-3	730-4
714-1	713-2	713-1
714-4	713-3	713-4

BONITA BUTTE, CALIF.
PROVISIONAL EDITION 1988
N4137.5—W12137.5/7.5
713-2
REVISED 1992

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

MEDICINE LAKE SW
7.5 MINUTE SERIES



Base map prepared by the USGS

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by Geometronics Service Center from 1982 1:40,000 Forest Service photography and 1982 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1983 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LEGEND

- National Forest Boundary
- Non-Forest Service Land within Proclaimed Boundary as of 1983
- TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed,Location Reliable
- Surveyed,Location Approximate
- Unsurveyed, Protraction
- Primary Highway
- Secondary Highway
- Improved Light Duty
- Unimproved Dirt
- Trail
- Approximate Road
- Approximate Trail
- US Highway
- State Highway
- County Road
- Forest Highway
- Forest Road
- Forest Trail

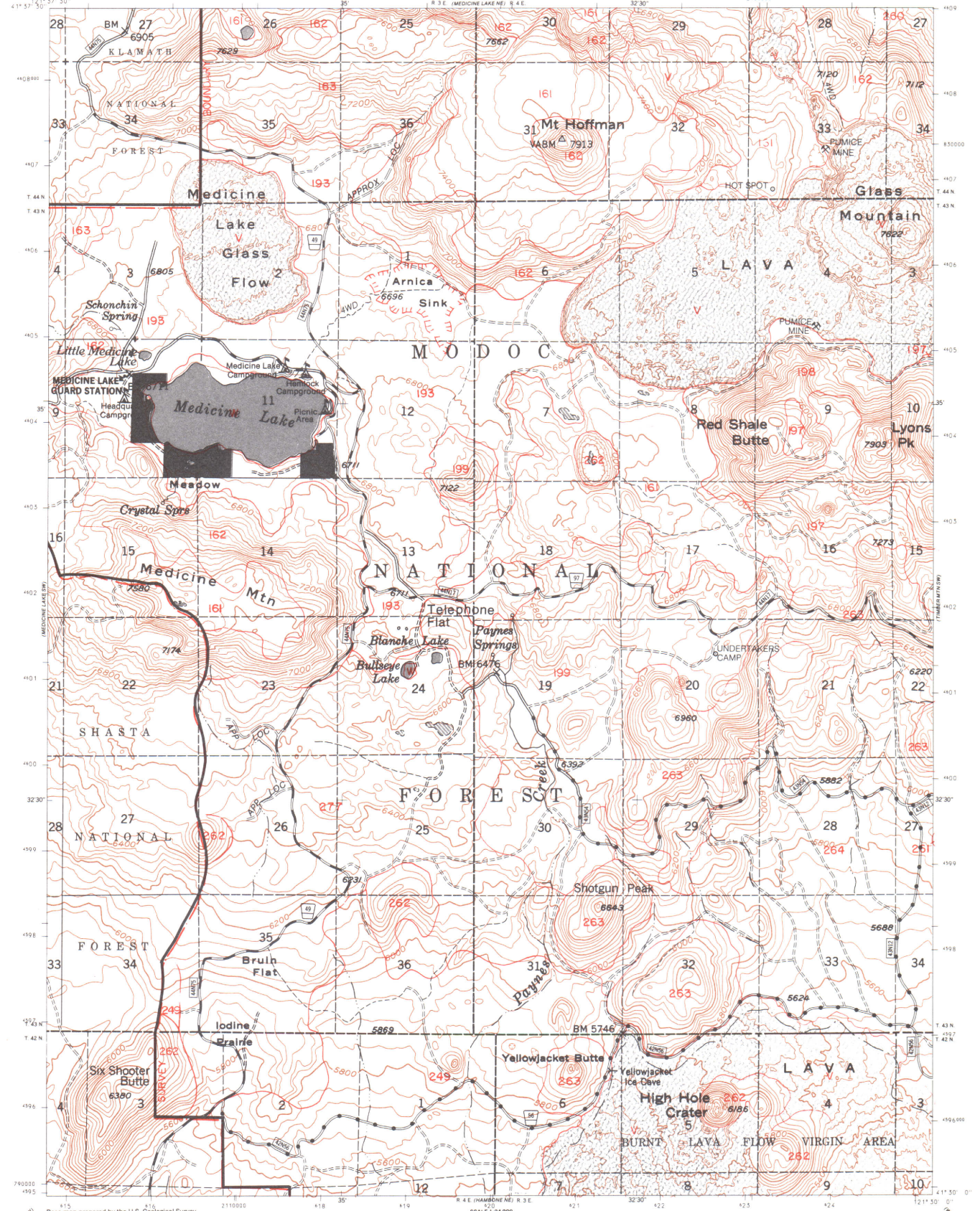
SHASTA - TRINITY NATIONAL FOREST

MEDICINE LAKE SW
N4130-W12137.5/7.5
1983
713-3C

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

MEDICINE LAKE SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

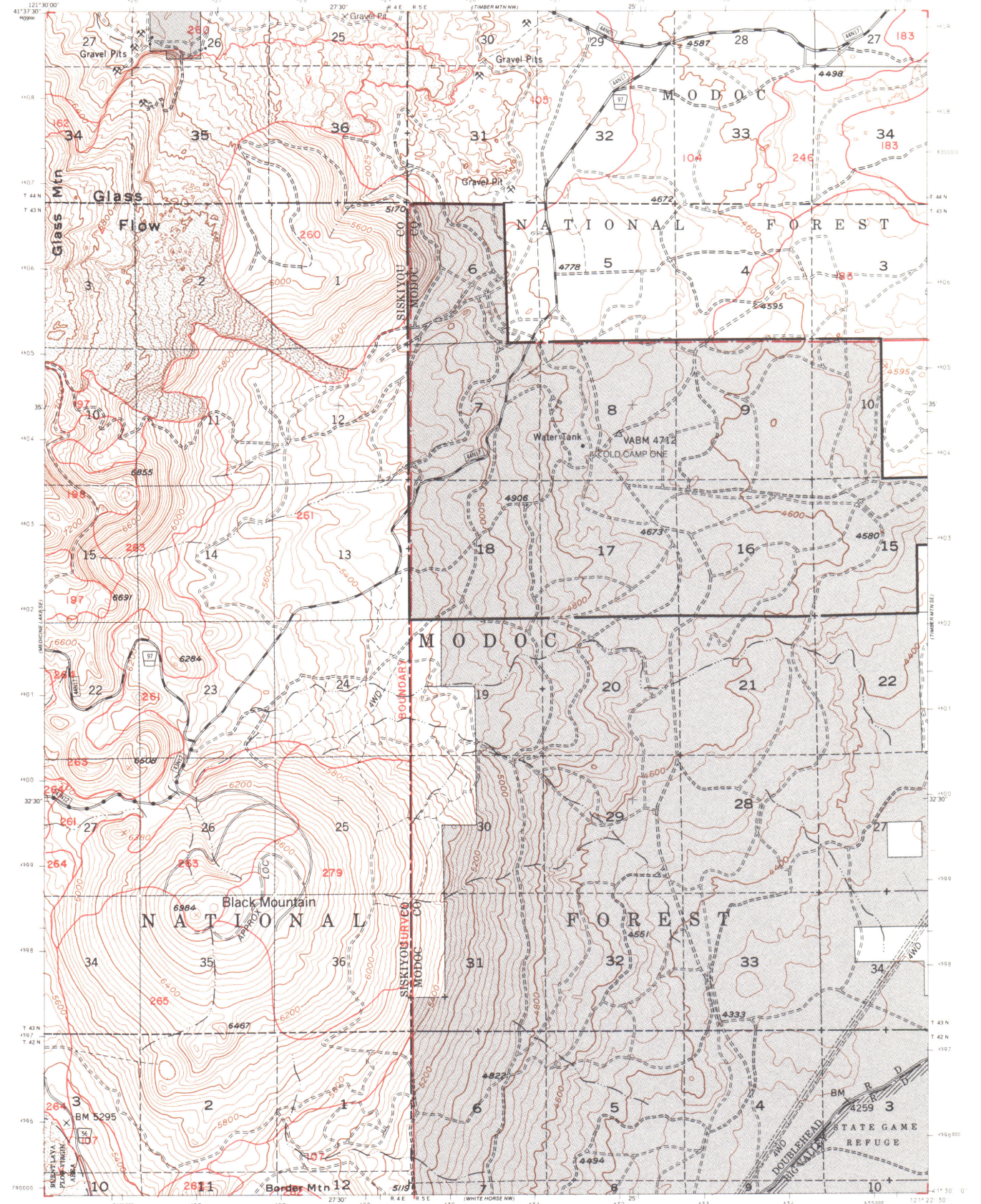
MODOC NATIONAL FOREST

MEDICINE LAKE SE
N4130-W12130/7.5
1952
713-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

TIMBER MTN SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

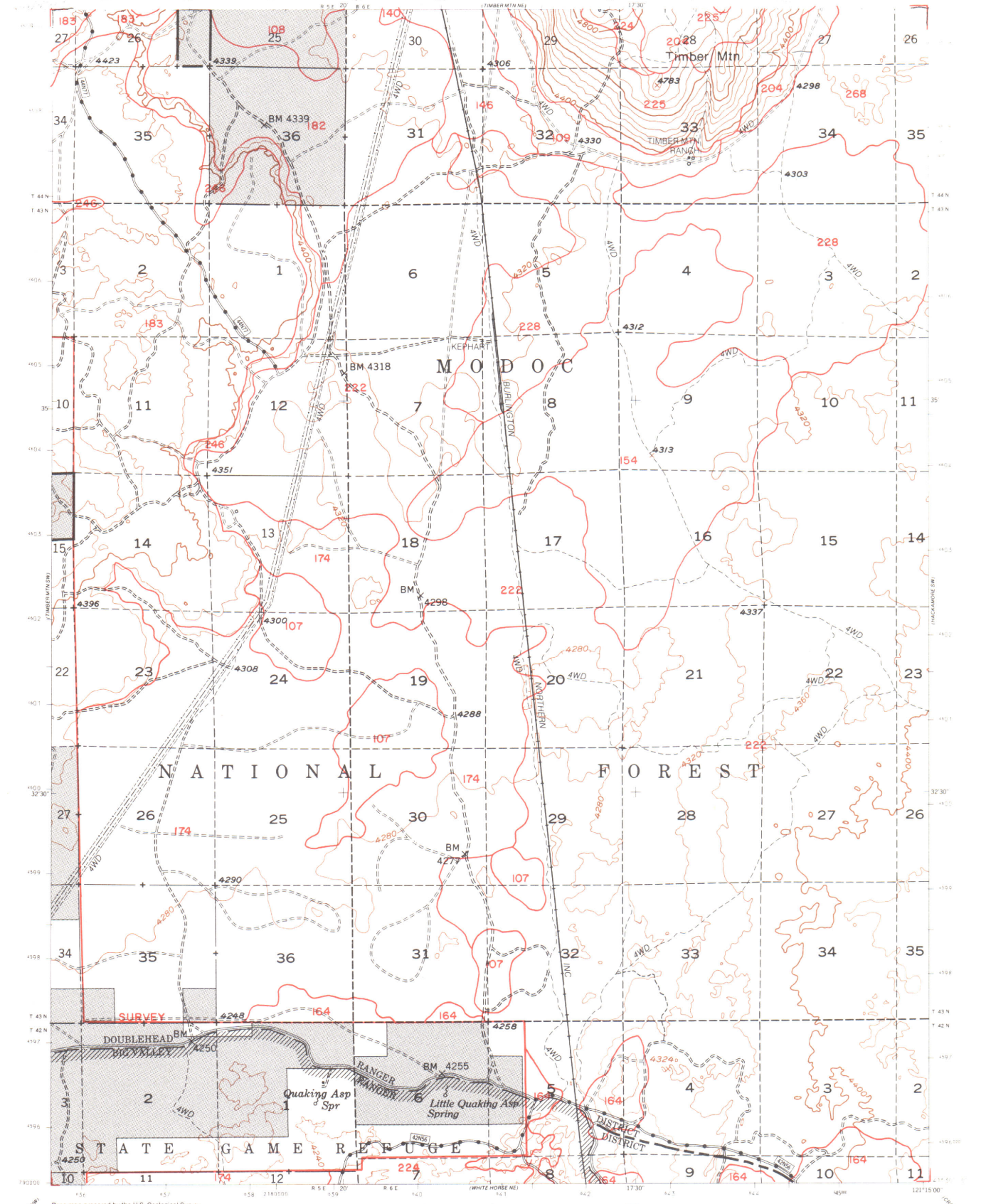
MODOC NATIONAL FOREST

TIMBER MTN SW
N4130-W12122.5/7.5
1952
712-3C
REVISED 1967

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

TIMBER MTN SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone I
1000 meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

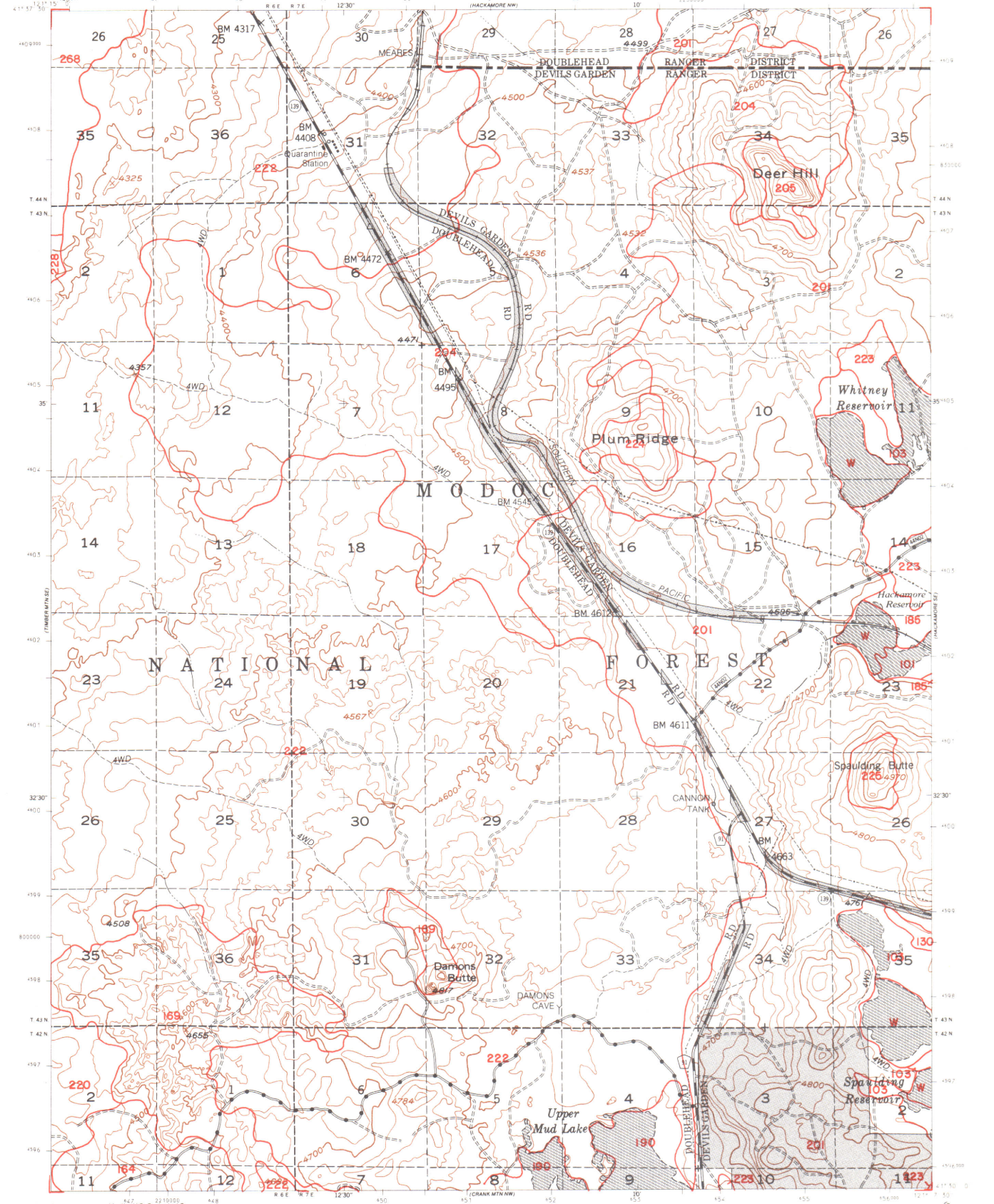
MODOC NATIONAL FOREST

TIMBER MTN SE
N4130-W12115/7.5
1952
712-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

HACKAMORE SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

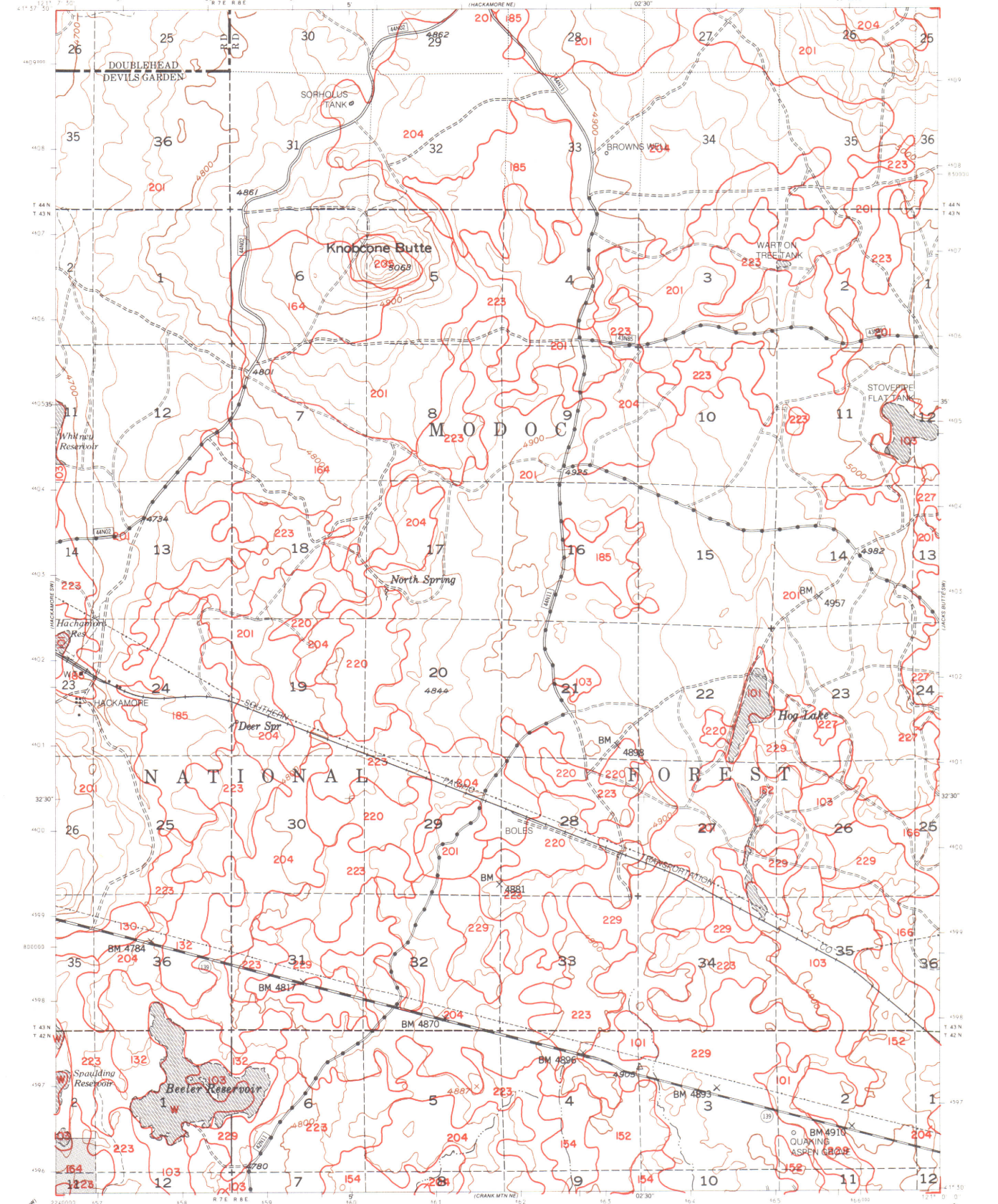
MODOC NATIONAL FOREST

HACKAMORE SW
N4130-W12107.5/7.5
1952
711-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

HACKAMORE SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 20 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

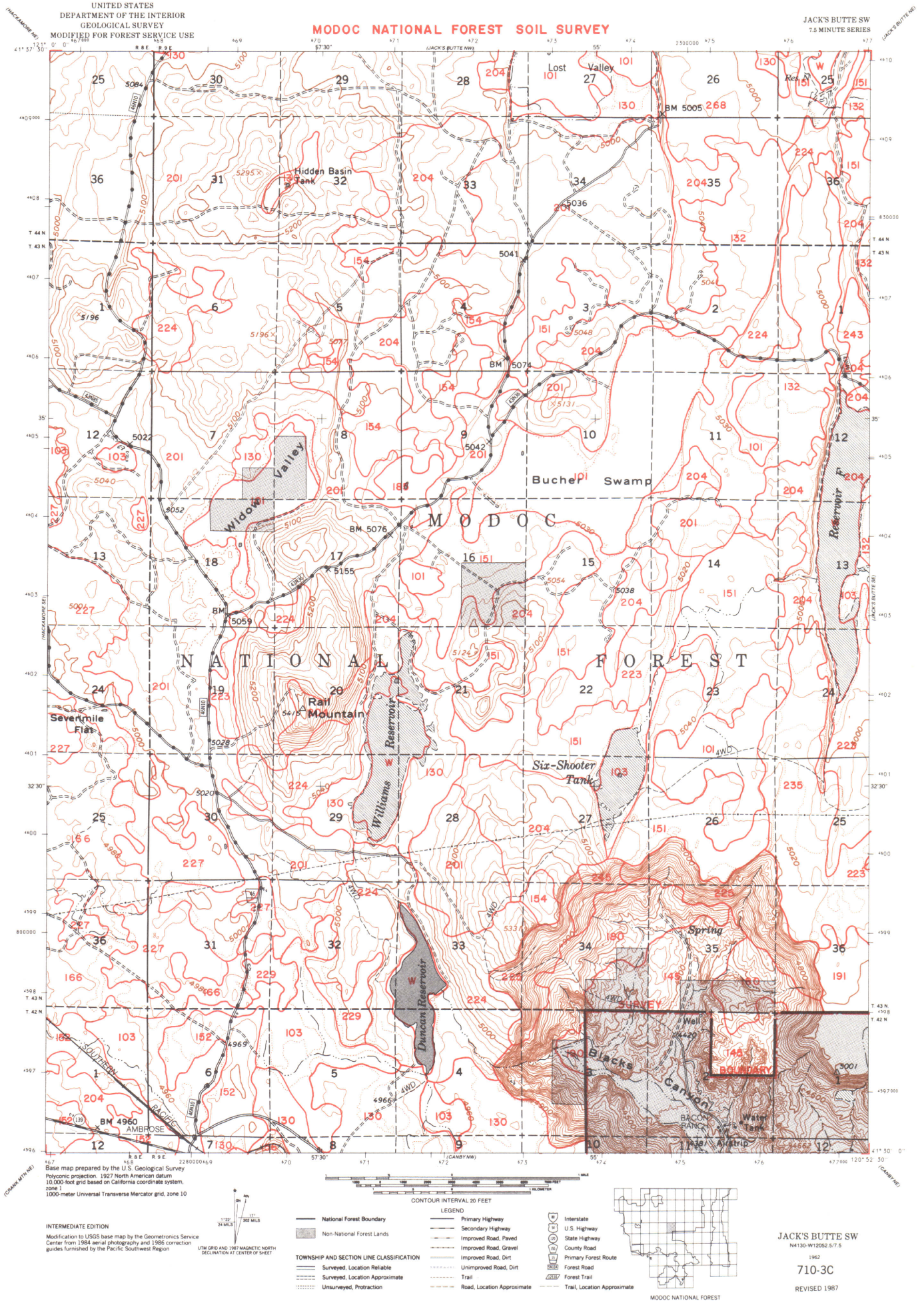
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

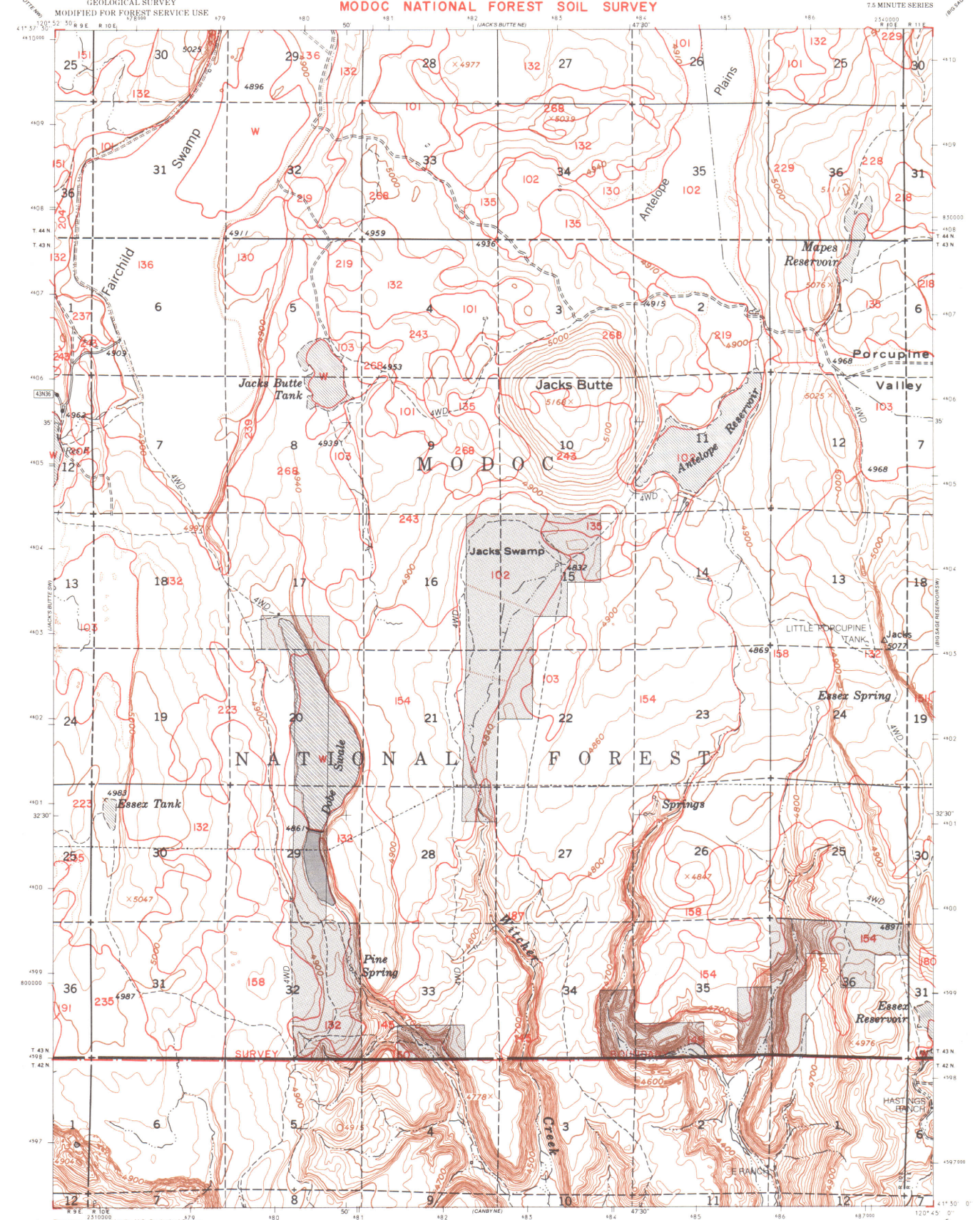
HACKAMORE SE
N4130—W12100/7.5
1952
711-4C
REVISED 1987


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE
MODOC NATIONAL FOREST SOIL SURVEY
JACK'S BUTTE SW
7.5 MINUTE SERIES
MODOC
NATIONAL FOREST
Lost Valley
Hidden Basin Tank
Widow Valley
Bucher Swamp
Rail Mountain
Severimile Flat
Williams Reservoir
Duncan Reservoir
Six-Shooter Tank
Spring
Blacks Canyon
BACON RANCH
Water Tank
Airstrip
Well
BOUNDARY
SURVEY
SOUTHERN PACIFIC
AMBROSE
BM 5005
BM 5074
BM 5076
BM 5059
BM 4960
Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
CONTOUR INTERVAL 20 FEET
LEGEND
National Forest Boundary
Non-National Forest Lands
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
MODOC NATIONAL FOREST
JACK'S BUTTE SW
N4130-W12052.5/7.5
1962
710-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

JACK'S BUTTE SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 20 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

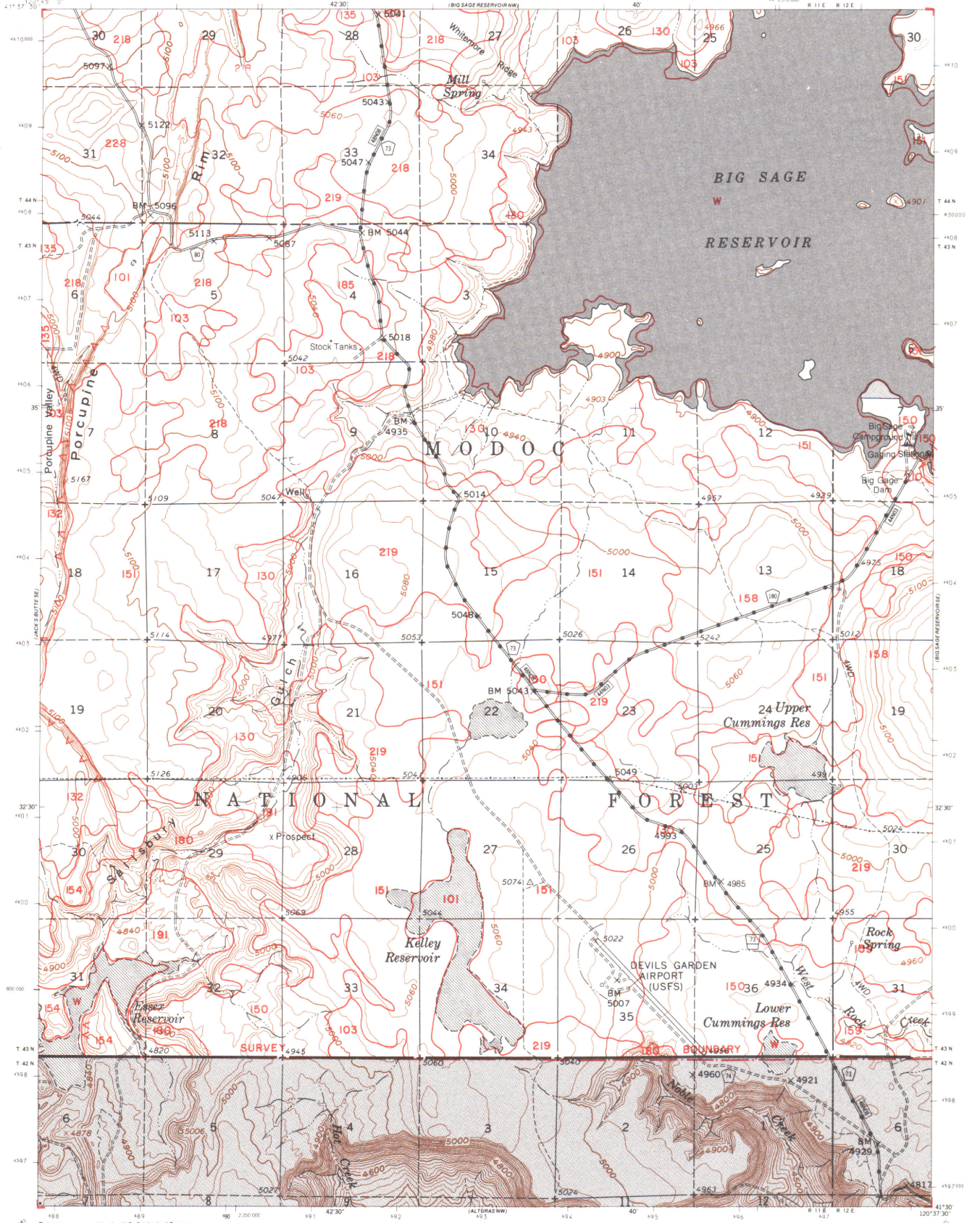
JACK'S BUTTE SE
N4130-W12045/7.5
1962
710-4C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

BIG SAGE RESERVOIR SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands
- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate
- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

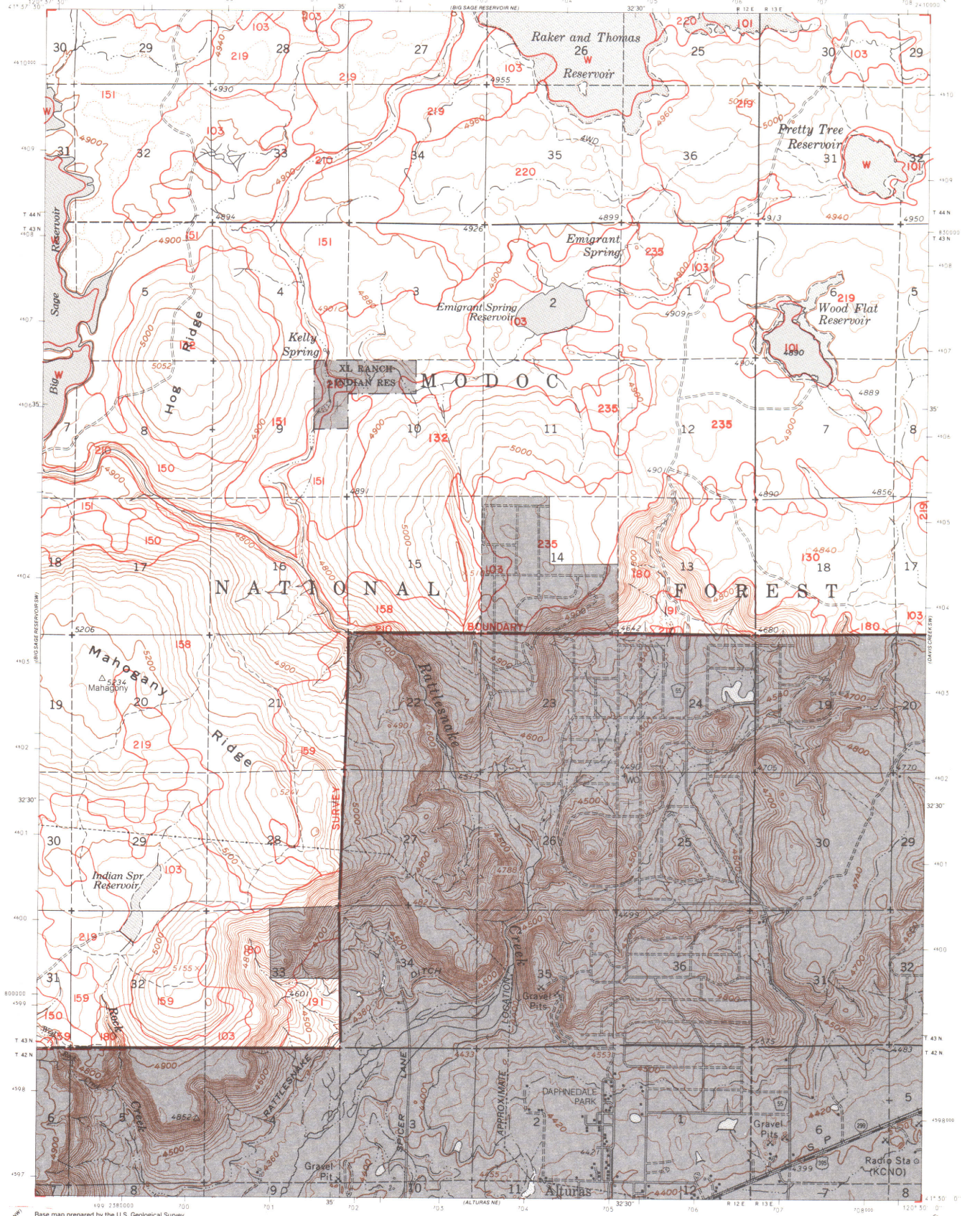
MODOC NATIONAL FOREST

BIG SAGE RESERVOIR SW
N4130-W12037.5/7.5
1962
709-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

BIG SAGE RESERVOIR SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1967 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

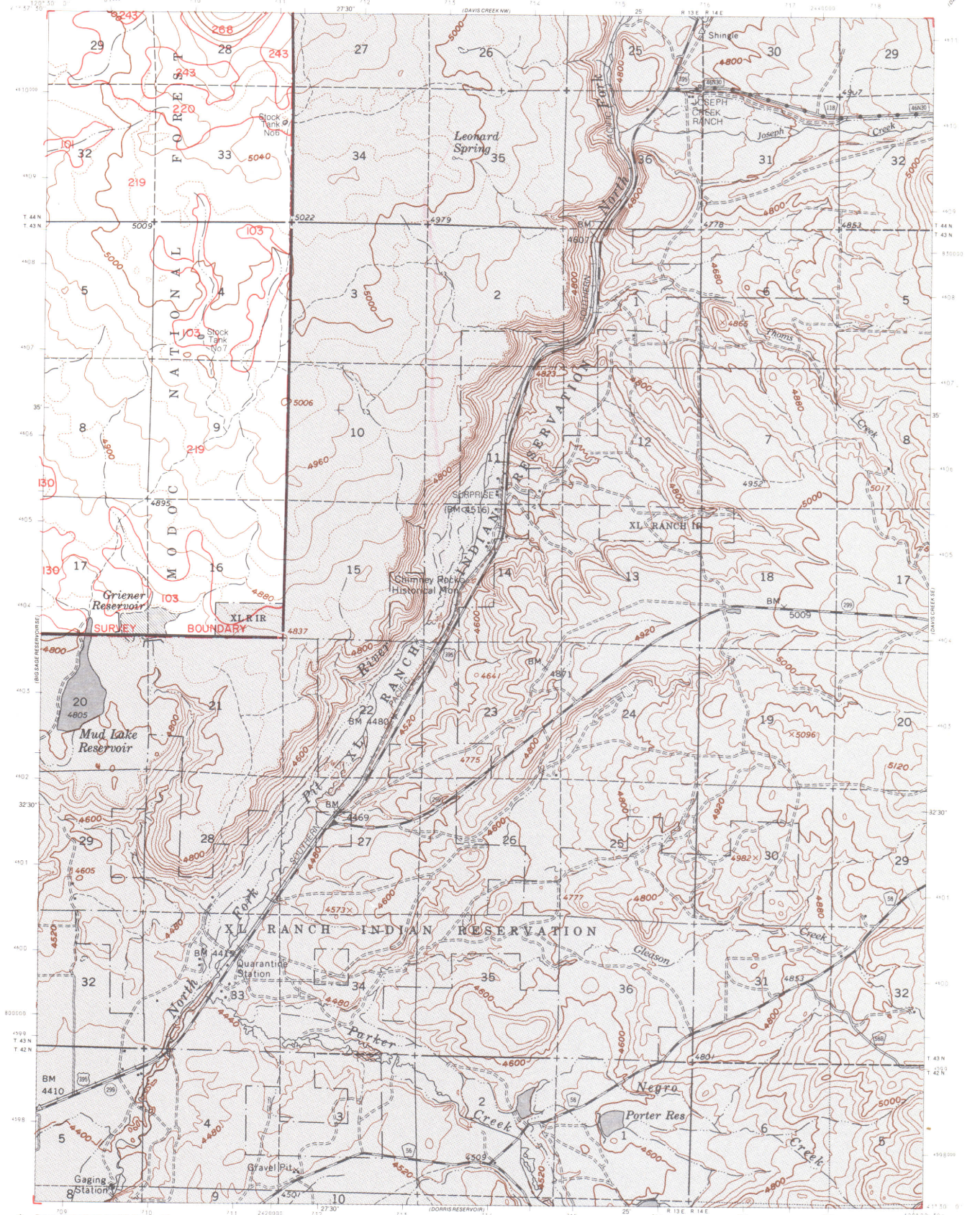
MODOC NATIONAL FOREST

BIG SAGE RESERVOIR SE
N4130-W12030/7.5
1962
709-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

DAVIS CREEK SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

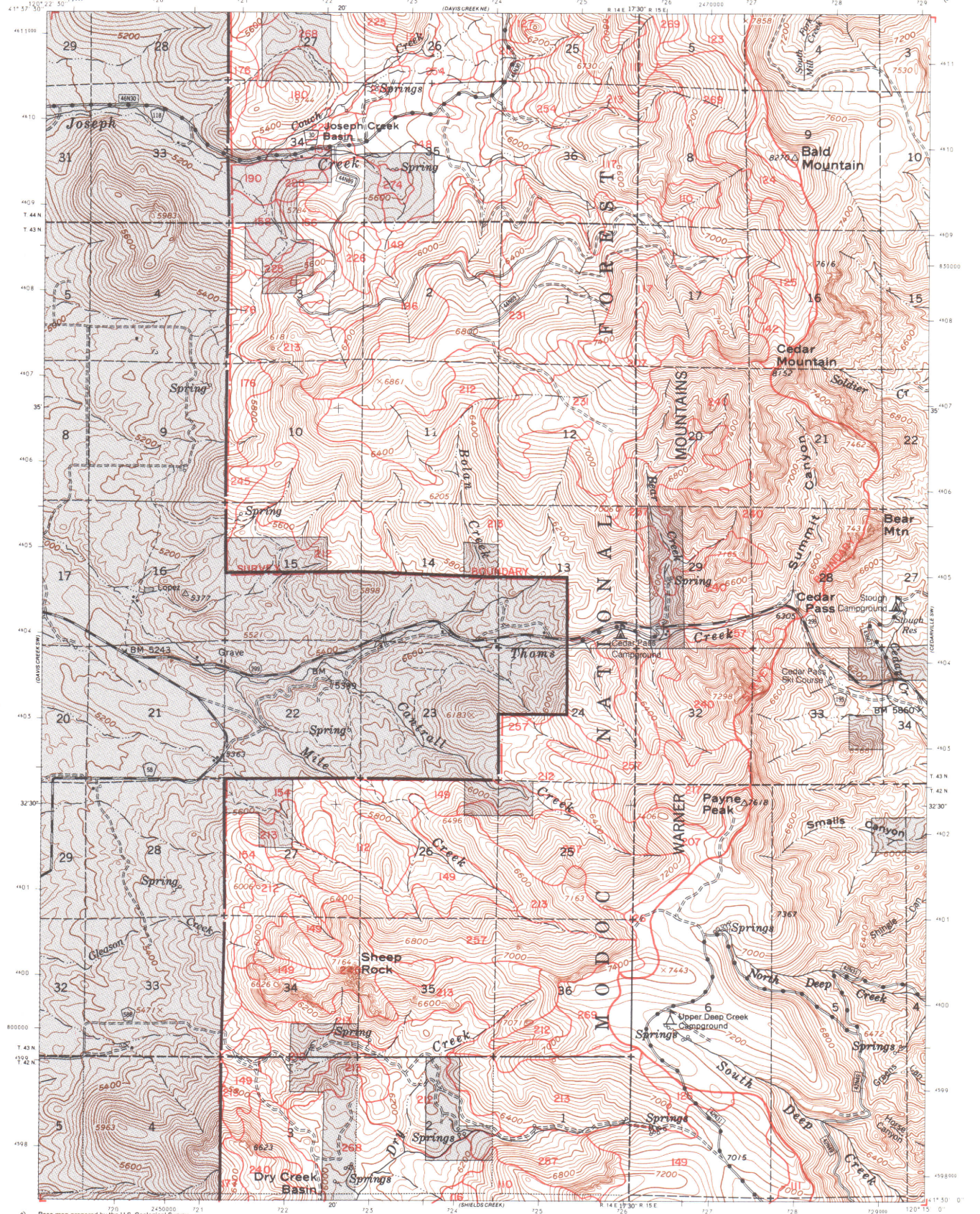
MODOC NATIONAL FOREST

DAVIS CREEK SW
N4130-W12022.5/7.5
1962
708-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

DAVIS CREEK SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

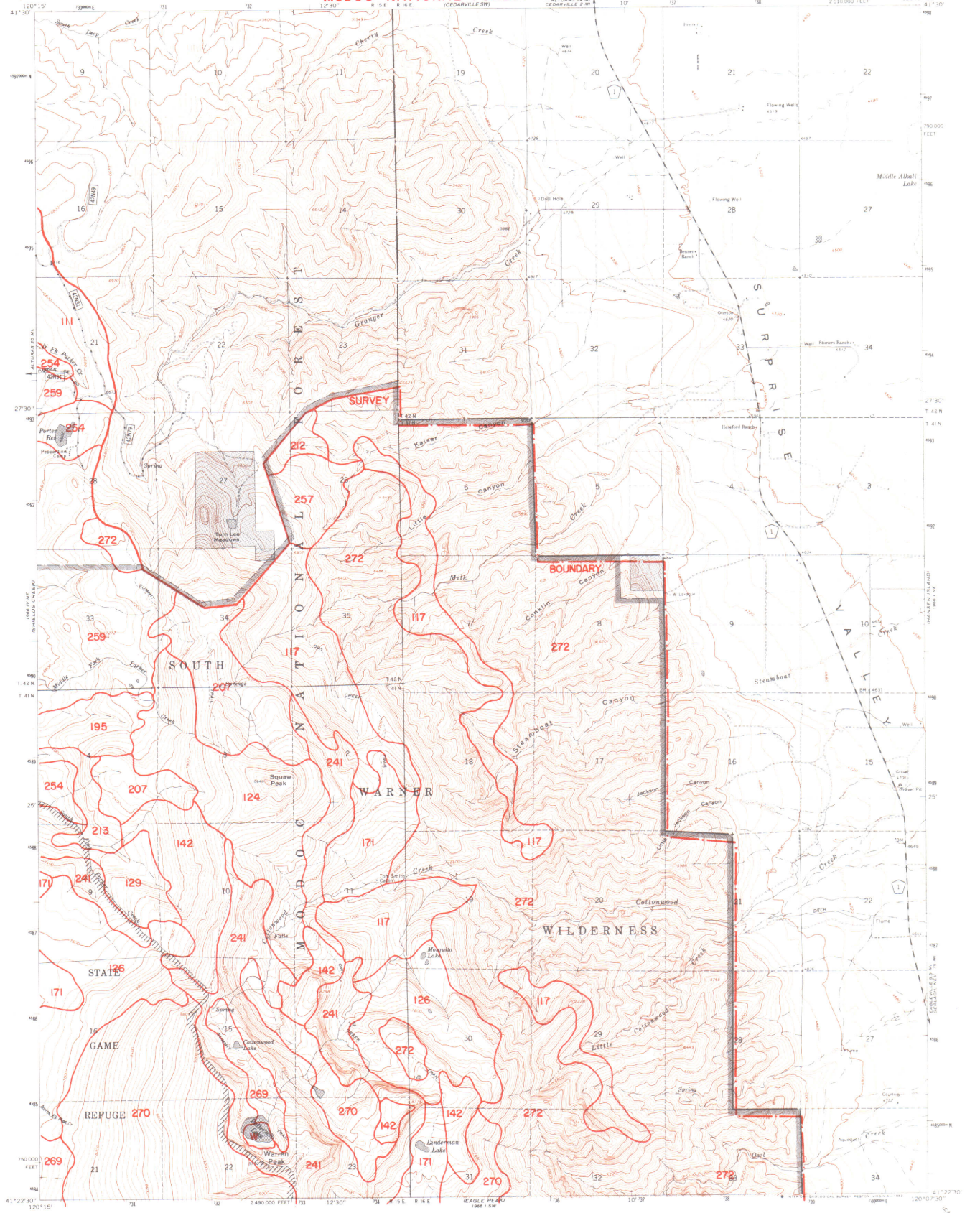
MODOC NATIONAL FOREST

DAVIS CREEK SE
N4130-W12015/7.5
1962
708-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

WARREN PEAK QUADRANGLE
CALIFORNIA – MODOC CO.
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Control by USGS, NOS/NOAA, and U.S. Forest Service

Topography by photogrammetric methods from aerial photographs taken 1955, 1959, and 1962. Field checked by USGS 1963

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid ticks, zone 10

Fine red dashed lines indicate selected fence lines

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

WARREN PEAK, CALIF.
N4122.5—W12007.5/7.5

1963
PHOTOREVISED 1982
DMA 3661 I NW—SERIES V895

690-2C

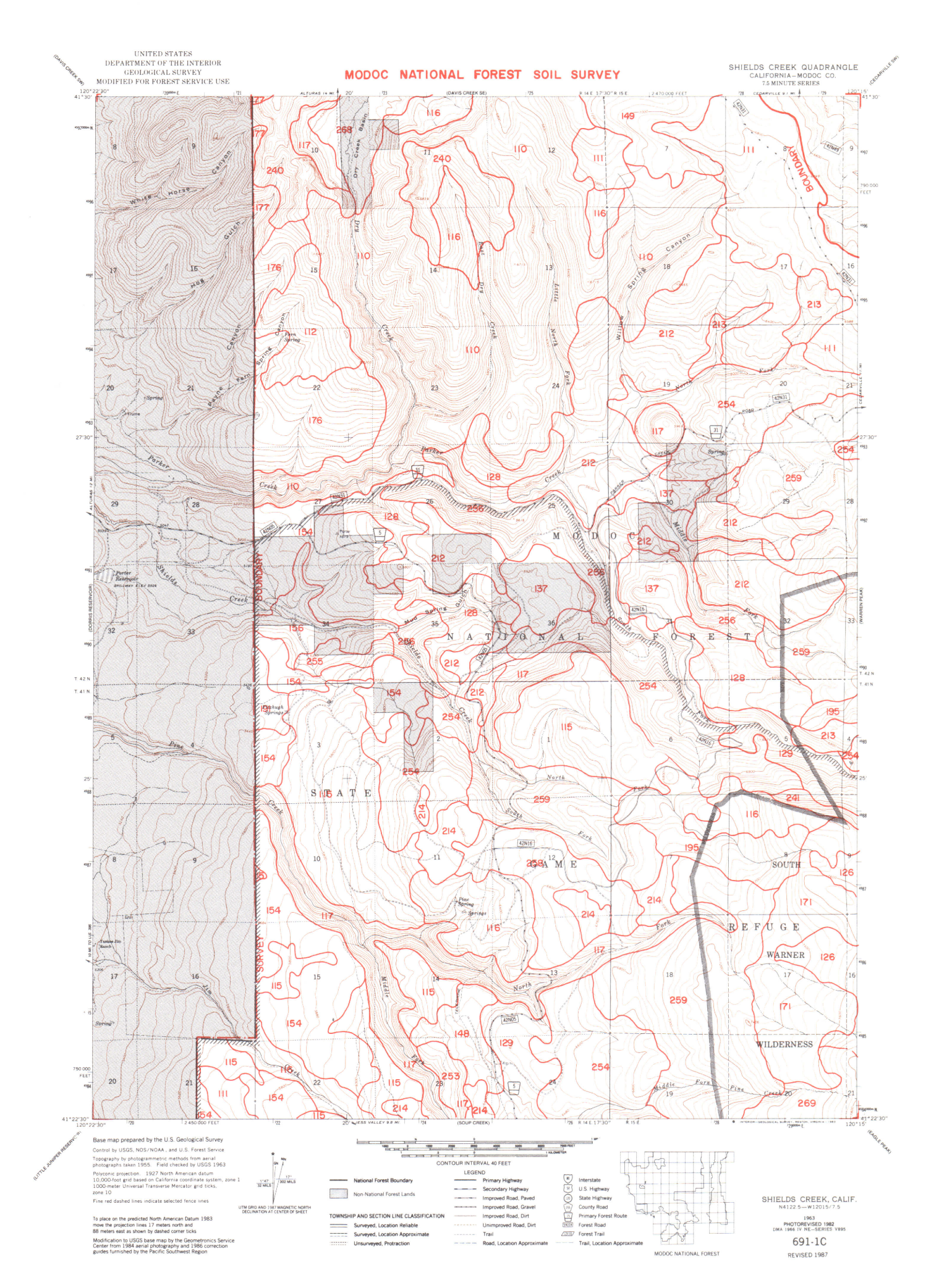
REVISED 1987

MODOC NATIONAL FOREST

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

SHIELDS CREEK QUADRANGLE
CALIFORNIA—MODOC CO.
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Control by USGS, NOS/NOAA, and U.S. Forest Service

Topography by photogrammetric methods from aerial photographs taken 1955. Field checked by USGS 1963

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid ticks, zone 10

Fine red dashed lines indicate selected fence lines

To place on the predicted North American Datum 1983 move the projection lines 17 meters north and 88 meters east as shown by dashed corner ticks

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

SHIELDS CREEK, CALIF.
N4122.5—W12015/7.5

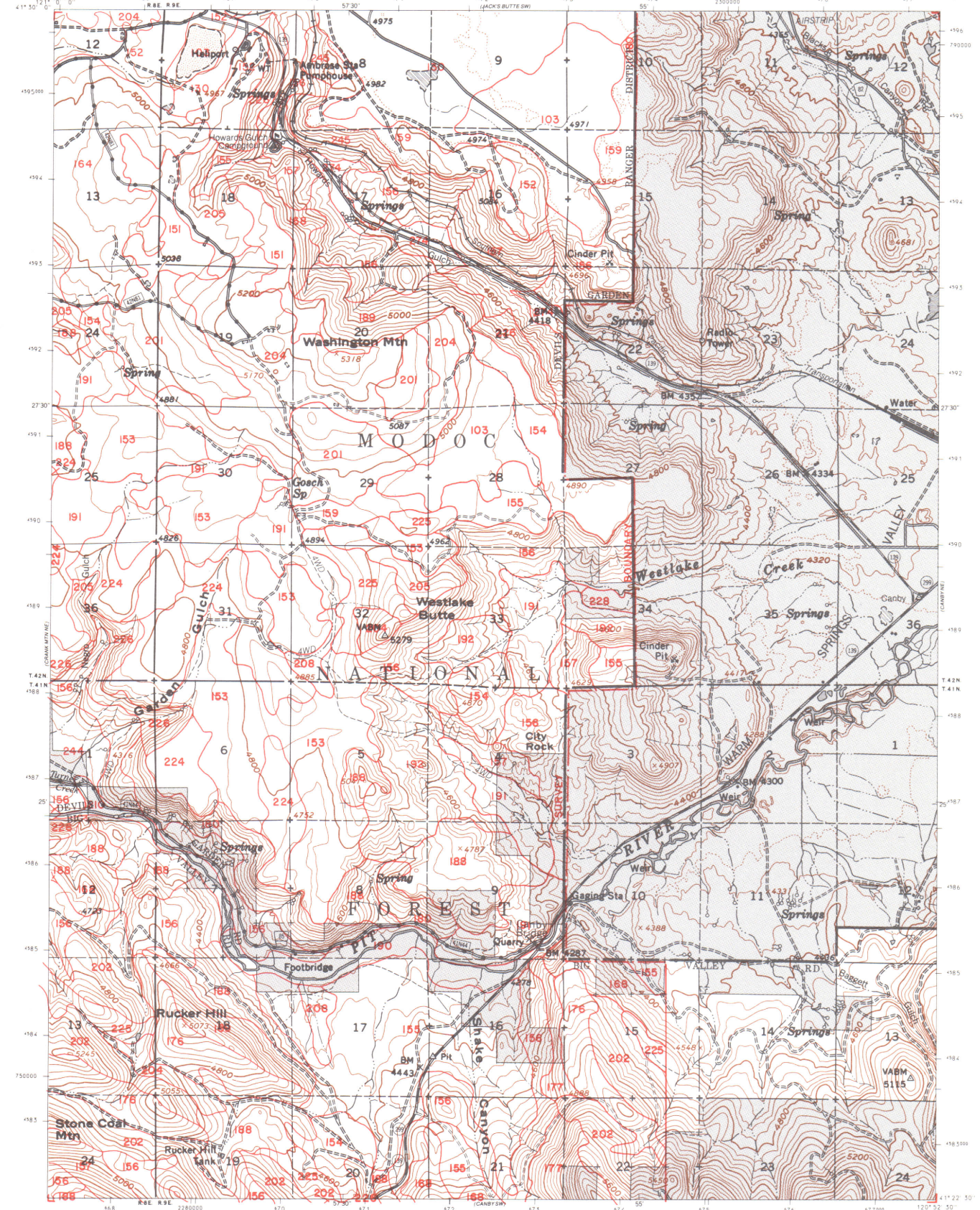
1963
PHOTOREVISED 1982
DMA 1966 IV NE—SERIES V895

691-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

CANBY NW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000 foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

National Forest Boundary
Non-National Forest Lands

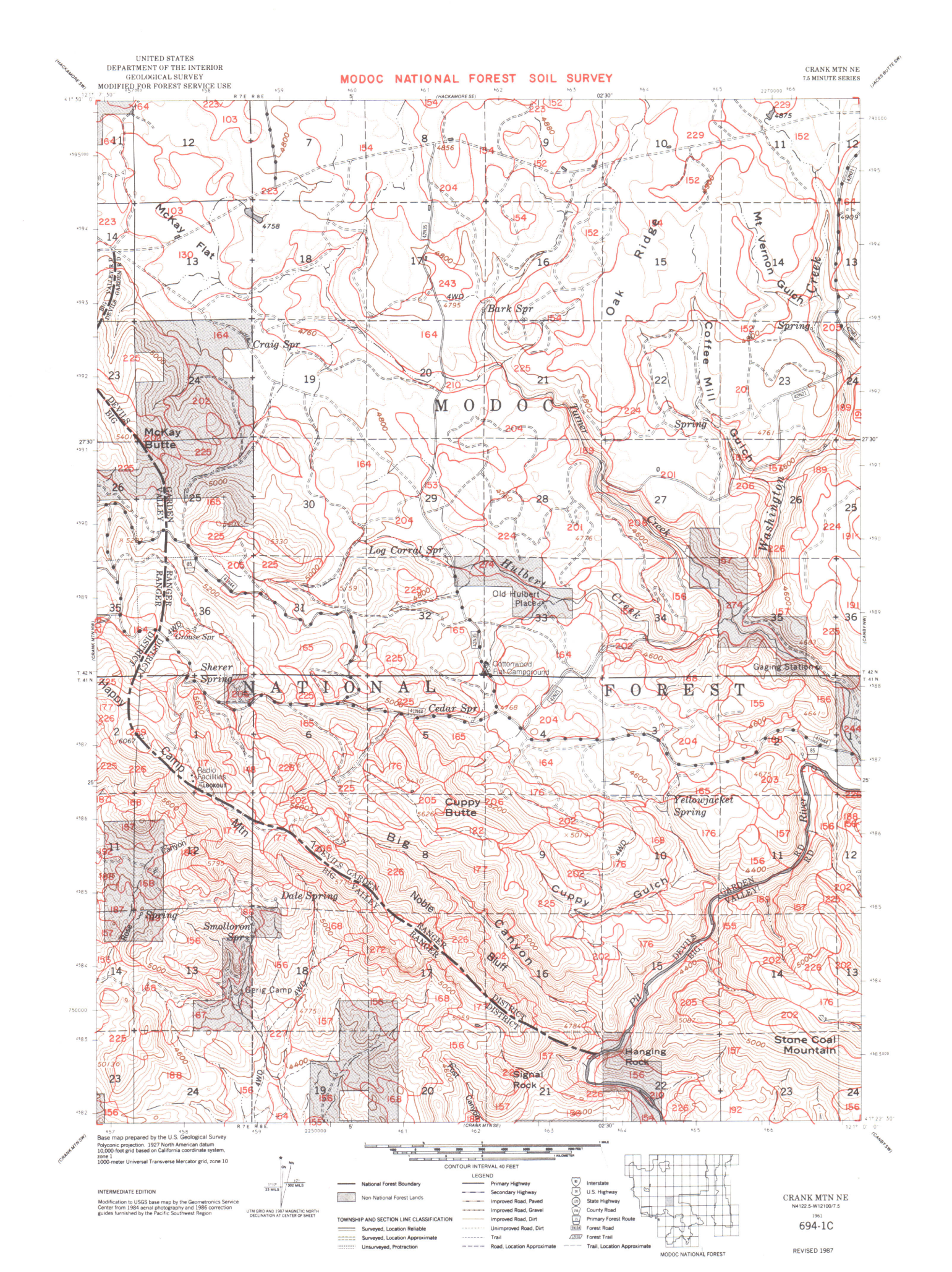
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction

Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate

Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate

MODOC NATIONAL FOREST

CANBY NW
N4122.5-W12052.5/7.5
1961
693-2C
REVISED 1987


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE
MODOC NATIONAL FOREST SOIL SURVEY
CRANK MTN NE
7.5 MINUTE SERIES
MODOC
NATIONAL FOREST
McKay Flat
Craig Spr
Bark Spr
Oak Ridge
Mt Vernon Gulch
Coffee Mill Spring
Tunnel Gulch
Washington Creek
McKay Butte
Log Corral Spr
Hulbert Creek
Old Hulbert Place
Dattonwood Flat Campground
Gaging Station
Sherer Spring
Grouse Spr
Cedar Spr
Happy Camp
Radio Facilities
LOOKOUT
Cuppy Butte
Yellowjacket Spring
Big Canyon
Dale Spring
Smolloron Spr
Noble Canyon
Cuppy Gulch
Red River
Gerig Camp
Pit River
Hanging Rock
Signal Rock
Stone Coal Mountain
GARDEN VALLEY
DEVILS GARDEN RANGER DISTRICT
Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
CONTOUR INTERVAL 40 FEET
INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
LEGEND
National Forest Boundary
Non-National Forest Lands
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate
MODOC NATIONAL FOREST
CRANK MTN NE
N4122.5-W12100/7.5
1961
694-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

CRANK MTN NW
7.5 MINUTE SERIES

Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

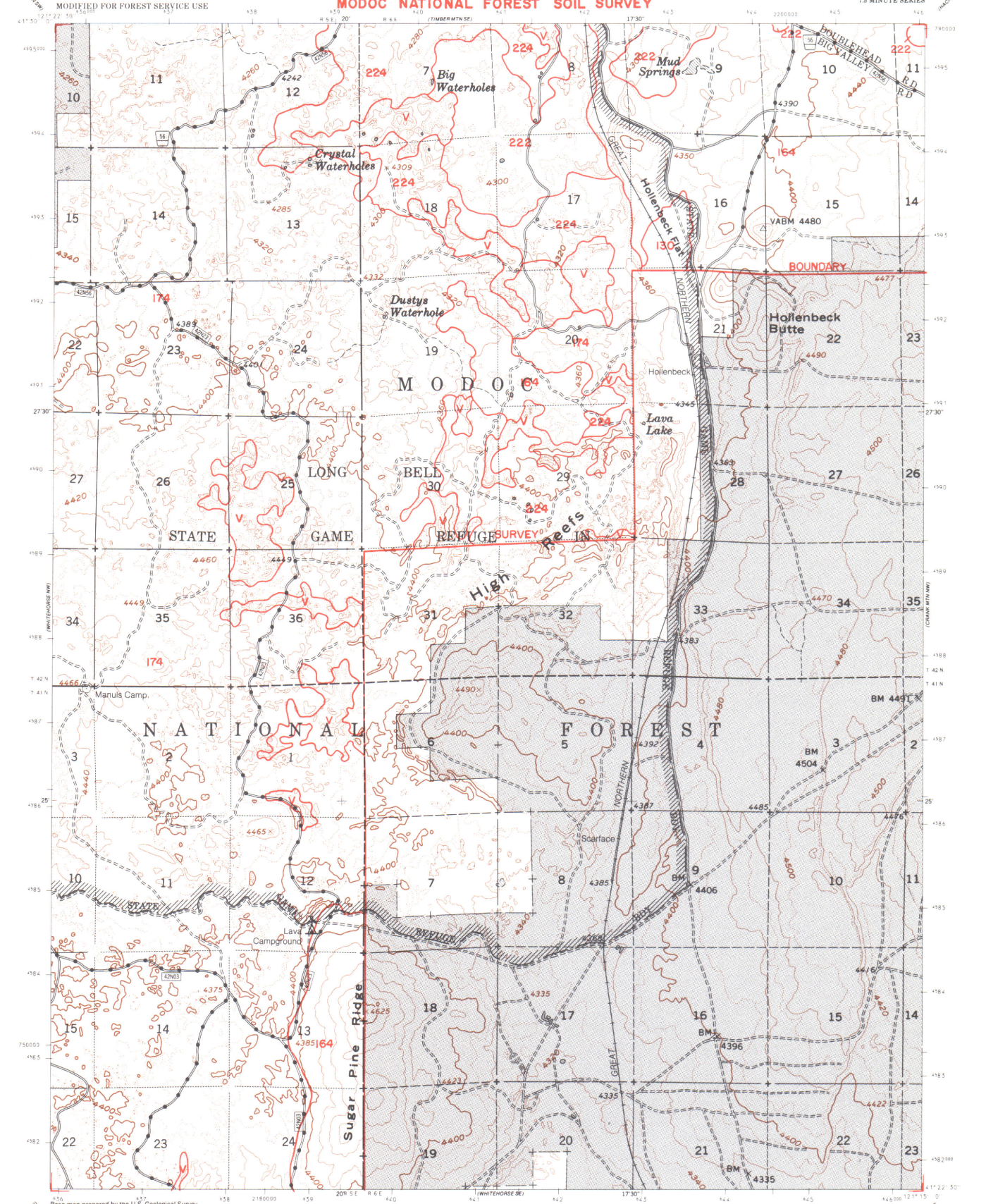
CRANK MTN NW
N4122.5-W12107.5/7.5
1961
694-2C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

WHITE HORSE NE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

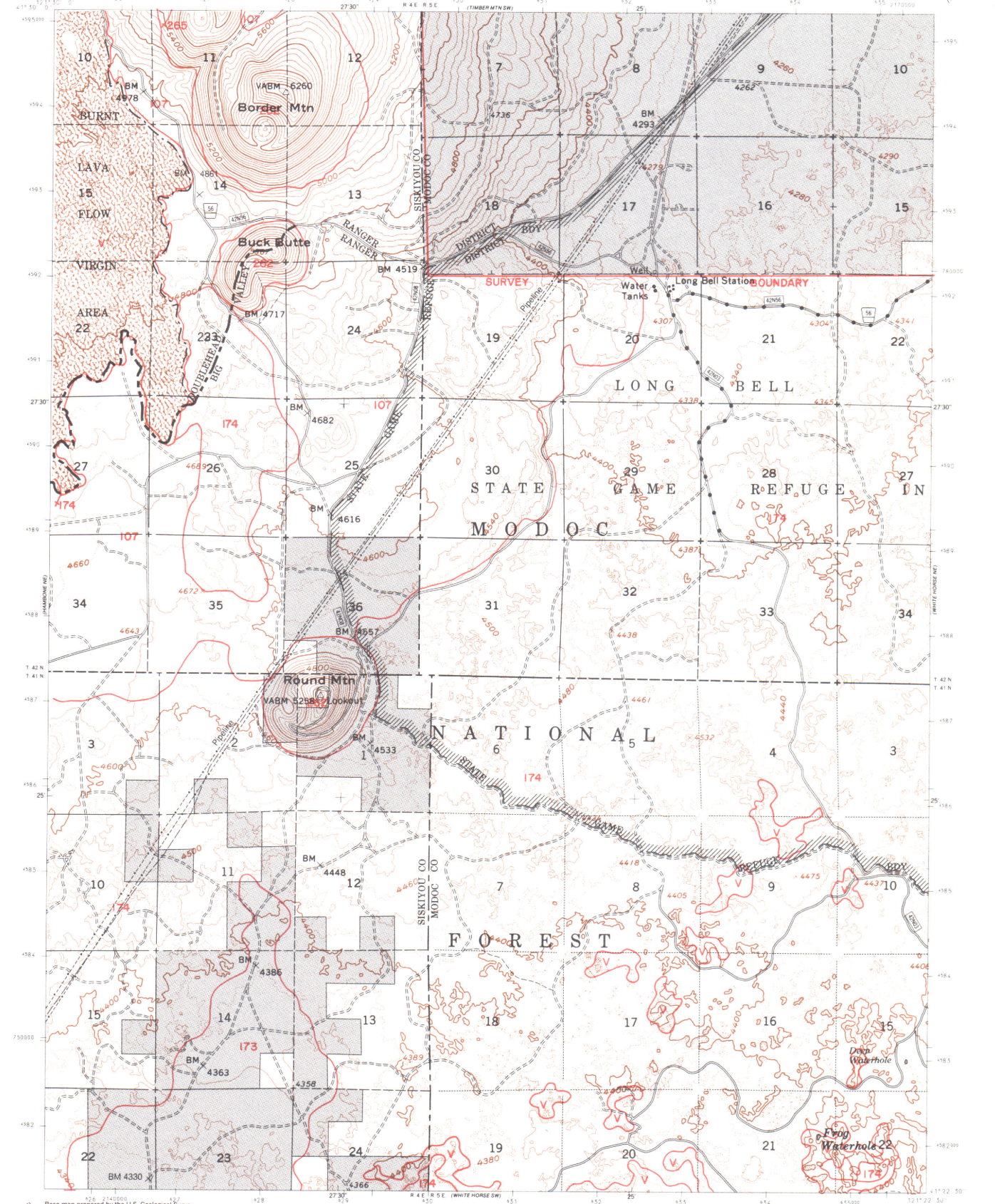
MODOC NATIONAL FOREST

WHITE HORSE NE
N4122.5—W12115/7.5
1962
695-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

WHITE HORSE NW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

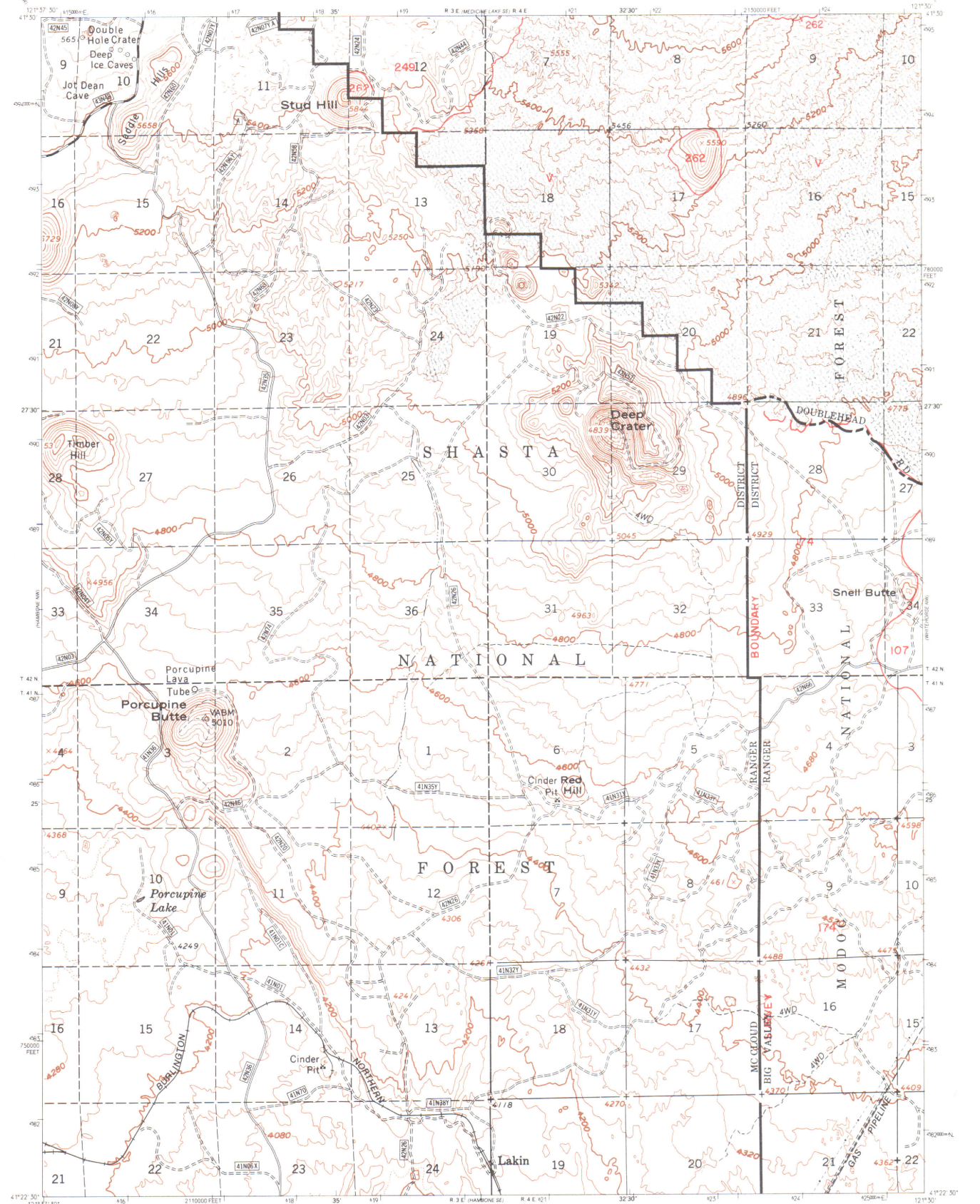
- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

WHITE HORSE NW
N4122.5-W12122.5/7.5
1962
695-2C
REVISED 1987

MODOC NATIONAL FOREST SOIL SURVEY



Base map prepared by the USGS

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

INTERMEDIATE EDITION

Modification to USGS base map by Geometronics Service Center from 1982 1:40,000 Forest Service photography and 1982 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1983 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

TOWNSHIP AND SECTION LINE CLASSIFICATION

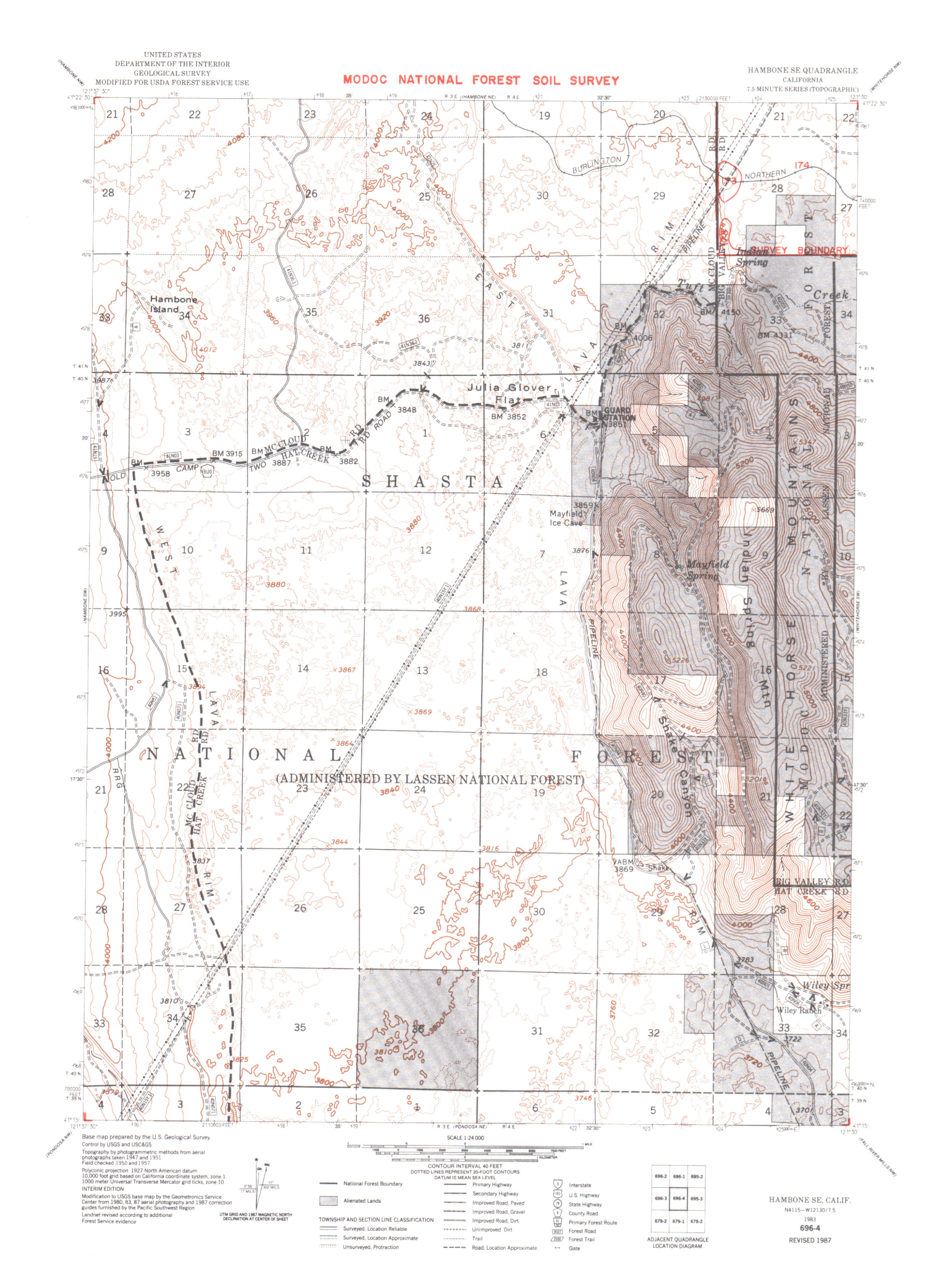
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

LEGEND

- National Forest Boundary
- Non-Forest Service Land within Proclaimed Boundary as of 1983
- Primary Highway
- Secondary Highway
- Improved Light Duty
- Unimproved Dirt
- Trail
- Approximate Road
- Approximate Trail
- US Highway
- State Highway
- County Road
- Forest Highway
- Forest Road
- Forest Trail

SHASTA - TRINITY NATIONAL FOREST

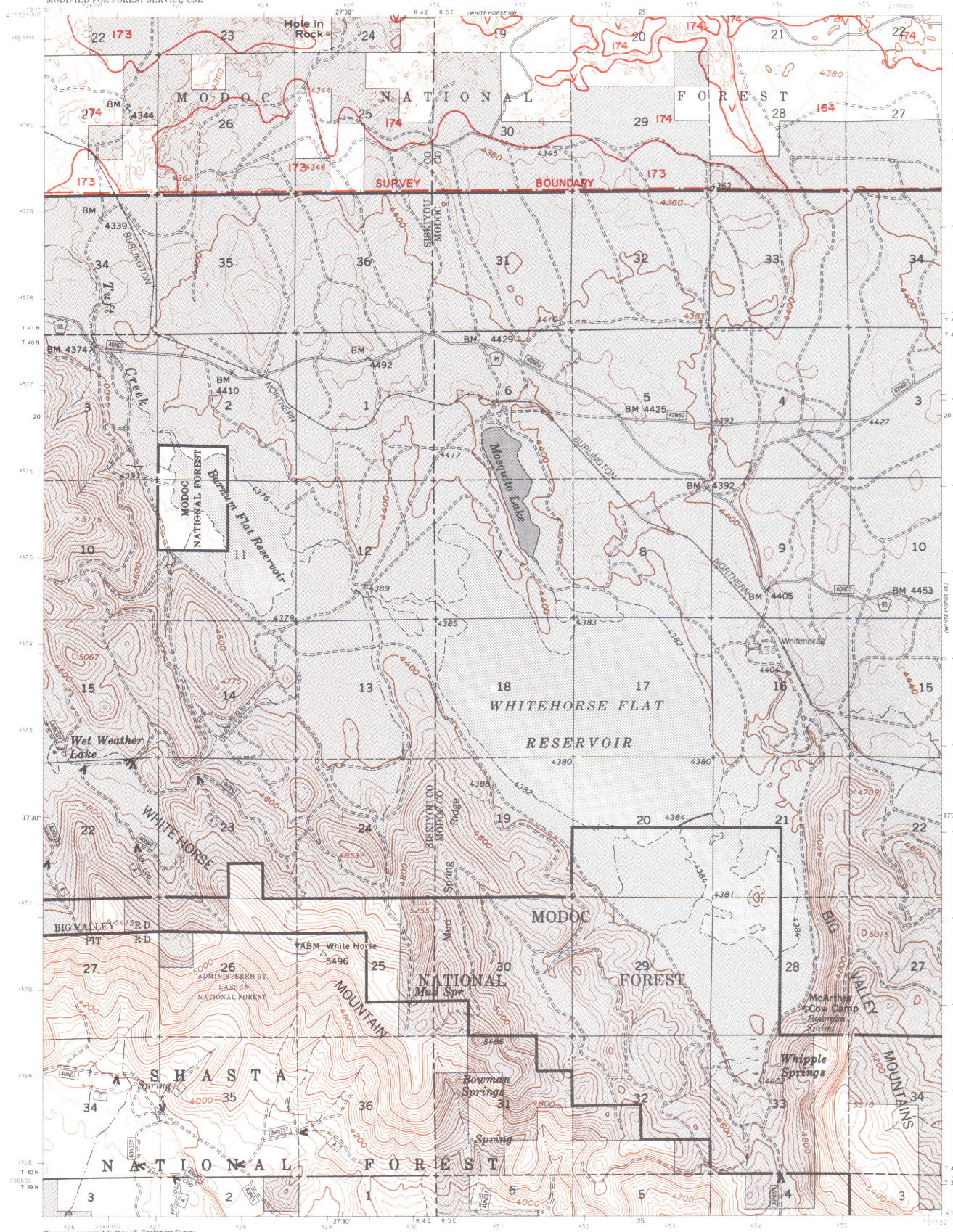
HAMBONE NE
N4122.5-W12130/7.5
1983
696-1C


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE
MODOC NATIONAL FOREST SOIL SURVEY
HAMBONE SE QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SURVEY BOUNDARY
NATIONAL FOREST
(ADMINISTERED BY LASSEN NATIONAL FOREST)
MODOC NATIONAL FOREST
WHITEHORSE MOUNTAINS
(ADMINISTERED BY LASSEN NATIONAL FOREST)
Hambone Island
Julia Glover Flat
Mayfield Ice Cave
Mayfield Spring
Indian Spring
Tuft Spring
Wiley Ranch
Wiley Spr
Shake Canyon
Mc Cloud Rim
Mc Cloud Pipeline
Big Valley Rd
Hat Creek Rd
Old Camp Two
Guard Station
Burlington
Northern
East Lava
West Lava
Base map prepared by the U.S. Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1947 and 1951
Field checked 1950 and 1957
Polyconic projection. 1927 North American datum
10,000 foot grid based on California coordinate system, zone 1
1000 meter Universal Transverse Mercator grid ticks, zone 10
INTERIM EDITION
Modification to USGS base map by the Geometronics Service Center from 1980, 83, 87 aerial photography and 1987 correction guides furnished by the Pacific Southwest Region
Landnet revised according to additional Forest Service evidence
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
SCALE 1:24 000
CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
National Forest Boundary
Alienated Lands
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Gate
696-2
696-1
695-2
696-3
696-4
695-3
679-2
679-1
678-2
ADJACENT QUADRANGLE LOCATION DIAGRAM
HAMBONE SE, CALIF.
N4115—W12130/7.5
1983
696-4
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

WHITE HORSE SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

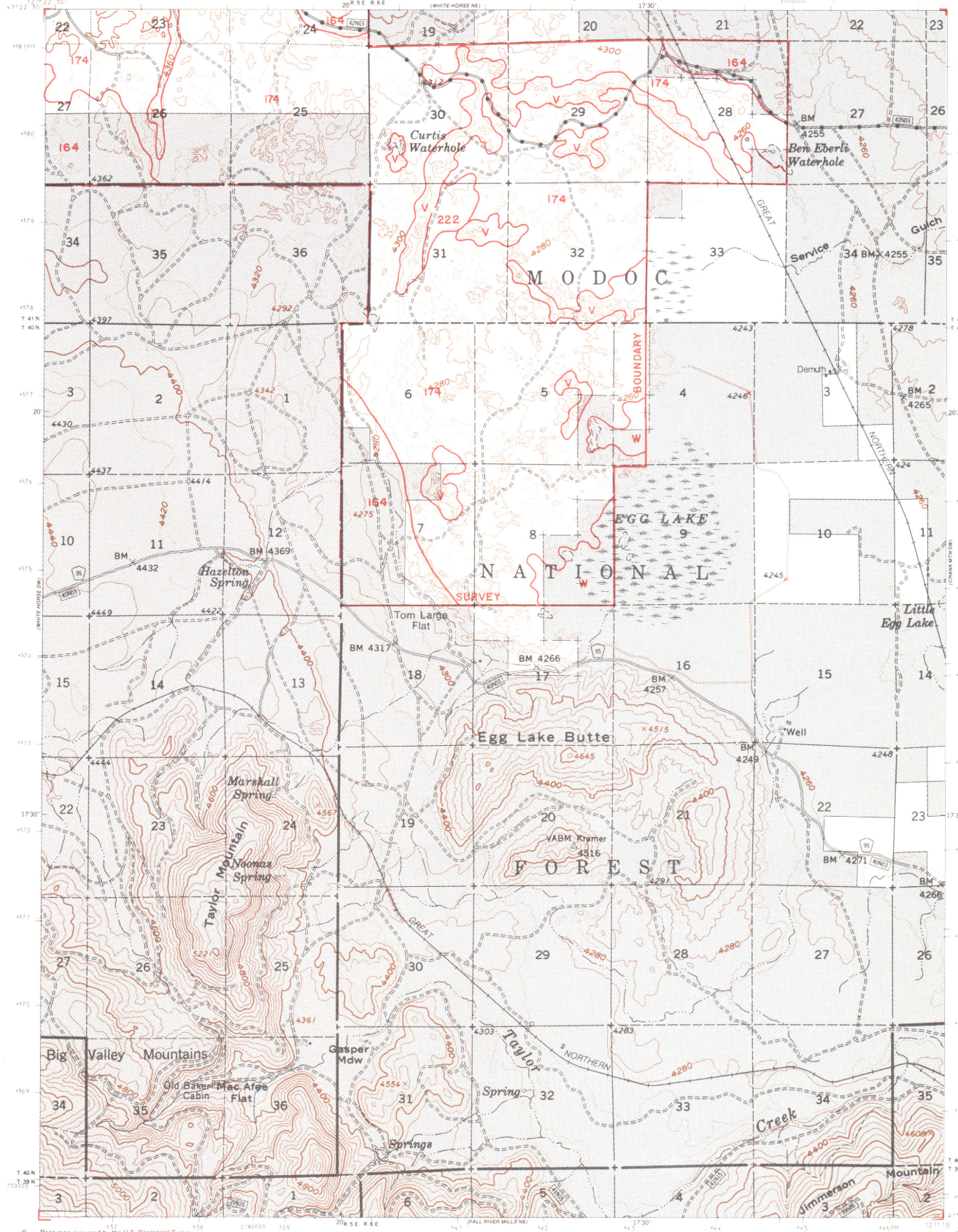
MODOC NATIONAL FOREST

WHITE HORSE SW
N4115-W12122.5/7.5
1962
695-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

WHITE HORSE SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

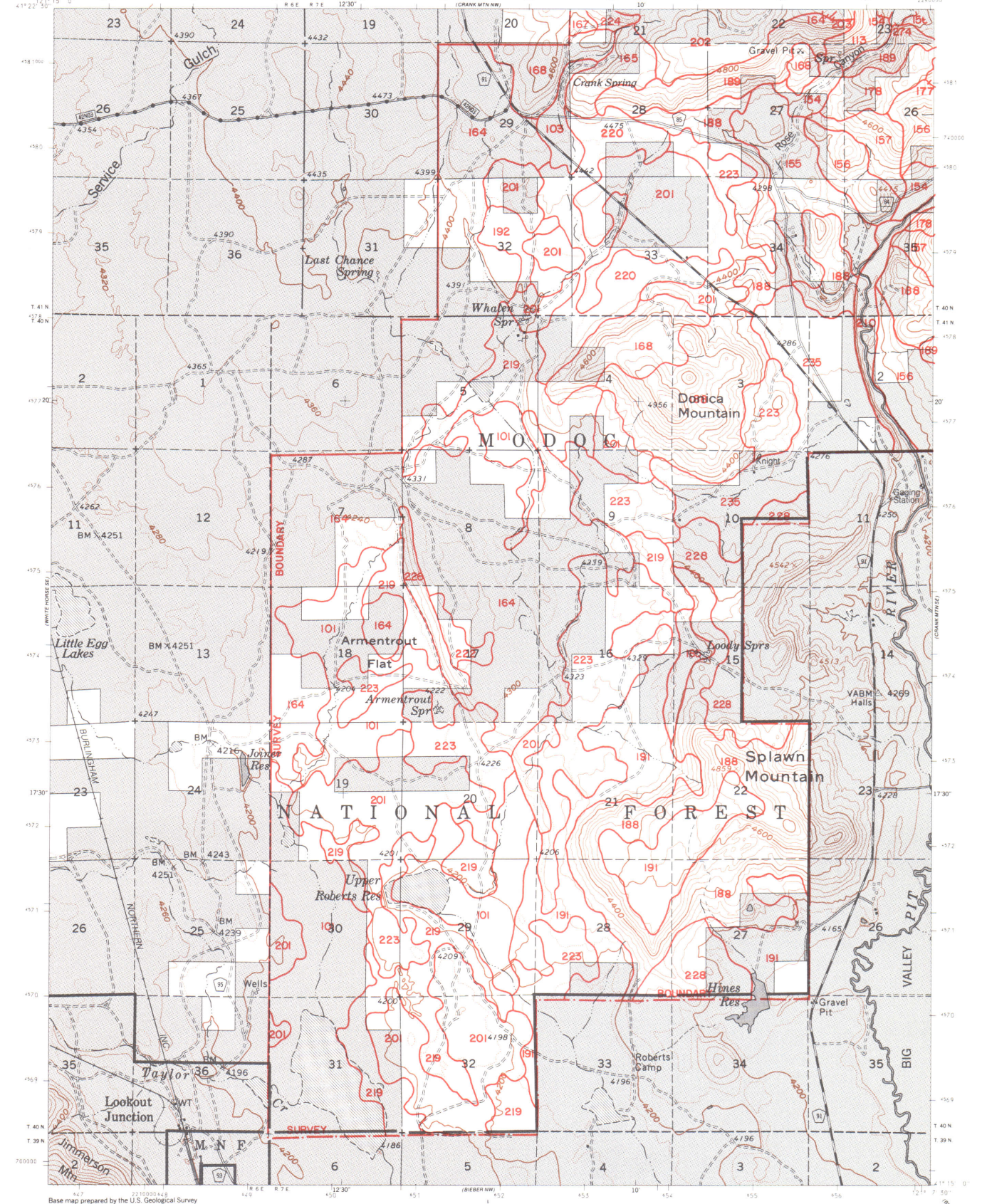
MODOC NATIONAL FOREST

WHITE HORSE SE
N4115—W12115/7.5
1962
695-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

CRANK MTN SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

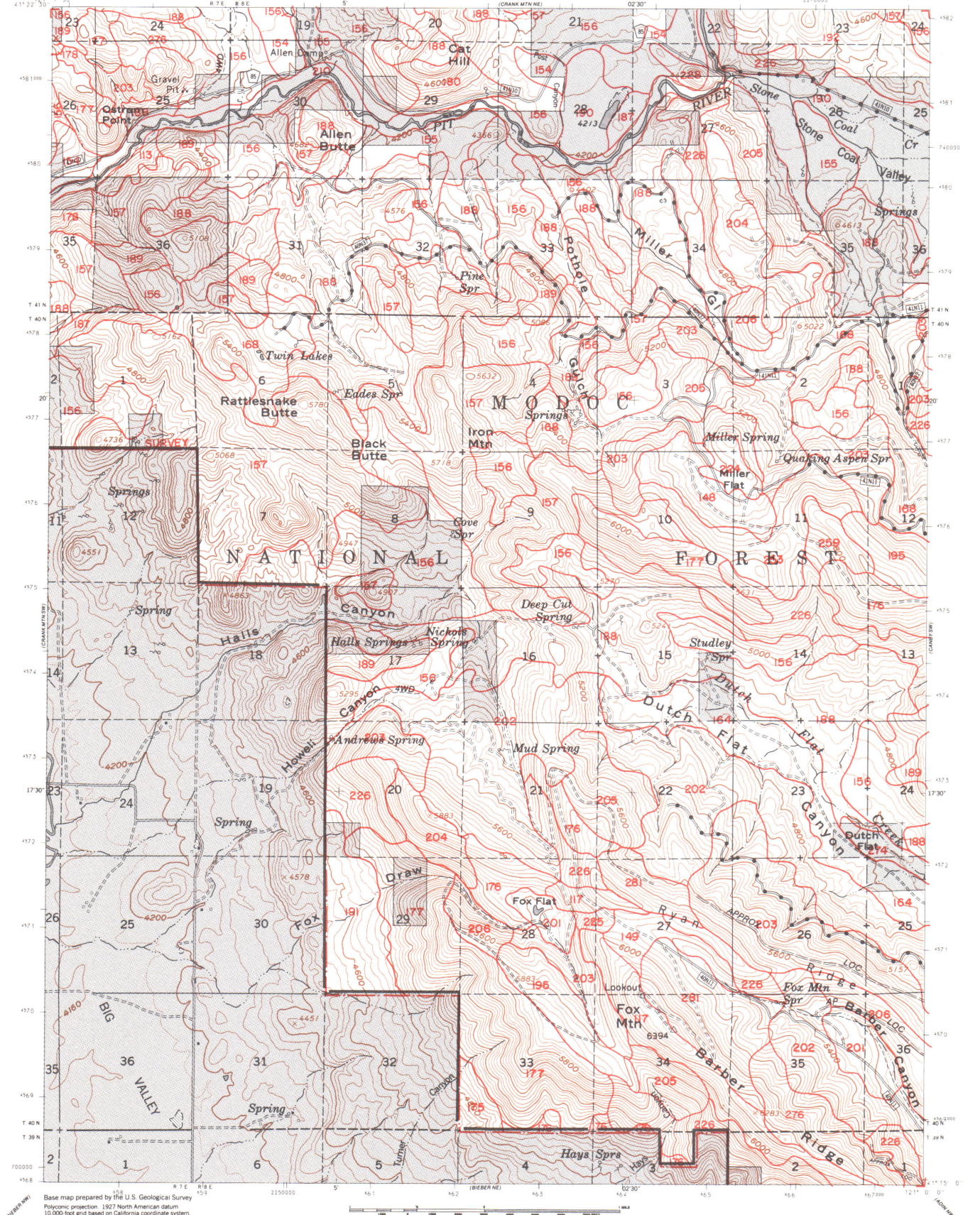
CRANK MTN SW
N4145-W12107.5/7.5
1962
694-3C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

CRANK MTN SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1967 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

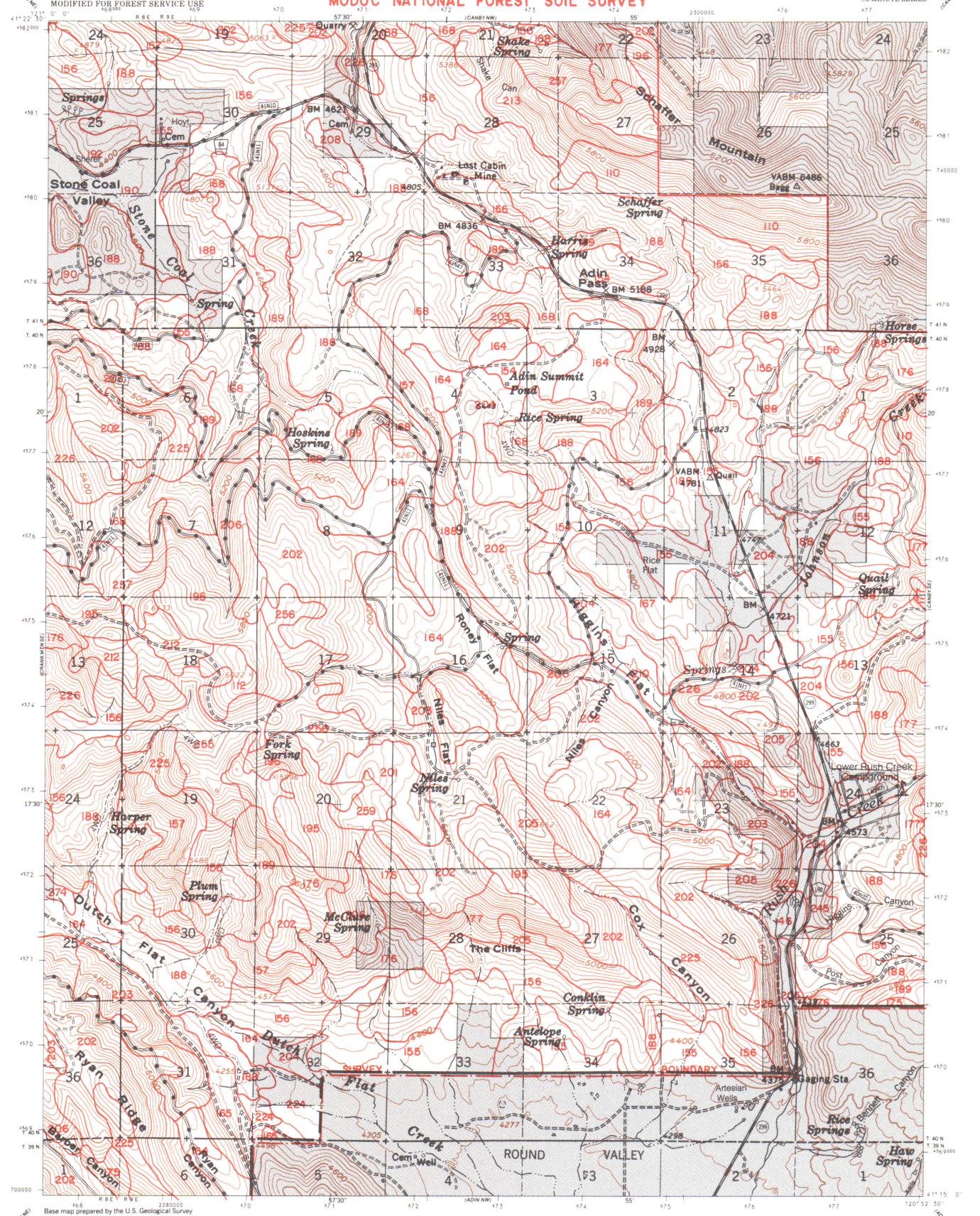
CRANK MTN SE
N4115-W12100/7.5
1961
694-4C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

CANBY SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

Republished by the USFS San Francisco in 1975 by photogrammetric methods.

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

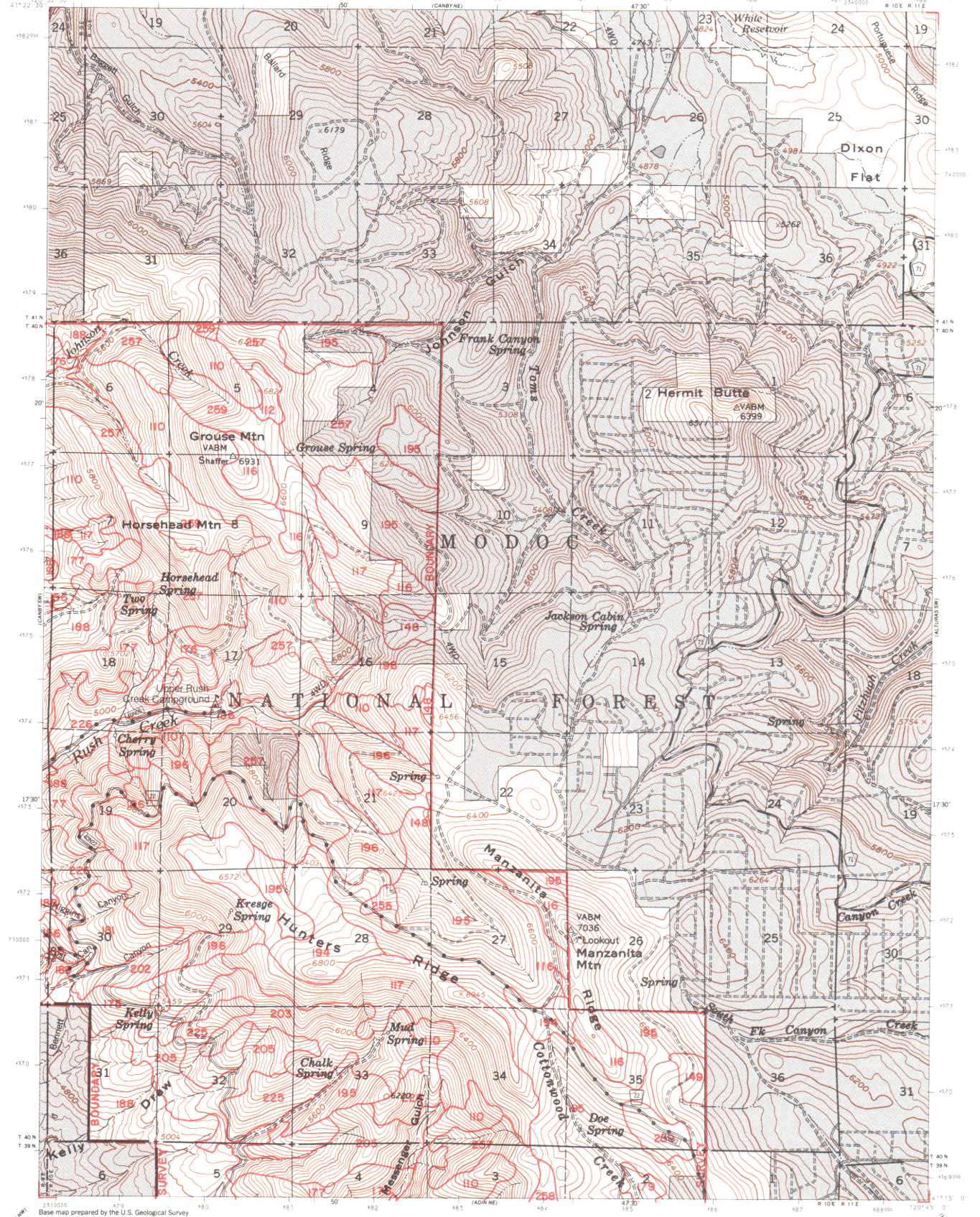
MODOC NATIONAL FOREST

CANBY SW
N4115-W12052.5/7.5
1961
693-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

CANBY SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

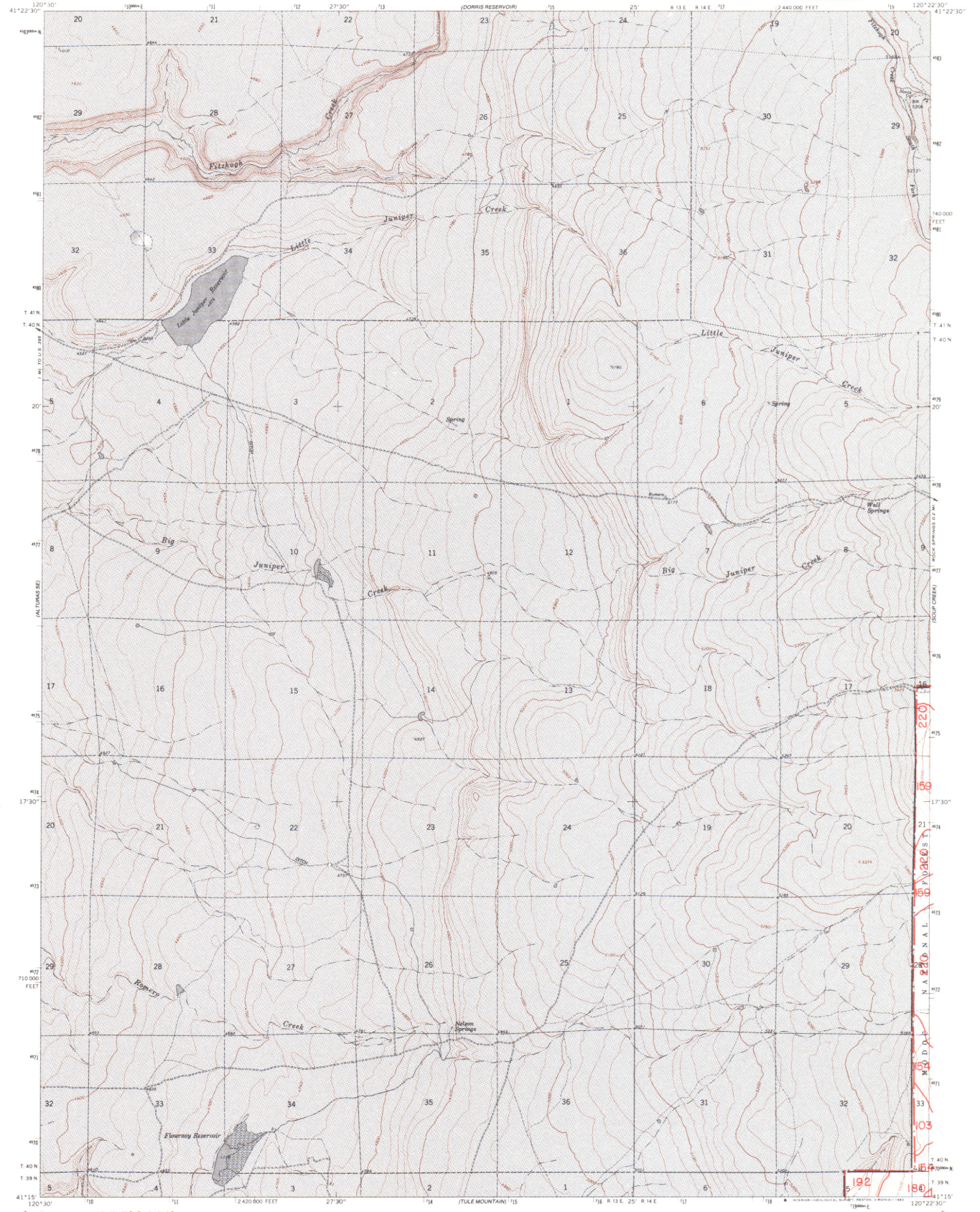
- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

CANBY SE
N4115-12045/7.5
1961
693-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

LITTLE JUNIPER RESERVOIR QUADRANGLE
CALIFORNIA—MODOC CO.
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1958. Field checked 1963

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid ticks, zone 10

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

LITTLE JUNIPER RESERVOIR,
N4115—W12022.5/7.5

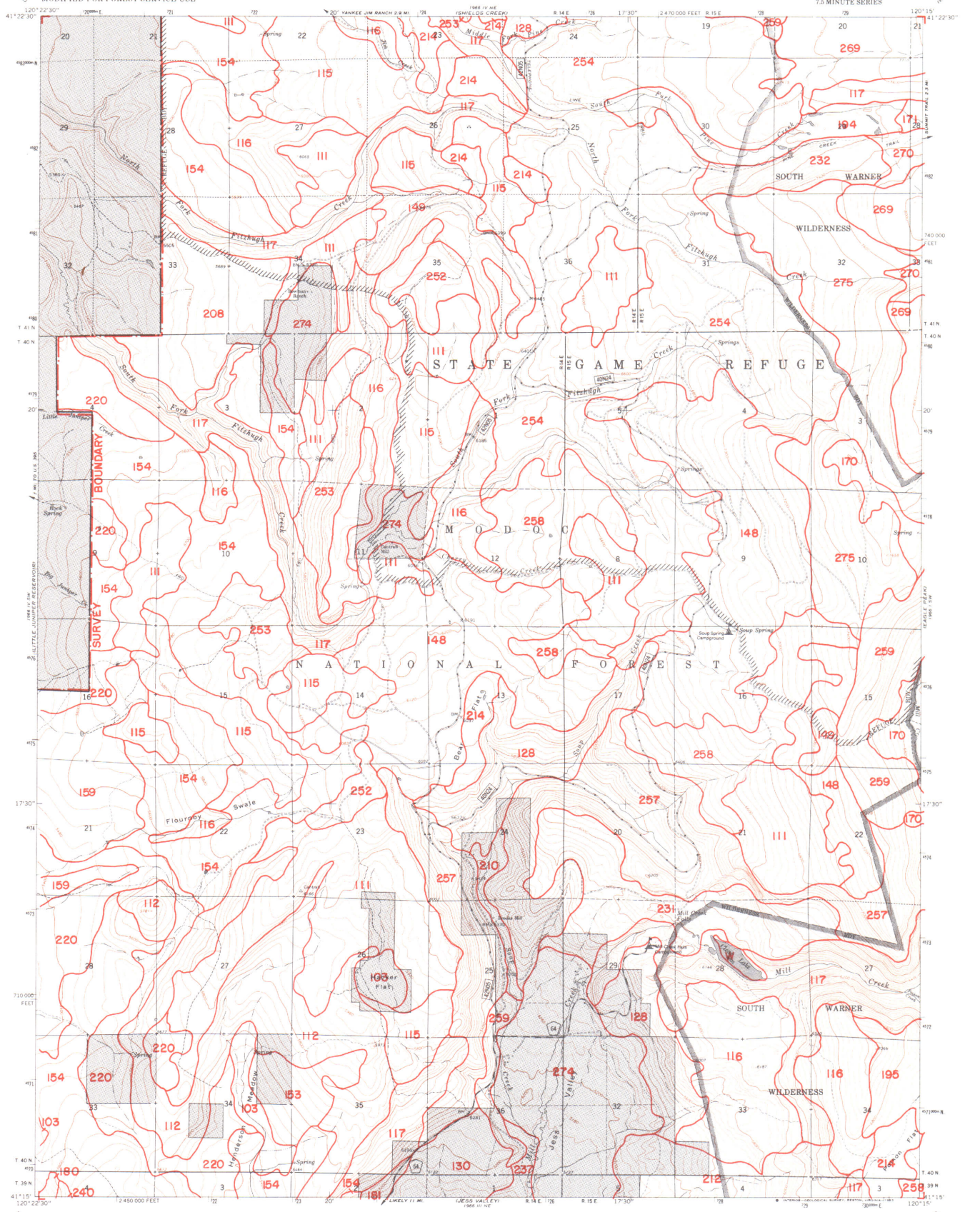
1963
PHOTOREVISED 1982
DMA 1966 IV SW—SERIES V895

691-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

SOUP CREEK QUADRANGLE
CALIFORNIA—MODOC CO.
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Control by USGS, NOS/NOAA, and U.S. Forest Service
Topography by photogrammetric methods from aerial photographs taken 1948 and 1955. Field checked by USGS 1963
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid ticks, zone 10
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

National Forest Boundary
Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction

Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate

Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate

MODOC NATIONAL FOREST

SOUP CREEK, CALIF.
N4115—W12015/7.5

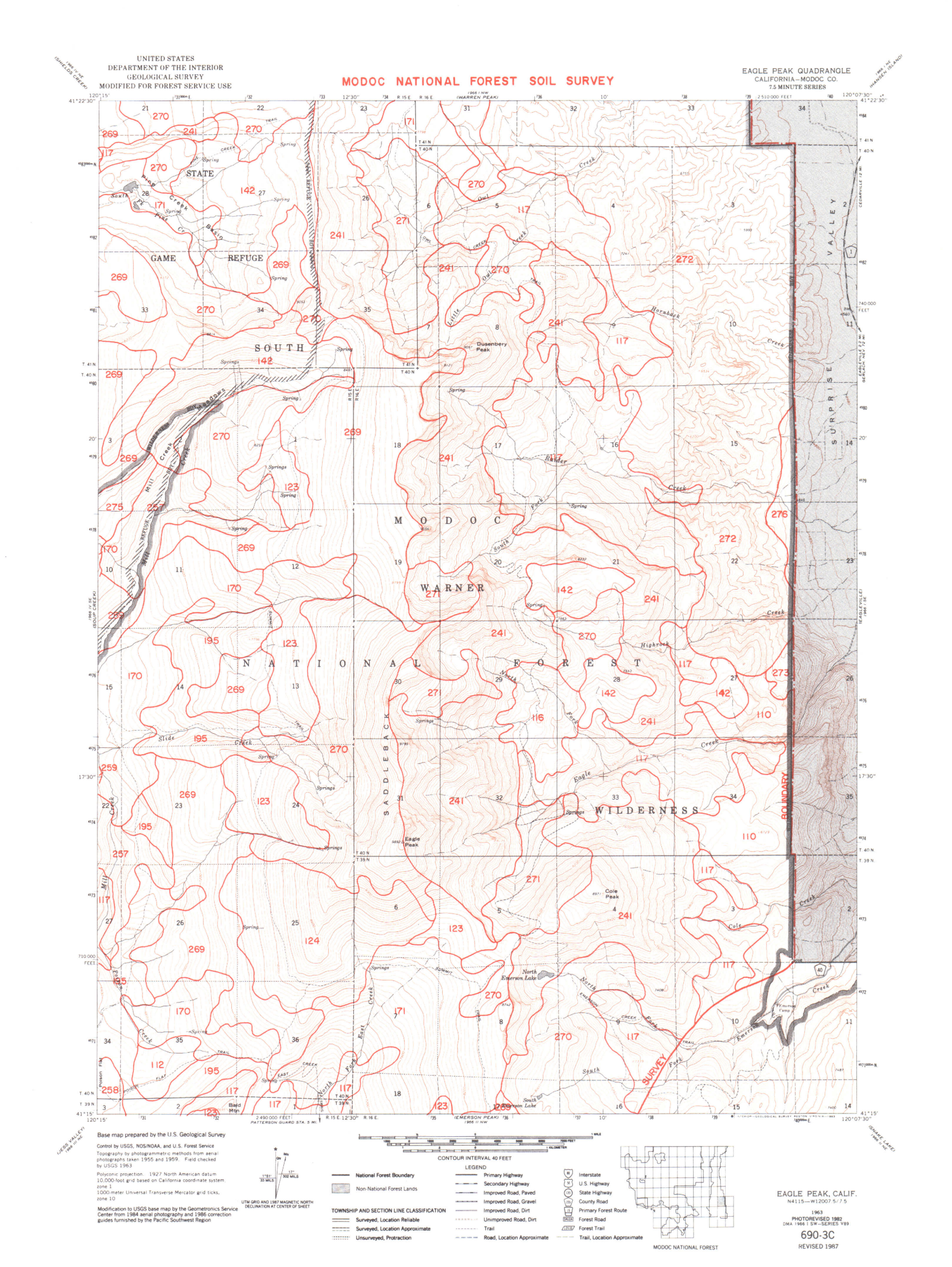
1963
PHOTOREVISED 1982
DMA 1966 IV SE—SERIES V895

691-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

EAGLE PEAK QUADRANGLE
CALIFORNIA—MODOC CO.
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Control by USGS, NOS/NOAA, and U.S. Forest Service

Topography by photogrammetric methods from aerial photographs taken 1955 and 1959. Field checked by USGS 1963

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid ticks, zone 10

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate
- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

EAGLE PEAK, CALIF.
N4115—W12007.5/7.5

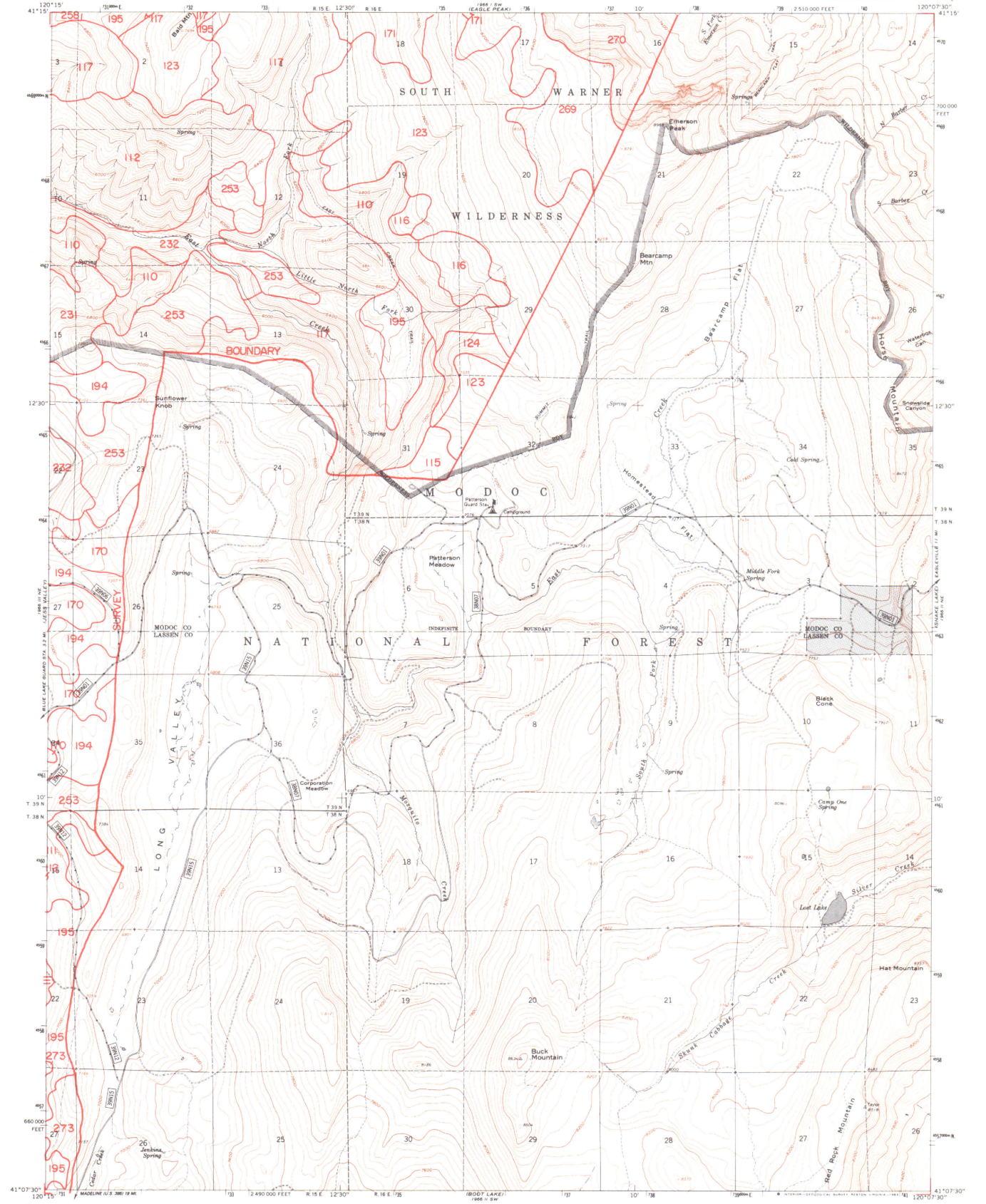
1963
PHOTOREVISED 1982
DMA 1986 I SW—SERIES V89

690-3C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

EMERSON PEAK QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Control by USGS, NOS/NOAA, and U.S. Forest Service

Topography by photogrammetric methods from aerial photographs taken 1954, 1955, and 1958. Field checked by USGS 1962

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid ticks, zone 10

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

EMERSON PEAK, CALIF.
N4107.5—W12007.5/7.5

1962

PHOTOREVISED 1982
DMA 1968 II NW—SERIES V895

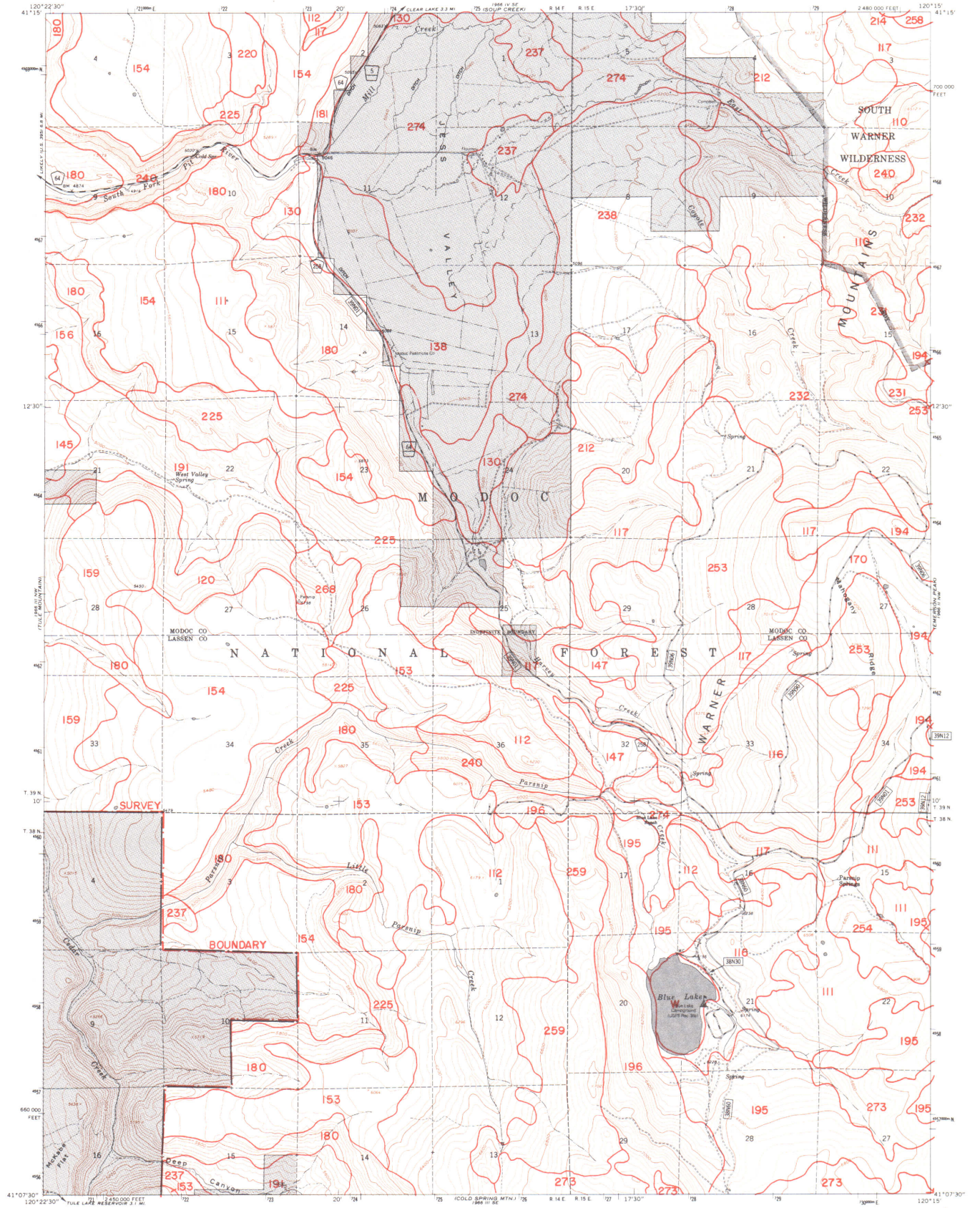
673-2C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

JESS VALLEY QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Control by USGS, NOS/NOAA, and U.S. Forest Service

Topography by photogrammetric methods from aerial photographs taken 1954–55. Field checked by USGS, 1962

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid ticks, zone 10

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

JESS VALLEY, CALIF.
N4107.5—W12015/7.5

1962
PHOTOREVISED 1982
DMA 1966 III NE–SERIES V895

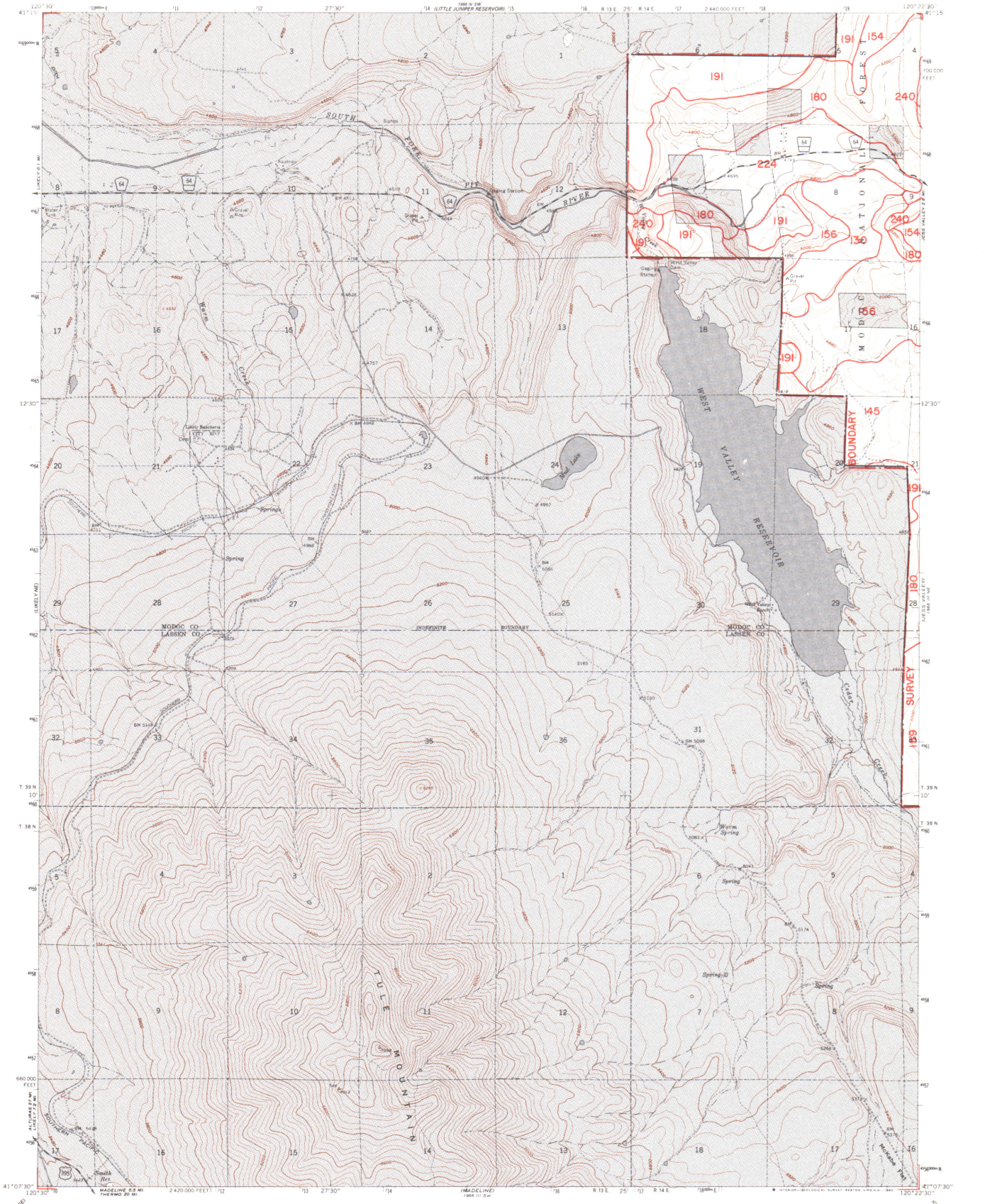
674-1C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

TULE MOUNTAIN QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Control by USGS,NOS/NOAA, and U.S. Forest Service

Topography by photogrammetric methods from aerial photographs taken 1955 and 1958. Field checked by USGS 1962

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid ticks, zone 10

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

To place on the predicted North American Datum 1983 move the projection lines 17 meters north and 88 meters east as shown by dashed corner ticks

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

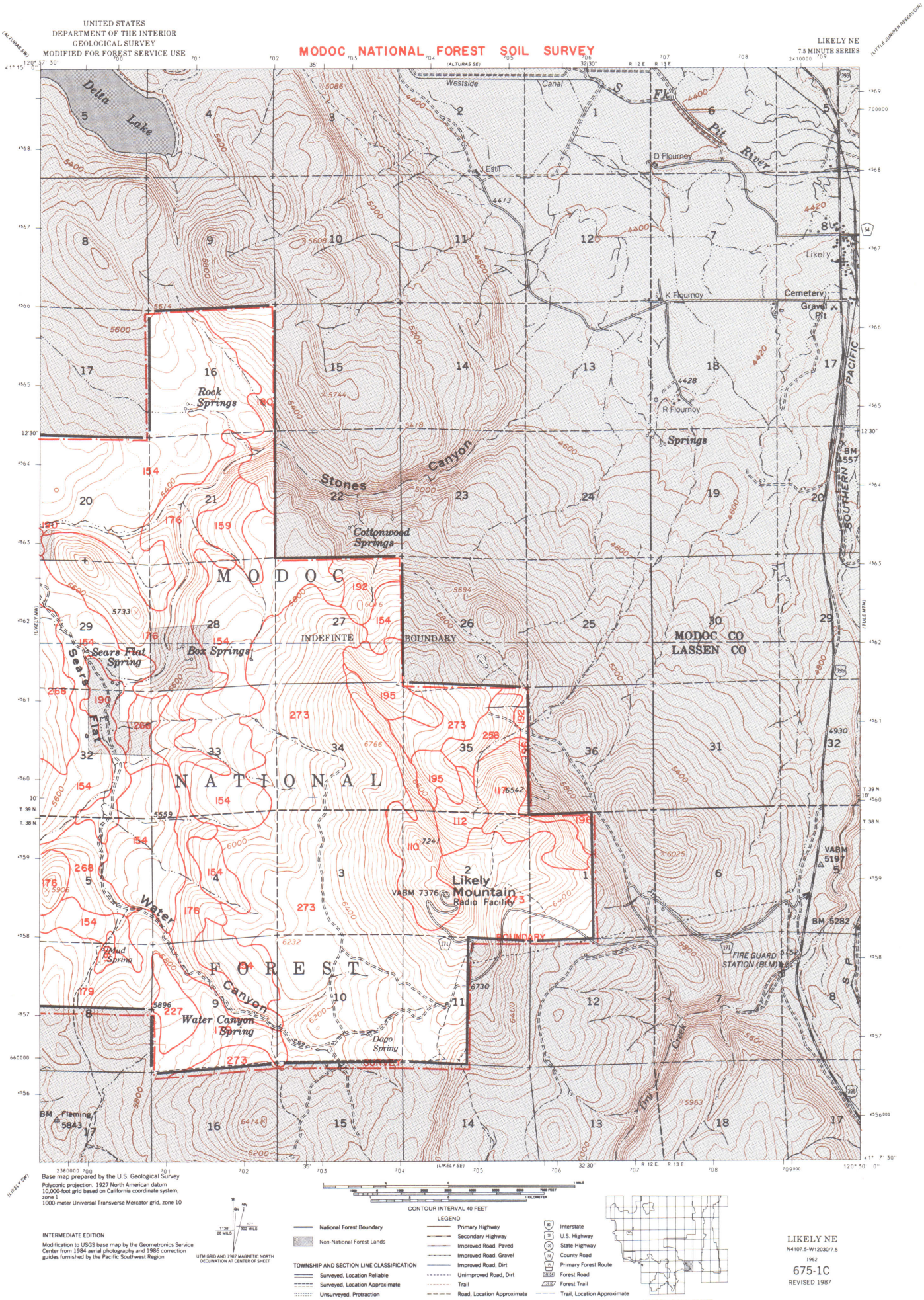
MODOC NATIONAL FOREST

TULE MOUNTAIN, CALIF.
N4107.5—W12022.5/7.5

1962
PHOTOREVISED 1982
DMA 1966 III NW—SERIES V895

674-2C

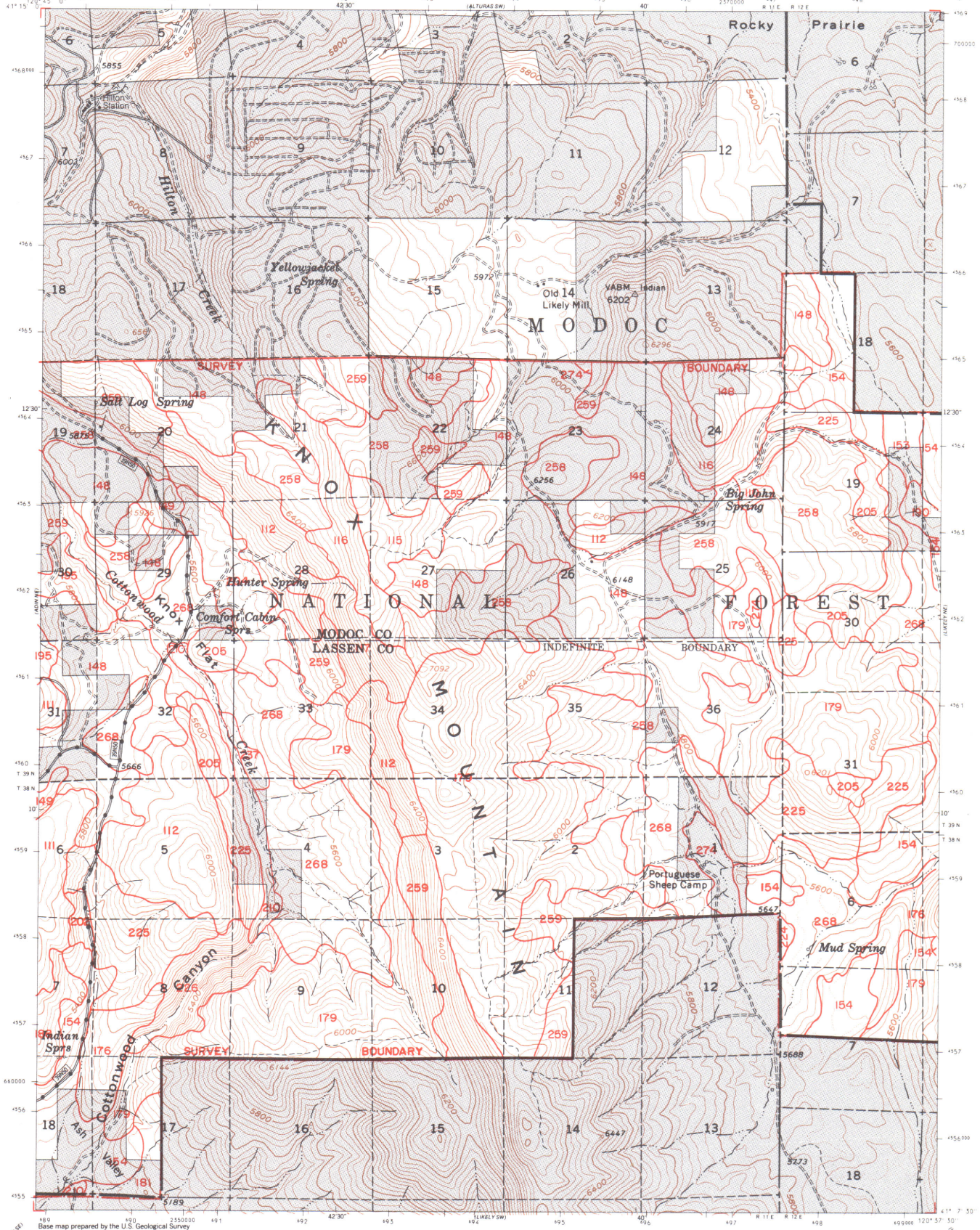
REVISED 1987


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE
MODOC NATIONAL FOREST SOIL SURVEY
LIKELY NE
7.5 MINUTE SERIES
Delta Lake
Westside Canal
S Fk Pit River
D Flournoy
J Estill
Likely
K Flournoy
Cemetery
Gravel Pit
R Flournoy
Springs
PACIFIC
SOUTHERN
Rock Springs
Stones Canyon
Cottonwood Springs
MODOC
INDEFINTE BOUNDARY
MODOC CO
LASSEN CO
Sears Flat Spring
Box Springs
Sears Flat
NATIONAL
FOREST
Likely Mountain
VABM 7376
Radio Facility
BOUNDARY
FIRE GUARD STATION (BLM)
VABM 5197
BM 5282
Mud Spring
Water Canyon Spring
Dago Spring
Water Canyon
Deep Creek
BM Fleming
5843
(ALTURAS SW)
(ALTURAS SE)
(LIKELY SW)
(LIKELY SE)
(LITTLE JUNIPER RESERVOIR)
(LAKE HWY)
(TULE MTN)
T. 39 N.
T. 38 N.
R 12 E.
R 13 E.
Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10
CONTOUR INTERVAL 40 FEET
INTERMEDIATE EDITION
Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
LEGEND
National Forest Boundary
Non-National Forest Lands
TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction
Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate
Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate
MODOC NATIONAL FOREST
LIKELY NE
N4107.5-W12030/7.5
1962
675-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

LIKELY NW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

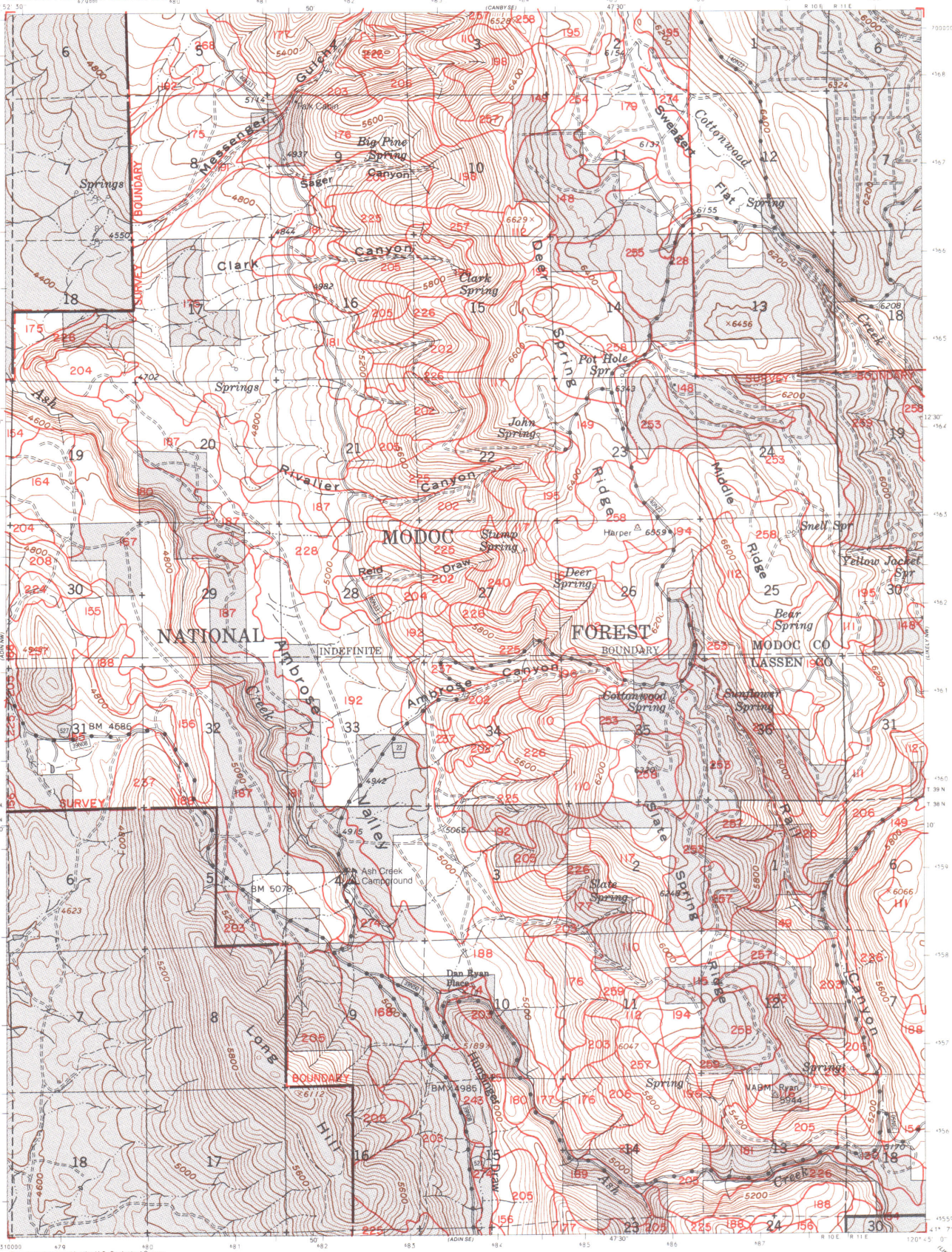
MODOC NATIONAL FOREST

LIKELY NW
N4107.5-W12037.5/7.5
1962
675-2C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

ADIN NE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

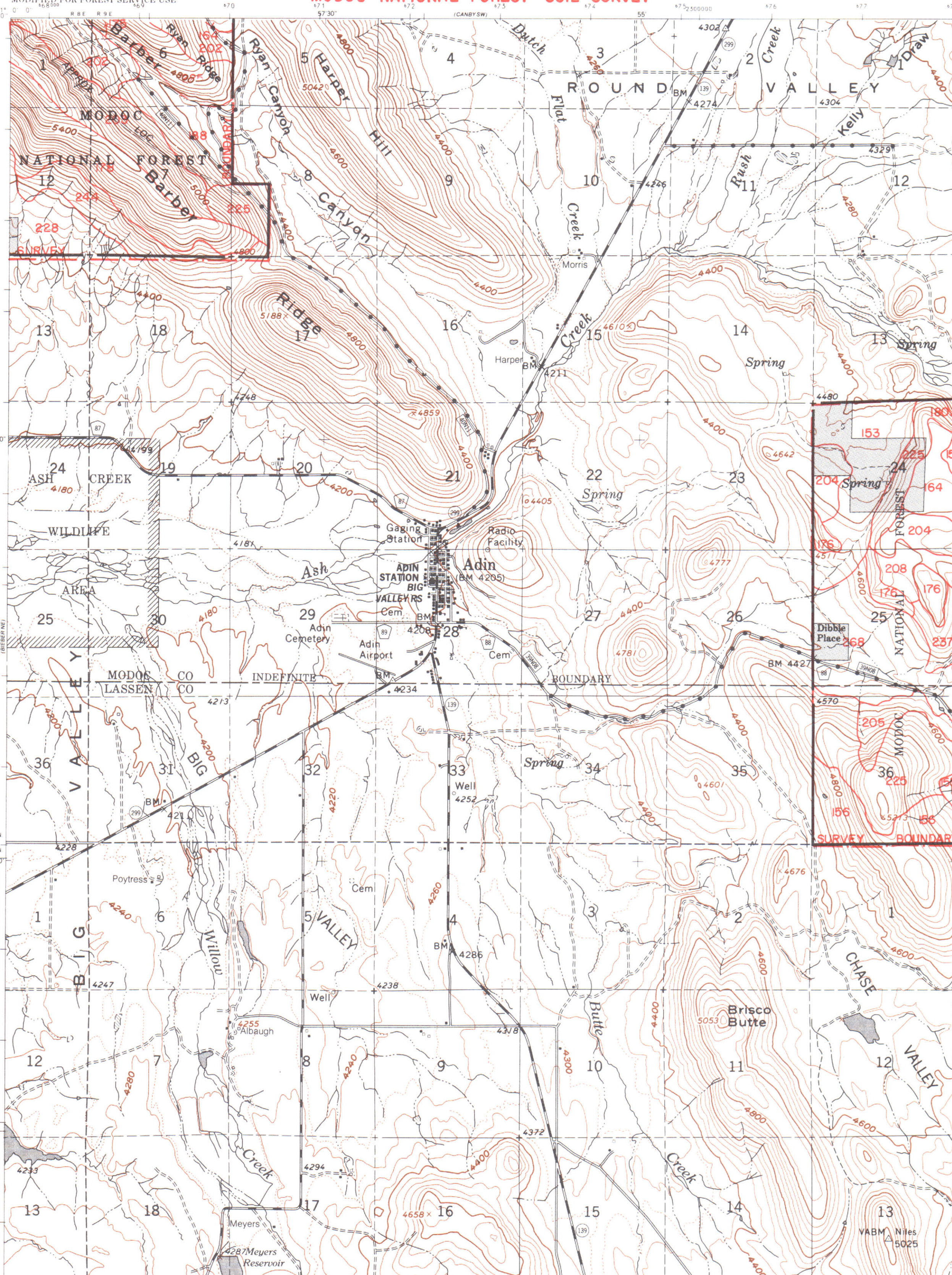
MODOC NATIONAL FOREST

ADIN NE
N4107.5-W12045/7.5
1961
676-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

ADIN NW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

LEGEND

National Forest Boundary
Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction

Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate

Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate

MODOC NATIONAL FOREST

ADIN NW
N4107.5-W12052.5/7.5
1962

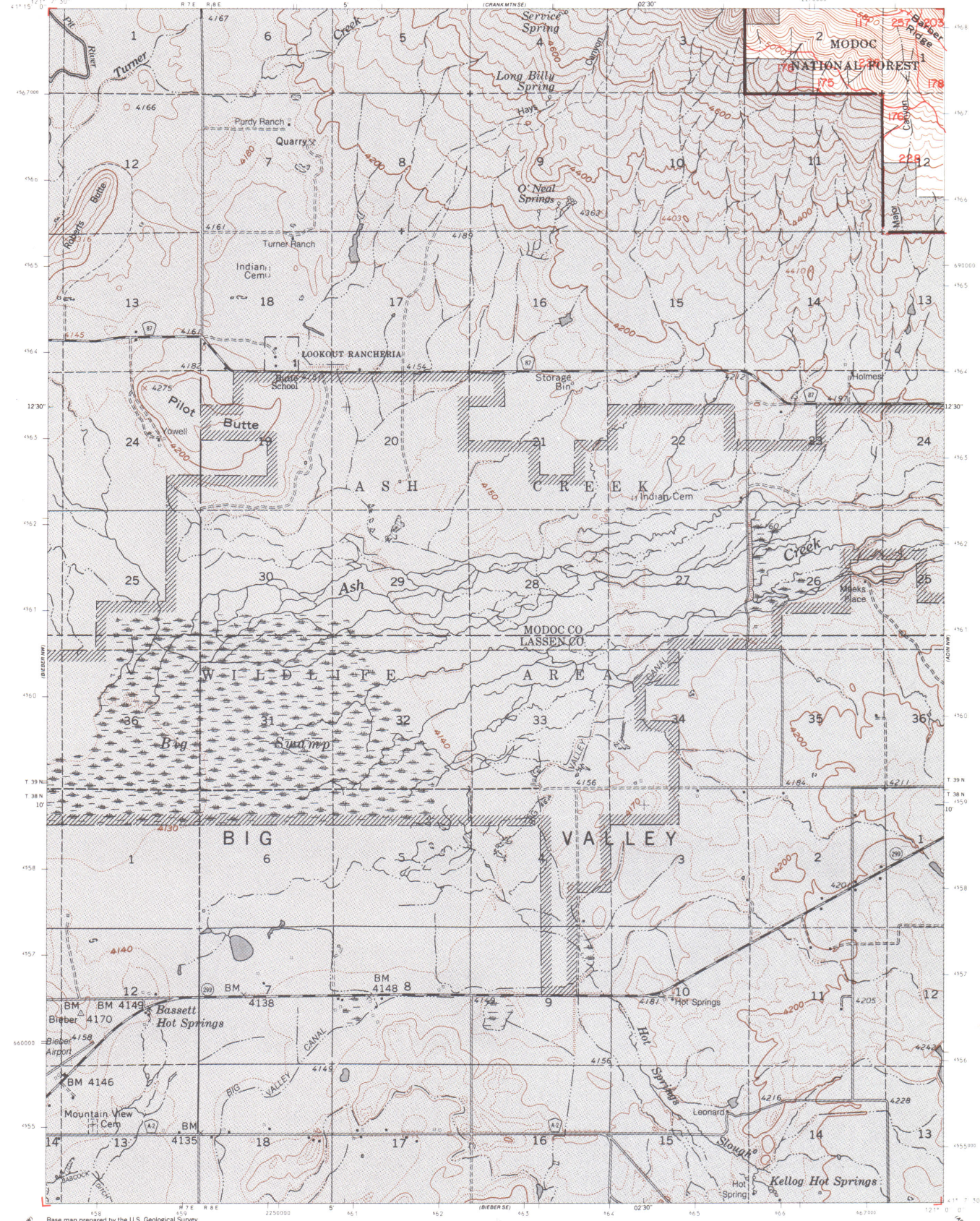
676-2C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

BIEBER NE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

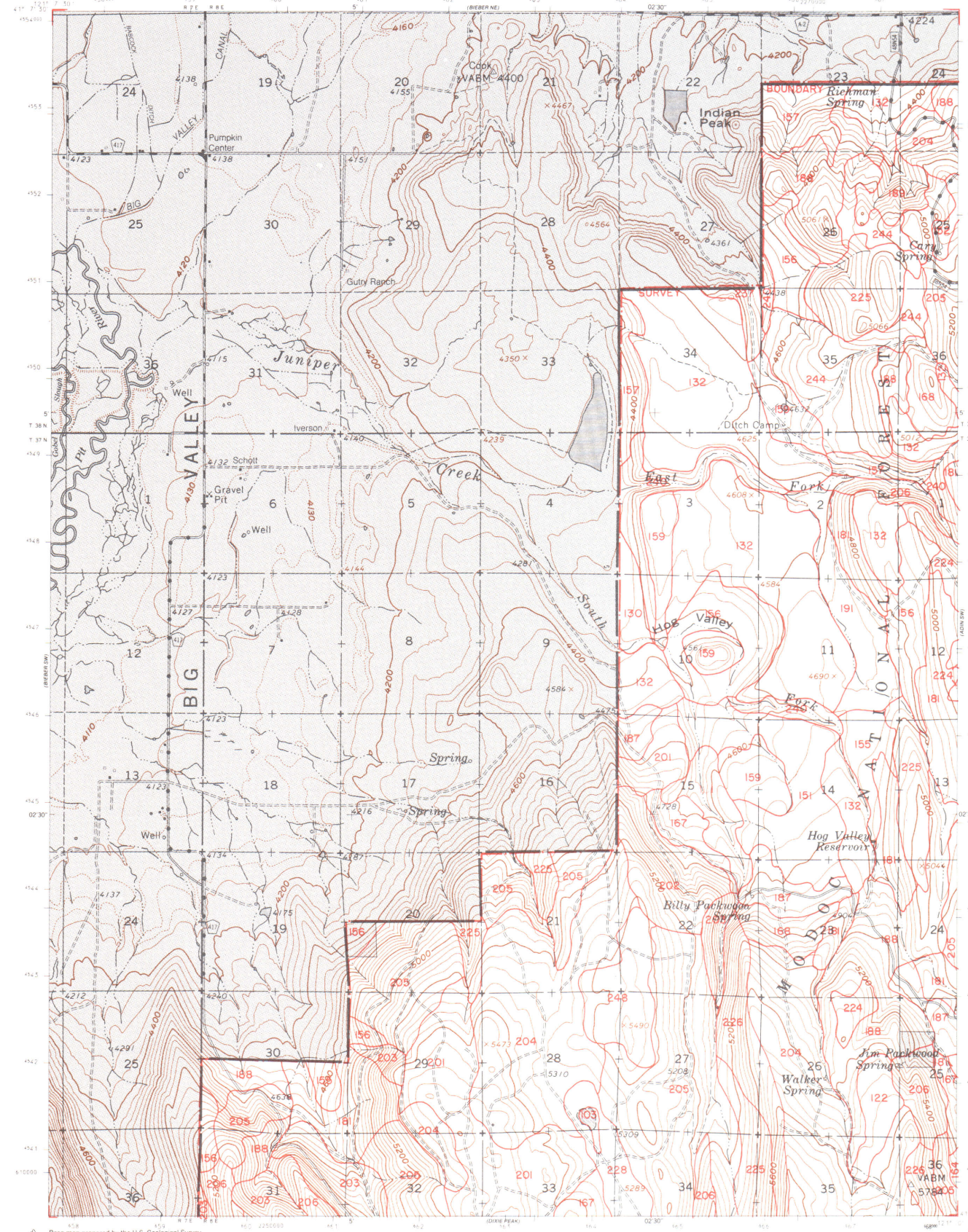
MODOC NATIONAL FOREST

BIEBER NE
N4107.5-W12100/7.5
1961
677-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

BIEBER SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

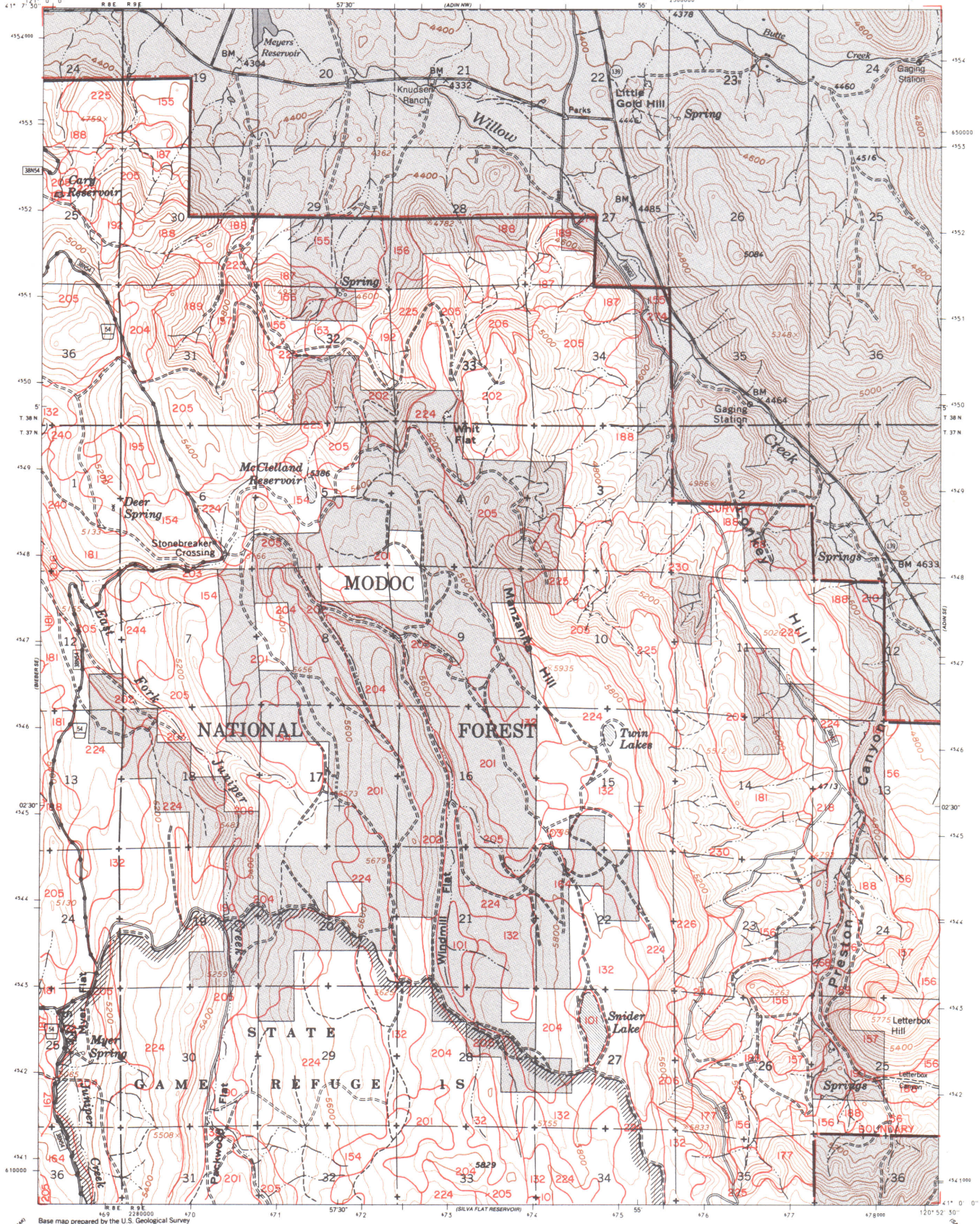
MODOC NATIONAL FOREST

BIEBER SE
N4100-W12100/7.5
1961
677-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

ADIN SW
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

CONTOUR INTERVAL 40 FEET

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

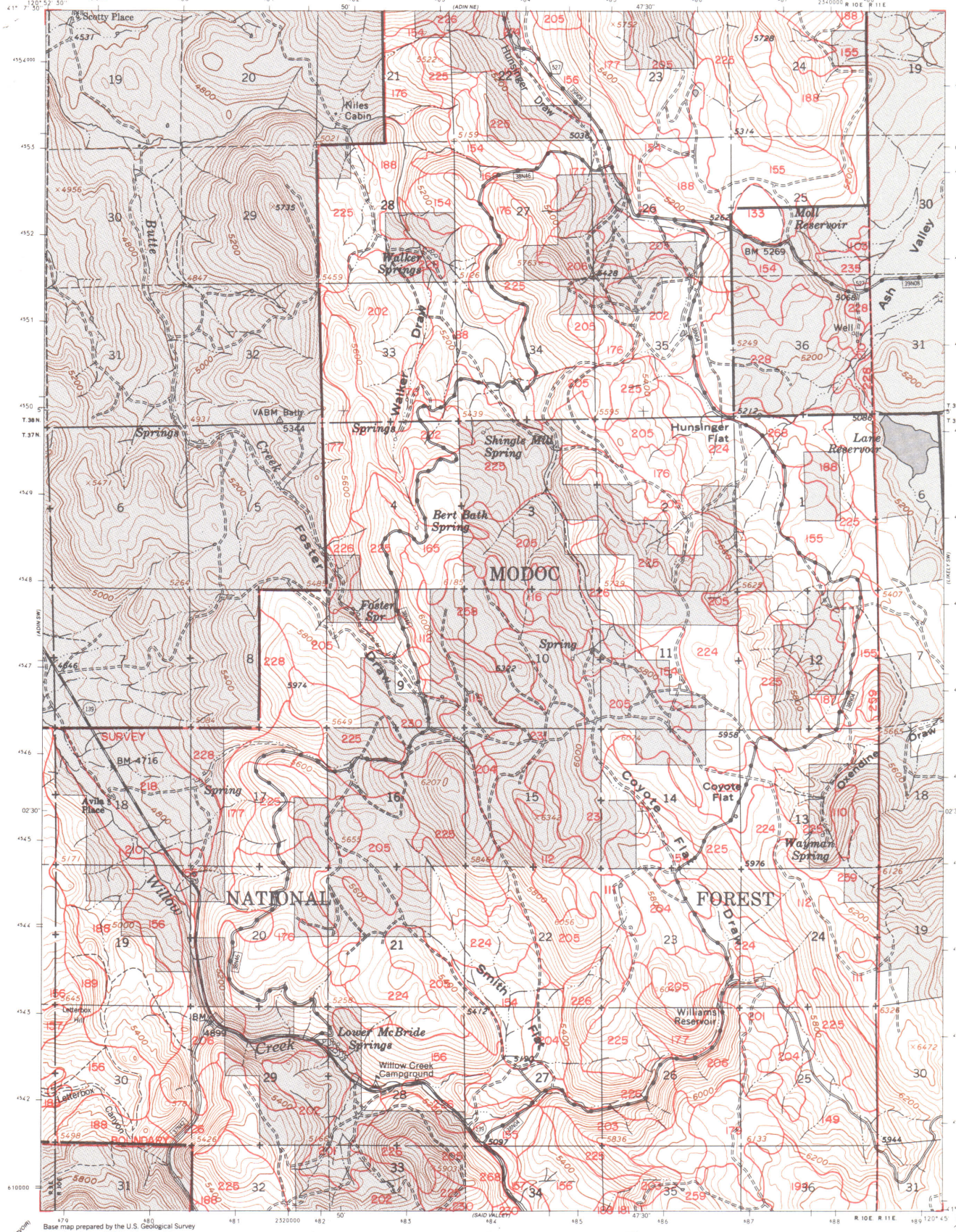
ADIN SW
N4100-W12052.5/7.5
1961
676-3C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

ADIN SE
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid, zone 10

INTERMEDIATE EDITION

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 40 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

ADIN SE
N4100-W12045/7.5
1962
676-4C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

COLD SPRING MTN. QUADRANGLE
CALIFORNIA—LASSEN CO.
7.5 MINUTE SERIES

Base map prepared by the U.S. Geological Survey
Control by USGS, NOS/NOAA, and U.S. Forest Service
Topography by photogrammetric methods from aerial photographs taken 1958. Field checked 1962
Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid ticks, zone 10

To place on the predicted North American Datum 1983 move the projection lines 16 meters north and 87 meters east as shown by dashed corner ticks

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1982 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

COLD SPRING MTN., CALIF.
N4100—W12015/7.5

1962
PHOTOREVISED 1982
DMA 1968 III SE—SERIES V895

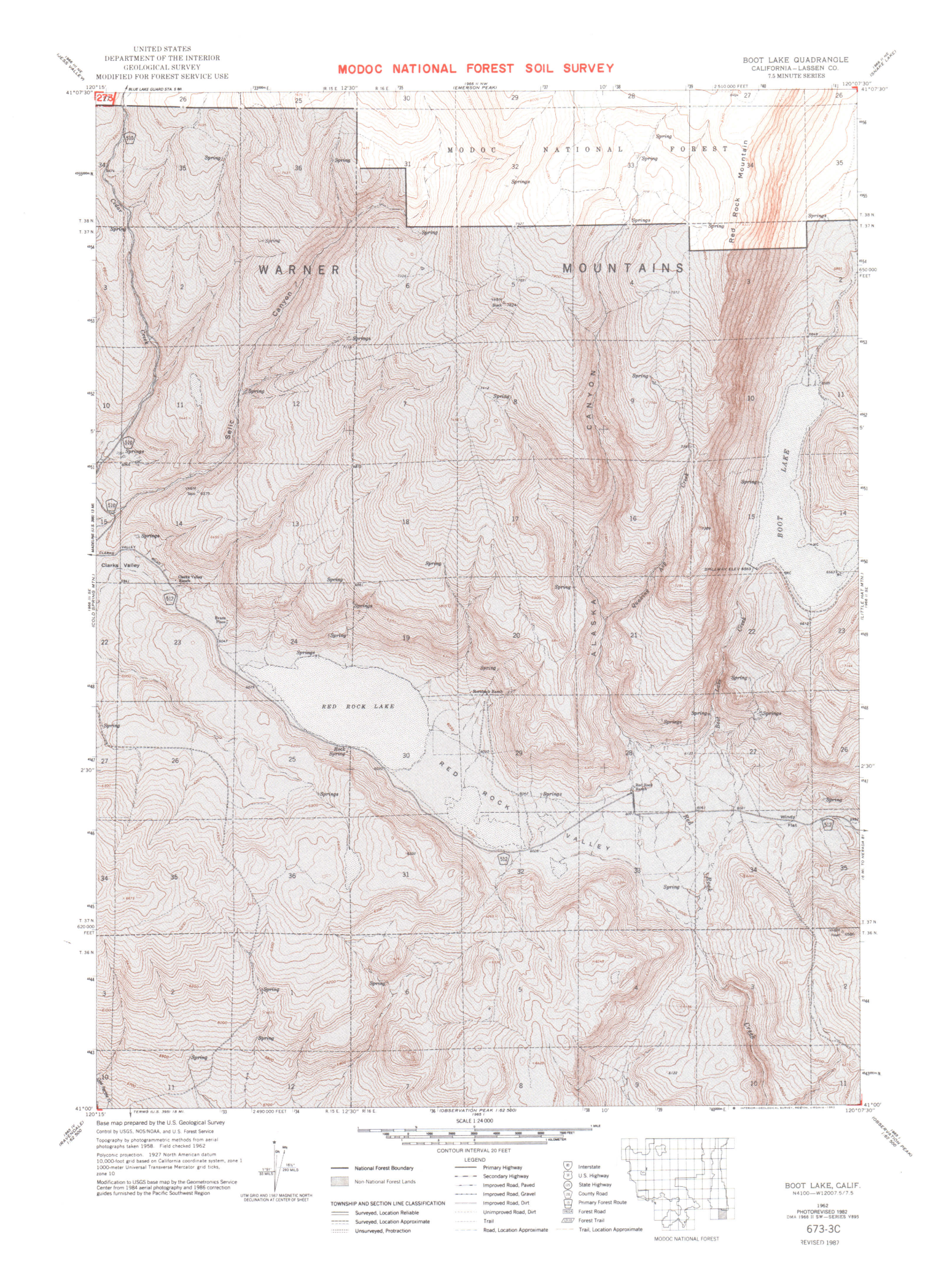
674-4C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

BOOT LAKE QUADRANGLE
CALIFORNIA—LASSEN CO.
7.5 MINUTE SERIES



Base map prepared by the U.S. Geological Survey

Control by USGS, NOS/NOAA, and U.S. Forest Service

Topography by photogrammetric methods from aerial photographs taken 1958. Field checked 1962

Polyconic projection. 1927 North American datum
10,000-foot grid based on California coordinate system, zone 1
1000-meter Universal Transverse Mercator grid ticks, zone 10

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

UTM GRID AND 1967 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET

LEGEND

- National Forest Boundary
- Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION

- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Road, Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Trail, Location Approximate

MODOC NATIONAL FOREST

BOOT LAKE, CALIF.
N4100—W12007.5/7.5

1962
PHOTOREVISED 1982
DMA 1966 II SW—SERIES V895

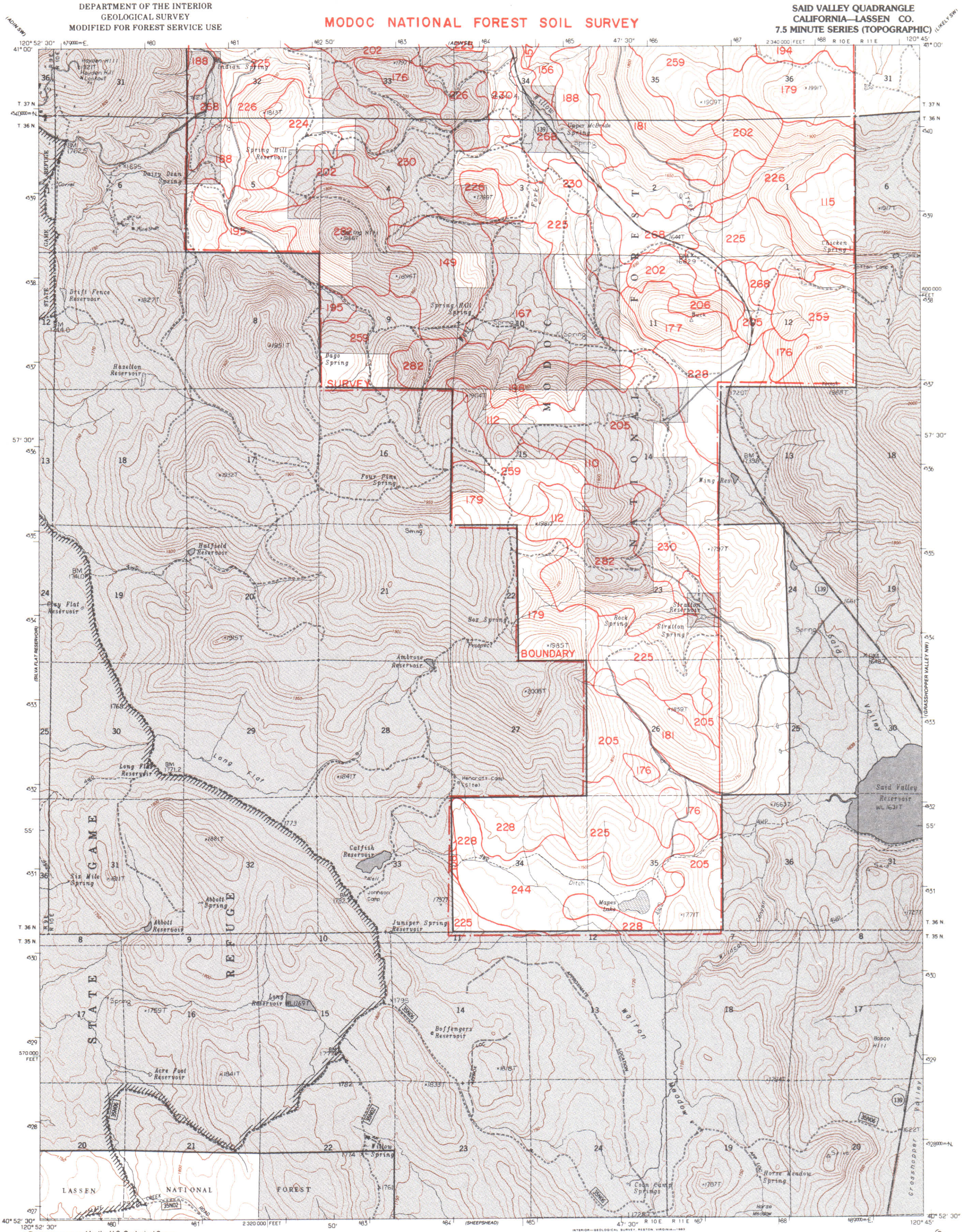
673-3C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

SAID VALLEY QUADRANGLE
CALIFORNIA—LASSEN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1983

Base map prepared by the U.S. Geological Survey

CONTROL BY .... USGS, NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1980
FIELD CHECKED .... 1981. MAP EDITED 1983
PROJECTION .... UNIVERSAL TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR .... ZONE 10
10,000-FOOT STATE GRID TICKS .... CALIFORNIA, ZONE 1
UTM GRID DECLINATION .... 1°26′ EAST
1983 MAGNETIC NORTH DECLINATION .... 17°30′ EAST
VERTICAL DATUM .. NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM .... 1927 NORTH AMERICAN DATUM

To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (17 meters north/89 meters east)

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region

GN MN 1°26′ 25 MILS 16½° 293 MILS

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

1 ½ 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 METERS

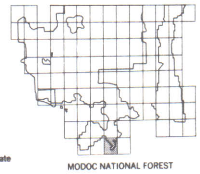
LEGEND

National Forest Boundary
Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction

Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate

80 Interstate
50 U.S. Highway
120 State Highway
155 County Road
15 Primary Forest Route
5N10A Forest Road
12E10 Forest Trail
Trail, Location Approximate



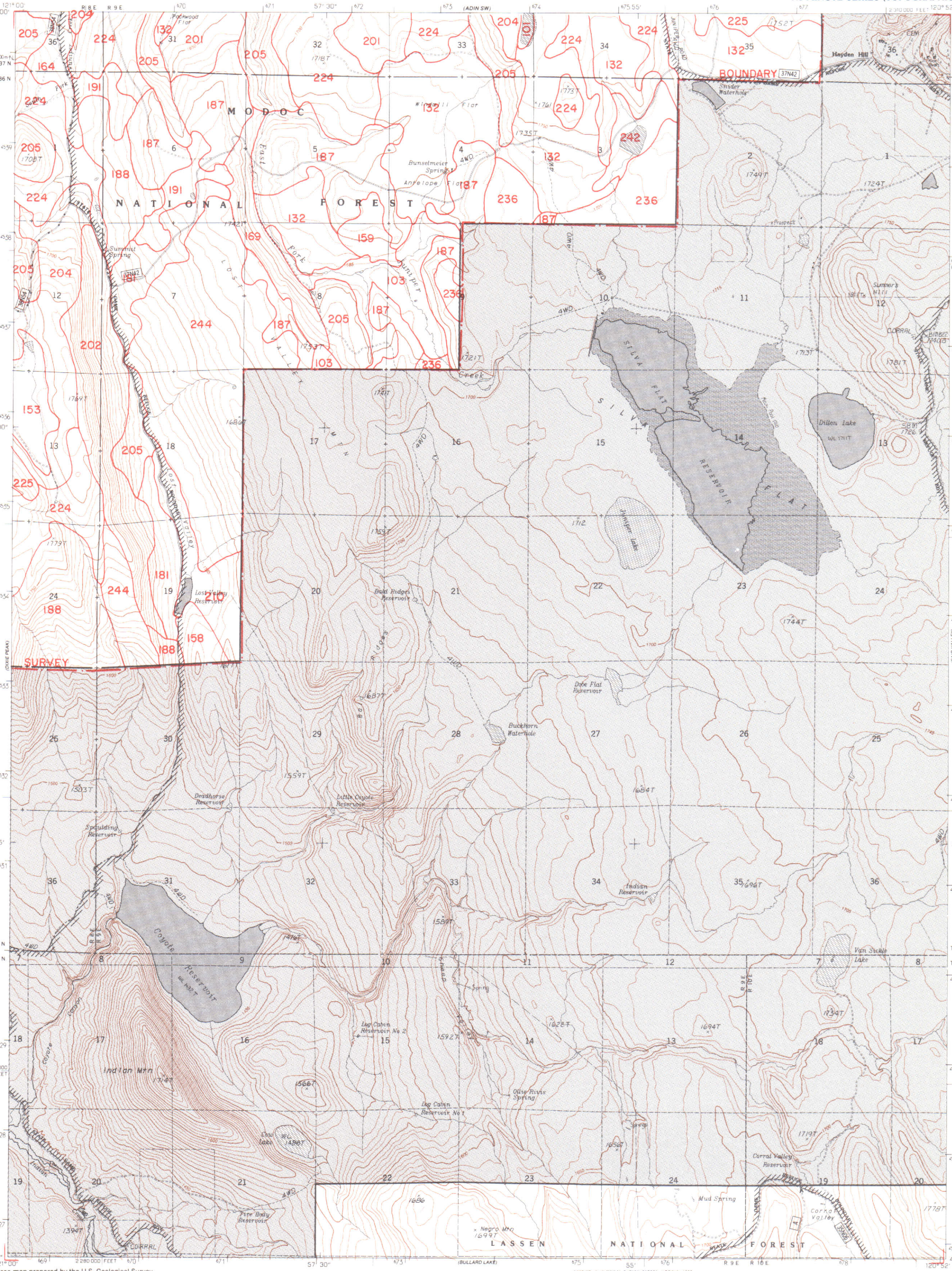
MODOC NATIONAL FOREST

SAID VALLEY, CALIF.
PROVISIONAL EDITION 1983
40120-H7-TM-024
N4052.5-W12045/7.5
659-1C
REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

SILVA FLAT RESERVOIR QUADRANGLE
CALIFORNIA—LASSEN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Base map prepared by the U.S. Geological Survey
CONTROL BY .... USGS, NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1980
FIELD CHECKED .... 1981 MAP EDITED 1983
PROJECTION .... UNIVERSAL TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR .... ZONE 10
10,000-FOOT STATE GRID TICKS .... CALIFORNIA, ZONE 1
UTM GRID DECLINATION .... 1°21' EAST
1980 MAGNETIC NORTH DECLINATION .... 17°30' EAST
VERTICAL DATUM .. NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM .... 1927 NORTH AMERICAN DATUM

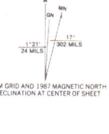
To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (17 meters north / 90 meters east)

There may be private inholdings within the boundaries of any Federal and State Reservations shown on this map

No distinction made between houses, barns, and other buildings

Area covered by dashed light-blue pattern is subject to controlled inundation to 1710 meters

Modification to USGS base map by the Geometronics Service Center from 1984 aerial photography and 1986 correction guides furnished by the Pacific Southwest Region



UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

1 MILE
7000 FEET
1 KILOMETER

CONTOUR INTERVAL 10 METERS

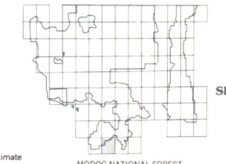
LEGEND

National Forest Boundary
Non-National Forest Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
Surveyed, Location Reliable
Surveyed, Location Approximate
Unsurveyed, Protraction

Primary Highway
Secondary Highway
Improved Road, Paved
Improved Road, Gravel
Improved Road, Dirt
Unimproved Road, Dirt
Trail
Road, Location Approximate

Interstate
U.S. Highway
State Highway
County Road
Primary Forest Route
Forest Road
Forest Trail
Trail, Location Approximate


MODOC NATIONAL FOREST

SILVA FLAT RESERVOIR, CALIF.

PROVISIONAL EDITION 1985

40120-H8-TM-024

N4052.5—W12052.5/7.5

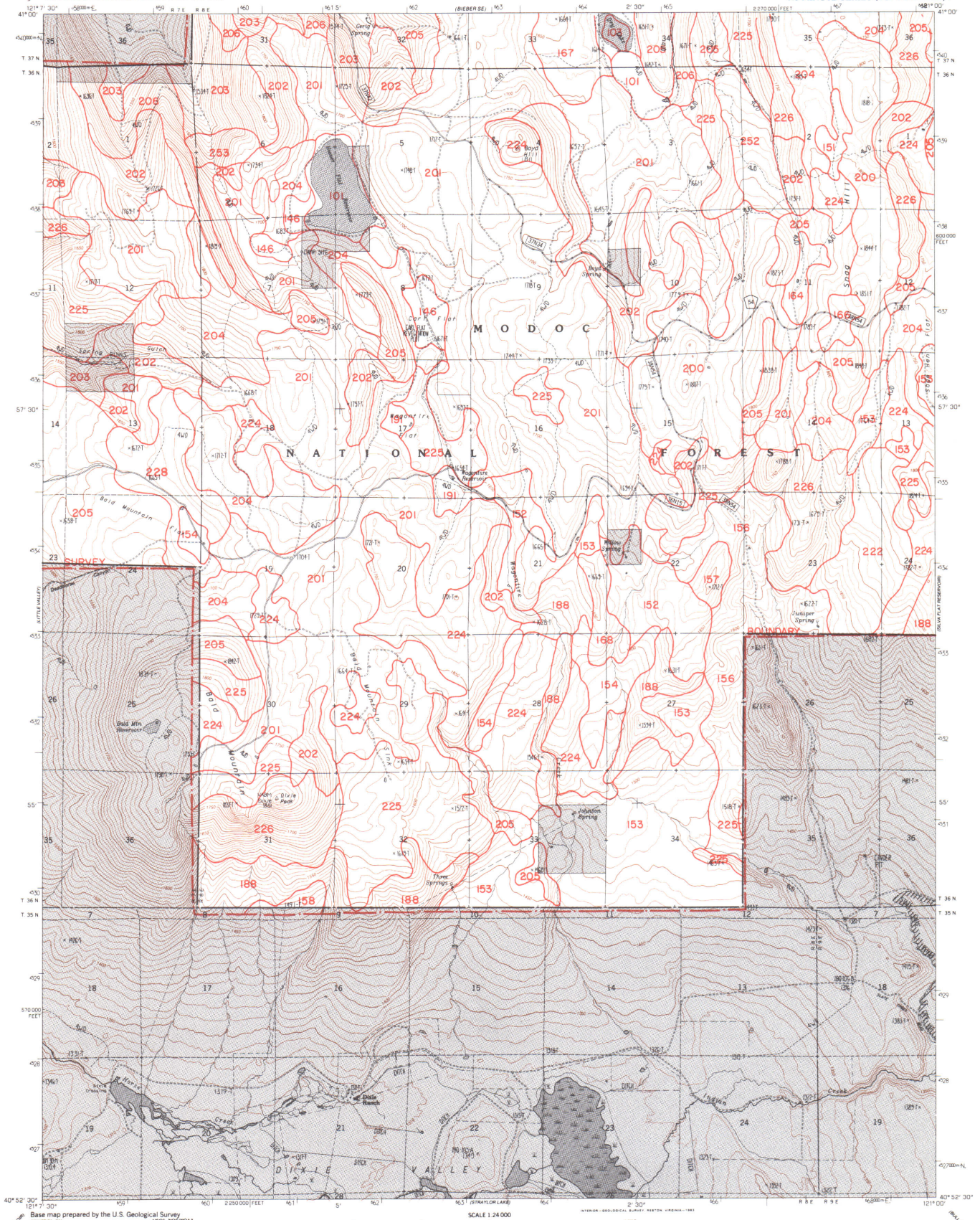
659-2C

REVISED 1987

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

MODOC NATIONAL FOREST SOIL SURVEY

DIXIE PEAK QUADRANGLE
CALIFORNIA—LASSEN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)


MODOC
NATIONAL
FOREST
SURVEY BOUNDARY
DIXIE VALLEY
Bald Mountain
Boyd Hill
Boyd Spring
Juniper Spring
Johnson Spring
Three Springs
Bald Mtn. Reservoir
Dixie Peak
Dixie Ranch
Bald Mountain Rd
Bald Mountain Spring
Bald Mountain Trail
Bald Mountain Well
Dixie Valley Creek
Indian Creek
Dixie Valley Rd
Dixie Valley Trail
Dixie Valley Well
Boyd Hill Trail
Boyd Hill Well
Boyd Spring Trail
Boyd Spring Well
Juniper Spring Trail
Juniper Spring Well
Johnson Spring Trail
Johnson Spring Well
Three Springs Trail
Three Springs Well
Bald Mtn. Rd
Bald Mtn. Spring
Bald Mtn. Trail
Bald Mtn. Well
Dixie Peak Trail
Dixie Peak Well
Dixie Ranch Trail
Dixie Ranch Well
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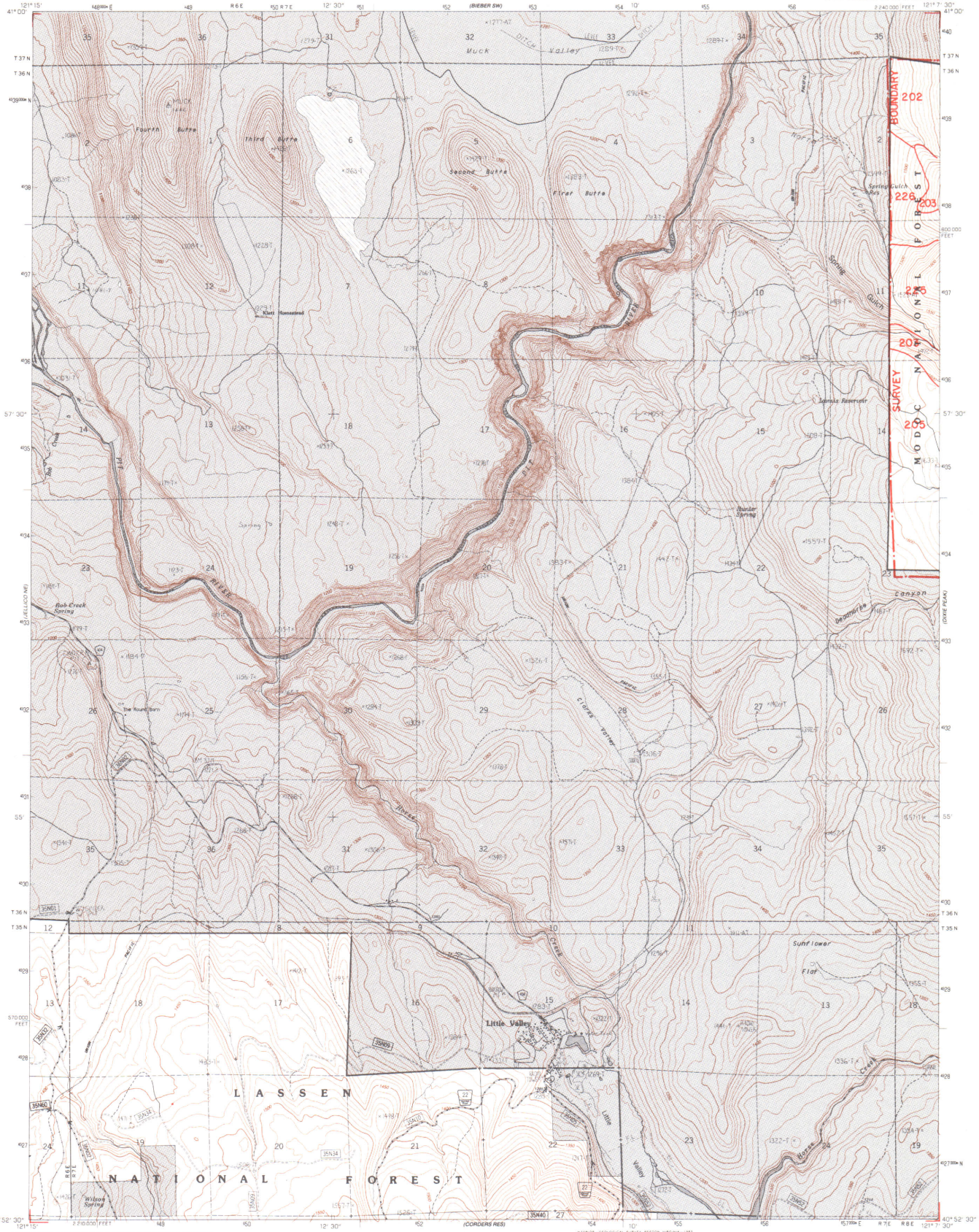
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

LITTLE VALLEY QUADRANGLE
CALIFORNIA—LASSEN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



PROVISIONAL BASE MAP PREPARED BY THE U.S. GEOLOGICAL SURVEY
CONTROL BY ..... USGS, NOS/NOAA
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1980
FIELD CHECKED ..... 1981 MAP EDITED 1983
PROJECTION ..... UNIVERSAL TRANSVERSE MERCATOR
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR ... ZONE 10
10,000-FOOT STATE GRID TICKS ..... CALIFORNIA, ZONE 1

VERTICAL DATUM . NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM ..... 1927 NORTH AMERICAN DATUM
To place on the predicted North American Datum of 1983, move the projection lines as shown by dashed corner ticks (17 meters north / 90 meters east)
Modification to USGS base map by the Geometronics Service Center from 1980, 83, 87 aerial photography and 1987 correction guides furnished by the Pacific Southwest Region.
Landnet revised according to additional Forest Service evidence

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 10 METERS
SUPPLEMENTARY CONTOUR INTERVAL 5 METERS

- National Forest Boundary
- Alienated Lands

TOWNSHIP AND SECTION LINE CLASSIFICATION
- Surveyed, Location Reliable
- Surveyed, Location Approximate
- Unsurveyed, Protraction

- Primary Highway
- Secondary Highway
- Improved Road, Paved
- Improved Road, Gravel
- Improved Road, Dirt
- Unimproved Dirt
- Trail
- Road, Location Approximate

- Interstate
- U.S. Highway
- State Highway
- County Road
- Primary Forest Route
- Forest Road
- Forest Trail
- Gate

678-4	677-3	677-4
661-1	660-2	660-1
661-4	660-3	660-4

ADJACENT QUADRANGLE LOCATION DIAGRAM

LITTLE VALLEY, CALIF.
PROVISIONAL EDITION 1983
N4052.5—W12107.5/7.5
660-2
REVISED 1987