United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with United States Department of the Interior, Bureau of Land Management; United States Department of Agriculture, Forest Service; Oregon Agricultural Experiment Station; and Lake County, Board of Commissioners.

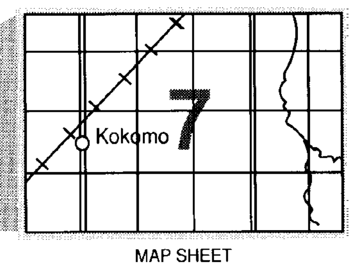
Soil Survey of Lake County, Oregon, Southern Part

How to Use This Soil Survey

General Soil Map

The general soil map, which is the color 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 color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

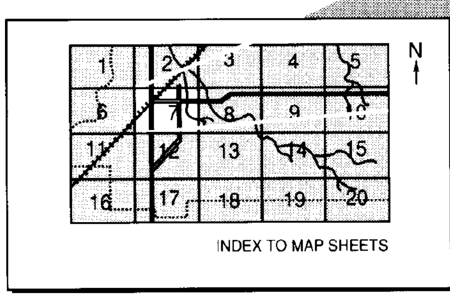


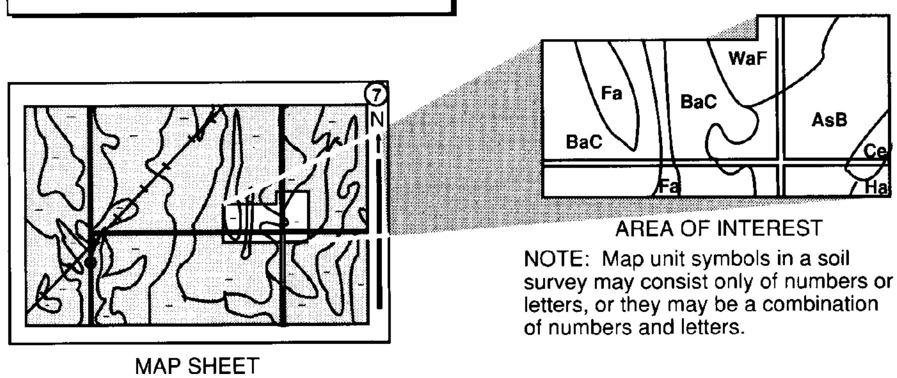
Detailed Soil Maps

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.

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





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

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, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1990. Soil names and descriptions were approved in 1991. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1990. This survey was made cooperatively by the Natural Resources Conservation Service and the Bureau of Land Management, the Forest Service, the Fish and Wildlife Service, the Oregon Agricultural Experiment Station, and Lake County. The survey is part of the technical assistance furnished to the Fort Rock-Silver Lake and Lakeview Soil and Water Conservation Districts.

Since the publication of this survey, more information on soil properties may have been collected, new interpretations developed, or existing interpretive criteria modified. The most current soil information and interpretations for this survey are in the Field Office Technical Guide (FOTG) at the local office of the Natural Resources Conservation Service. The soil maps in this publication may exist in digital form in a full quadrangle format. The digitizing of the maps is in accordance with the Soil Survey Geographic (SSURGO) database standards. During the digitizing process, changes or corrections to the maps may have occurred. These changes or corrections improve the matching of this survey to adjacent surveys and correct previous errors or omissions of map unit symbols or lines. If digital SSURGO-certified maps exist for this survey, they are considered the official maps for the survey area and are part of the FOTG at the local office of the Natural Resources Conservation Service.

Cover: View of Goose Lake Valley from the southeast. Warner Mountains in background.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov (click on "Technical Resources").

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Issued 1999

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

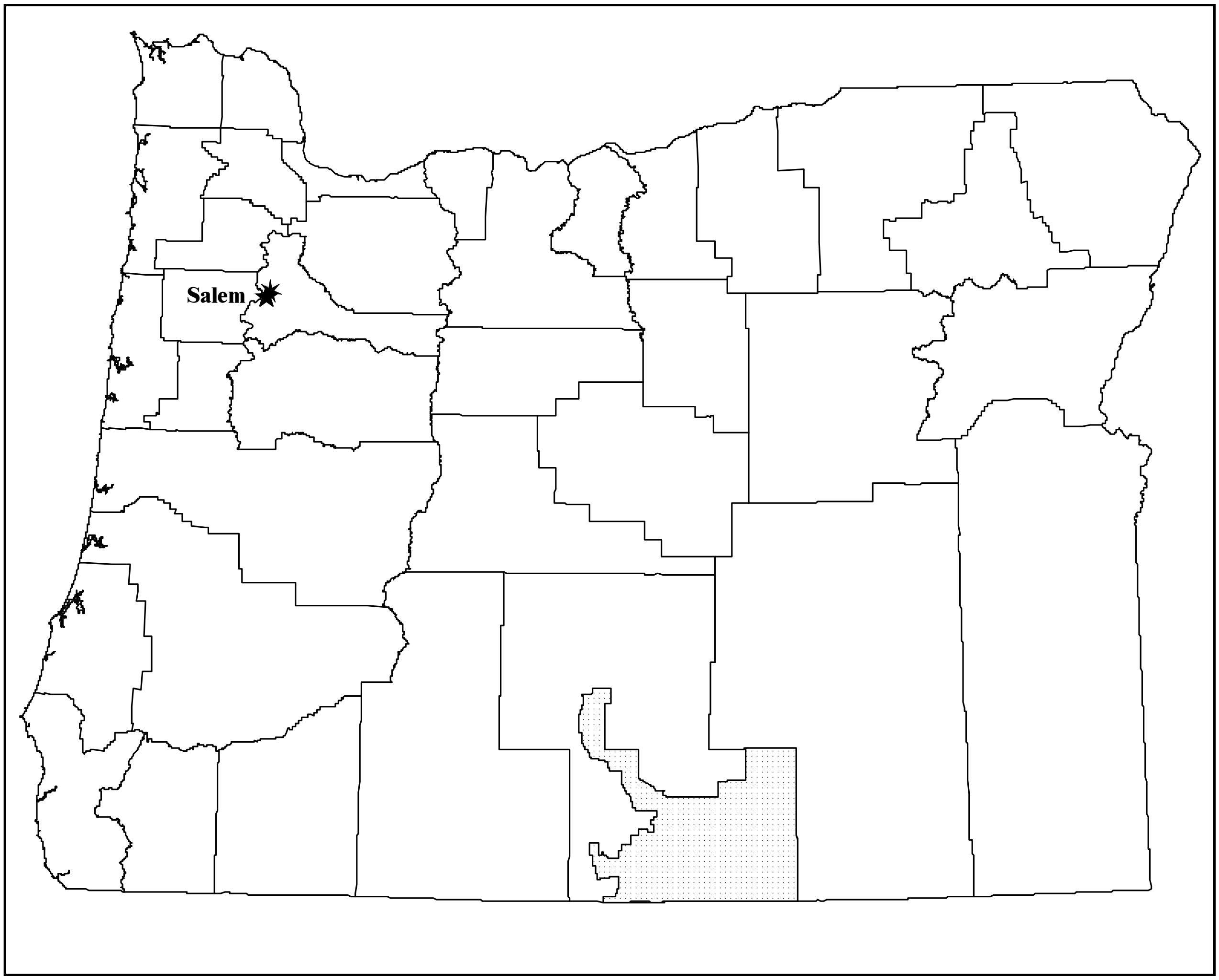
This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Bob Graham
State Conservationist
Natural Resources Conservation Service



Location of Lake County, Oregon, Southern Part.

Soil Survey of
Lake County, Oregon, Southern Part

By R. James Kienzle

Fieldwork by R. James Kienzle, Allen Makinson, Tom Clark, Roger Borine, Duane Monte, Billy Carpenter, Mark Block, Erick Johnson, and Steve Frisch, Natural Resources Conservation Service; Ken Lukl and Dave Wenzel, Forest Service; and Ralph Klein, Tom Champa, Paula Reid, Curt Leet, and John Barber, Bureau of Land Management

United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with
United States Department of the Interior, Bureau of Land Management; United States Department of Agriculture, Forest Service; Oregon Agricultural Experiment Station; and Lake County, Board of Commissioners

Lake County Area, Southern Part is in the south-central part of Oregon, adjoining California and Nevada on its southern boundary. Lakeview, the county seat, is northeast of Goose Lake, near the Oregon state line. Nearly one-half of the county's population of about 7,000 lives in or around Lakeview. Most of the economy of the county is directly or indirectly dependent on farming, ranching, timber harvesting, and milling.

The survey area consists of about 1.7 million acres of land and about 90,000 acres of water. The land in the area includes about 161,000 acres in the Fremont National Forest, mainly in the Warner Mountains; about 250,000 acres in the Hart Mountain National Antelope Refuge; and about 540,000 acres that is administered by the Bureau of Land Management.

The survey area lies within the Basin and Range Province, more commonly called the Great Basin, which extends into Nevada and northern California. Except in the areas that receive the higher amounts of precipitation, the Basin and Range Province does not support trees. It is characterized by basins that have closed or semiclosed drainage and are separated by north-trending, fault-block mountains.

Summer Lake, Chewaucan Basin, Abert Lake Basin, Goose Lake Valley, Guano Valley, and Warner Valley are the major basins in the survey area. These areas include dry salt flats and shallow saline playa lakes. During periods of higher precipitation, such as the Pleistocene, the lakes in these basins were as much as 350 feet deep. Many of the terraces that formed as a result of these ancient lakes are farmed. Elevation in the basins ranges from about 4,300 to 5,000 feet. Goose Lake Valley has an average annual precipitation of about 16 inches and a frost-free period of about 100 days. Chewaucan Basin and Warner Valley have a more arid climate with an average annual precipitation of 8 to 14 inches and a frost-free period of 70 to 110 days.

Winter Rim, Abert Rim, Warner Mountains, and Hart Mountain are some of the major fault-block escarpments and ranges that separate the basins. Cinder cones and lava buttes are scattered throughout these areas.

Areas that receive more than 18 inches of precipitation commonly support ponderosa pine and white fir. These areas are at elevations of about 5,000 to 8,000 feet or more. The average annual precipitation ranges from 18 to 35 inches, and the frost-free period is less than 90 days.

The watersheds in the survey area include Summer Lake, Goose Lake, Warner Lakes, and Guano Valley. The Warner Lakes watershed is about three times the size of the Goose Lake or Summer Lake watershed.

Soil scientists have identified more than 100 different soils in this survey area. Slope, texture, reaction (pH), and other features may vary from soil to soil. The soils range from coarse sand to clay and from those on barren, infertile salt flats to those that formed in very deep, fertile alluvium. Steepness of slope, a short growing season, low rainfall, salinity and alkalinity, and soil wetness in spring are the major limitations to cropping.

An older survey, “Hart Mountain National Antelope Refuge, Oregon,” was published in 1970 ***(38)***. This earlier survey covers a part of the present survey. The present survey, however, updates the earlier survey and provides additional information and has larger maps, which show the soils in greater detail.

General Nature of the Survey Area

This section briefly discusses the history and development and climate of the survey area.

History and Development

The desert-dwelling Northern Paiute Indians and the marsh- and riverine-dwelling Modoc and Klamath Indians were the first inhabitants of the Lake County area. The Northern Paiutes commonly were called the Snake Indians by explorers, and they depended on hunting and seed gathering for their sustenance. The Klamath and Modoc Tribes depended on fishing and root gathering for their sustenance. The Indian populations were reduced significantly by disease early in the 19th century, primarily as a result of their contact with white settlers. These settlers brought cattle and sheep to the area and planted crops, which altered the native vegetation to such an extent that traditional means of subsistence were no longer possible by late in the 19th century ***(18)***.

The 1860’s brought the gold rush to eastern Oregon and Idaho. The subsequent rush of miners from California northward through central and eastern Oregon increased tensions between the Indians and whites.

Before 1854, homesteading privileges were available only for surveyed land. In 1854, however, preemption laws were extended to allow settlers to claim unsurveyed land in Oregon. These laws allowed settlers to hold their claims until a township survey could be completed ***(11)***. The first settlers in the late 1860’s included David R. Jones, who settled in Warner Valley and hauled supplies to Camp Warner, and John O’Neil, a packer for George Crook who settled in Goose Lake Valley in 1869. August Miller established one of the first cattle herds in Lake County in that same year, and C. Hagerhorst brought in flocks of sheep a few years later.

A scramble for land in south-central Oregon began after 1870. Stock operators could secure additional land in several ways, including the purchase of school land owned by the state of Oregon. In 1870, Oregon attempted to dispose of land transferred to the state by the Swamp Land Act of 1850. By 1892, the Warner Valley Stock Company emerged as the successor to these claims. Between 1885 and 1888, 27 settlers contested in court the company’s rights to the land ***(31)***.

In 1870, the first post office in Lake County was established at New Pine Creek. Two mining districts were organized that same year. These included the Goose Lake District, which later became known as the High Grade District. It was located on the eastern side of Goose Lake and was mostly in Modoc County, California. Narrow veins of ore worth about $85,000 were mined from 1909 to 1934. Gold was discovered in 1875 in the Paisley Hills.

Lake County was established in 1874, and Warner Valley was added to the county in 1885. When a census was done in 1875, 944 residents lived in the area. M. Bullard, a homesteader, donated 20 acres to establish the town of Lakeview. In 1876, the county seat was moved from Linkville (Klamath Falls) to Lakeview. Klamath County separated from Lake County in 1882 ***(31)***. By 1900, the population of Lake County had increased to 2,847. The farmland in the county increased from about 250,000 acres to about 500,000 acres during the period 1899 to 1919. The acreage of irrigated land nearly doubled during the period 1909 to 1919. It increased from about 60,000 acres to about 100,000 acres ***(43, 44)***.

At the turn of the century, livestock production was the largest agricultural enterprise. Today, beef cattle operations account for about 75 percent of the agricultural commodities produced in the county. With the homesteading late in the 19th century, the rangeland was divided into small private parcels. Some of the parcels were isolated from water, and others were heavily overgrazed. This led to the Taylor Grazing Act of 1934, which placed federal grazing land under the management of the Department of the Interior. With the Bankhead-Jones Act of 1937, many square miles of high desert land were purchased by the Federal government from homesteaders ***(11)***. The General Land Office and its successor, the Bureau of Land Management, obtained a large percentage of the grazeable land in the area.

Logging and lumbering operations did not gain commercial importance in the economy until the establishment of railroad connections. The first sawmills were in operation in Lake County in the early 1870’s. By 1905, the county had five small mills, all of which produced less than 10,000 board feet per day.

The first commercial sale of timber from the Goose Lake Forest Reserve (Fremont National Forest) was in 1911 ***(5)***.

In 1936, the Hart Mountain National Antelope Refuge was established to provide range for the remnant herds of antelope in southeastern Oregon and northern Nevada. On July 1, 1947, Lake County established the Lakeview Soil and Water Conservation District to conserve water and control soil erosion.

In 1954, “yellow cake,” or uranium oxide ore, was discovered in Lake County by a rancher-turned-prospector, John Roush. For a short time many farmers and ranchers headed to the hills to prospect for uranium. The following year the White King and Lucky Lass Mines were leased to the Lakeview Mining Company. The mines were only 15 miles northwest of Lakeview. In 1958, the Atomic Energy Commission contracted with the company to buy uranium and construction of a $2.5 million uranium reduction plant began. This contributed to a short-lived building boom in Lakeview. In 1959, the shaft mines were abandoned and open-pit mining was begun. By fall of that year nearly all of the ore near the surface had been mined. The mining company closed the mines in 1960, but small amounts of ore were mined by other owners through 1965 ***(28)***.

Climate

By the Natural Resources Conservation Service, Water and Climate Center, Portland, Oregon.

The temperature and precipitation data were recorded at Adel, Hart Mountain National Antelope Refuge, Lakeview, and Paisley, Oregon, in the period 1961 to 1990. The thunderstorm, relative humidity, percent sunshine, and wind data were estimated.

Table 1 gives data on temperature and precipitation. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter, the average temperature is 33.3 degrees F at Adel, 29.7 degrees at Hart Mountain National Antelope Refuge, 30.3 degrees at Lakeview, and 33.1 degrees at Paisley and the average daily minimum temperature is 22.9 degrees at Adel, 19.1 degrees at Hart Mountain National Antelope Refuge, 20.9 degrees at Lakeview, and 22.8 degrees at Paisley. The lowest temperature on record at Adel is -24 degrees recorded on December 22, 1990; at Hart Mountain National Antelope Refuge, -32 degrees recorded on December 22, 1990; at Lakeview, -22 degrees recorded on January 7, 1937; and at Paisley, -28 degrees recorded on December 9, 1972. In summer, the average temperature is 66.9 degrees at Adel, 59.9 degrees at Hart Mountain National Antelope Refuge, 63.9 degrees at Lakeview, and 64.5 degrees at Paisley and the average daily maximum temperature is 84.2 degrees at Adel, 77.6 degrees at Hart Mountain National Antelope Refuge, 80.0 degrees at Lakeview, and 81.4 degrees at Paisley. The highest temperature on record at Adel is 107 degrees recorded on July 25, 1978; at Hart Mountain National Antelope Refuge, 98 degrees recorded on August 8, 1972; at Lakeview, 106 degrees recorded on July 20, 1931; and at Paisley, 101 degrees recorded on August 4, 1961.

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

The average annual precipitation is 10.24 inches at Adel, 12.07 inches at Hart Mountain National Antelope Refuge, 15.66 inches at Lakeview, and 11.05 inches at Paisley. Of this, about 35 percent usually falls in May through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record at Adel was 2.00 inches recorded on October 31, 1992; at Hart Mountain National Antelope Refuge, 2.86 inches recorded on May 16, 1955; at Lakeview, 2.39 inches recorded on December 10, 1937; and at Paisley, 2.38 inches recorded on January 8, 1990. Thunderstorms occur on about 13 days each year, and most occur in May through August.

The average seasonal snowfall is 23.7 inches at Adel, 42.6 inches at Hart Mountain National Antelope Refuge, 58.8 inches at Lakeview, and 21.0 inches at Paisley. The greatest snow depth at any one time during the period of record at Adel was 9 inches recorded on November 26, 1979; at Hart Mountain National Antelope Refuge, 23 inches recorded on January 9, 1965; at Lakeview, 44 inches recorded on January 13, 1993; and at Paisley, 14 inches recorded on January 8, 1993. On an average, at least 1 inch of snow is on the ground 17 days per year at Adel, 38 days at Hart Mountain National Antelope Refuge, 41 days at Lakeview, and 17 days at Paisley. The heaviest 1-day snowfall on record at Adel was 12 inches recorded on December 6, 1992; at Hart Mountain National Antelope Refuge, 18 inches recorded on May

18, 1991; at Lakeview, 17 inches recorded on January 21, 1967; and at Paisley, 14 inches recorded on January 20, 1964.

The average relative humidity in midafternoon is about 40 percent. Humidity is higher at night, and the average at dawn is about 67 percent. The sun shines 78 percent of the time in summer and 48 percent in winter. The prevailing wind is from the west. Average windspeed is 7 to 9 miles per hour throughout the year.

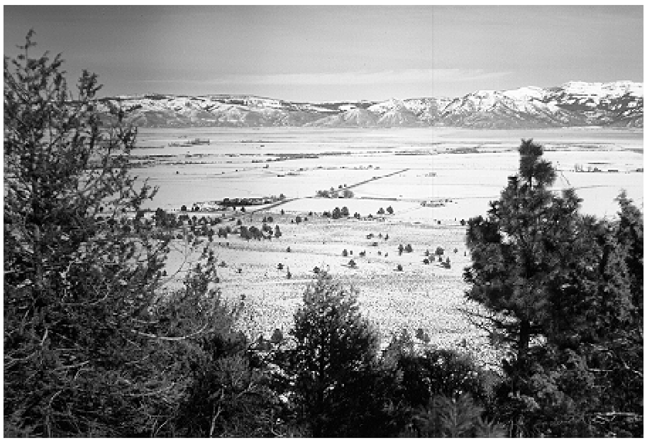


Figure 1.—View of Goose Lake Valley in February. Precipitation in winter falls as snow, and the highest accumulations are on forested mountains.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions. Data are assembled from other sources, such as research information, production records, and field experience of specialists.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Survey Procedures

The general procedures followed in making this survey are described in the National Soil Survey Handbook ***(34)*** of the Natural Resources Conservation Service. References used during the development of the survey include the soil surveys of Surprise Valley-Home Camp Area, California-Nevada ***(42)***; Modoc County, California, Alturas Area ***(40)***; and Hart Mountain National Antelope Refuge, Oregon ***(37)***; the Fremont National Forest Soil Resource Inventory ***(32)***; soil mapping for conservation farm plans; and reconnaissance geologic maps published by the U.S. Geological Survey (USGS) ***(12, 45, 46, 47)***.

Part of the survey area was mapped on preliminary field sheets at a scale of 1:15,840 and then transferred to orthophoto base maps at a scale of 1:24,000. Other areas of the survey were mapped on high-altitude photographs enlarged to 1:24,000, and the soil boundaries were directly transferred to the orthophoto base maps. Cultural features were transferred from USGS 7.5-minute topographic maps. Slopes or aspects of hillsides and mountainsides generally were determined from contour intervals on topographic maps, from stereoscopic studies, and from clinometer field checks.

The Bureau of Land Management ecological site inventory (ESI) team used high-altitude photographs enlarged to 1:24,000. Preliminary soil map unit boundaries were plotted on these photographs using a stereoscope and USGS 7.5-minute topographic maps. The map unit boundaries were based on tonal patterns, slope, and aspect. Sampling of delineated units was conducted primarily from helicopters.

Each unit was reviewed aerially by the ESI team, and on-the-ground sampling was conducted as needed to support soil-landform concepts established for the survey area. For each unit sampled, soil and plant characteristics were examined by the team. The range site inventory procedures in the National Range Handbook ***(39)*** were followed in sampling the vegetation.

The Fremont National Forest Soil Resource Inventory (SRI) was completed in 1979. Field mapping was conducted in April 1973 through October 1976 from black-and-white high-altitude photographs at a scale of 1:70,000. The scale was enlarged to 1:63,360 for publication in the SRI report.

Additional fieldwork was done in 1986 through 1988 to correlate the SRI to National soil survey standards. This included describing soil profiles for new soil series and delineating map units. A typical pedon was selected for each new series established for the part of the survey in the Fremont National Forest.

Most of the map unit boundaries established for the SRI were retained; however, additional detail was needed as a result of incorporating aspect and soil temperature regimes. For example, cryic soils at high elevations were separated from frigid soils at lower elevations. Rangeland and woodland data also were collected for the new series and map units. Range site data were collected over a period of two years by using the standards of the Natural Resources Conservation Service.

The intensity of mapping was varied according to the geographic area. Specific soil survey techniques were used for each of these areas.

Transects were used in areas where the patterns of the soils were not easily predicted. Tonal patterns and stereoscopic studies of aerial photos helped to predict some preliminary soil delineations, but the extent and composition of each map unit were determined by line-intercept transects. Transect lines and field samples were taken at regular intervals, commonly crossing several delineations on a single geomorphic surface.

Where predictable soil patterns existed, such as on terraces and tablelands, landform traverses were used to correlate soils with a particular geomorphic surface. Preliminary soil delineations were drawn using this soil-landform correlation. Traverses were planned using topographic maps and photo-interpretation of tonal patterns, slope, and aspect. These traverses crossed typical geomorphic surfaces and different slopes in each area. Field sampling was done primarily to support the particular soil-landform relationship established for each area. Potential plant communities were correlated to specific soil characteristics, such as depth to a claypan, drainage, and content of salt.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

Dominantly nonsaline and nonsodic soils on alluvial flats, low lake terraces, lake shorelines, and flood plains in warm basins

This group consists of three map units. It makes up about 9 percent of the survey area. The map units are used primarily for hay and pasture, for livestock grazing, and as wetland wildlife habitat.

1. Fluvaquents-Tandy

Frequently flooded or seasonally ponded, poorly drained and somewhat poorly drained soils; on lake shorelines and adjacent alluvial flats

This map unit is along the shoreline of Goose Lake and on alluvial flats adjacent to the lake. The native vegetation is mainly water-tolerant grasses and forbs, rushes, and sedges. Slopes are 0 to 2 percent. Elevation is 4,400 to 4,725 feet. The mean annual precipitation is about 14 to 16 inches, the mean annual air temperature is 45 to 48 degrees F, and the frost-free period is 70 to 110 days.

This unit makes up about 2 percent of the survey area. It is about 45 percent Fluvaquents and 40 percent Tandy soils. The remaining 15 percent is Goose Lake and Thunderegg soils on low lake terraces and numerous small stream channels.

Fluvaquents are on the shoreline of Goose Lake. They are very deep and are poorly drained or somewhat poorly drained. These soils are highly stratified silty clay loam, clay, silt loam, clay loam, coarse sand, or sand and are 0 to 50 percent gravel and 0 to 50 percent cobbles.

Tandy soils are on alluvial flats in slightly higher lying areas. These soils are very deep and somewhat poorly drained. The surface layer is loamy fine sand. The upper part of the substratum is fine sandy loam and loamy fine sand, and the lower part is silt loam over stratified clay loam and loamy fine sand.

This unit is used mainly as wetland wildlife habitat and for livestock grazing.

The main limitations for livestock grazing are seasonal wetness and a hazard of wind erosion.

Fluvaquents are subject to frequent flooding by Goose Lake, and the water table in these soils fluctuates directly with the level of the lake. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock. Grazing should be deferred during the period of nesting for waterfowl.

Tandy soils are subject to frequent ponding and a severe hazard of wind erosion. Seeding is needed in some areas to control blowing and drifting sand. The risk of wind erosion can be minimized by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover. Plants that tolerate seasonal wetness and provide cover for nesting waterfowl should be seeded.

2. Ozamis-Crump

Seasonally ponded, very poorly drained and poorly drained soils; on alluvial flats

This map unit is in Warner and Chewaucan Valleys, adjacent to Crump and Hart Lakes. The native vegetation is mainly rushes, sedges, and water-tolerant grasses and forbs. Slopes are 0 to 1 percent. Elevation is 4,200 to 4,800 feet. The mean annual precipitation is about 8 to 10 inches, the mean annual air temperature is 47 to 50 degrees F, and the frost-free period is 90 to 110 days.

This unit makes up about 5 percent of the survey area. It is about 40 percent Ozamis soils and 30 percent Crump soils. The remaining 30 percent is Reese, Pit, and Tulana soils on alluvial flats, and small open water areas.

Ozamis soils are subject to rare flooding and frequent ponding unless drained. These soils are very deep and poorly drained. The surface layer is silty clay loam. The upper part of the substratum is silt loam, the middle part is coarse pumice sand or ash, and the lower part is very fine sandy loam.

Crump soils are subject to rare flooding and frequent ponding unless drained. These soils are very deep and very poorly drained. The surface layer is muck. The upper part of the substratum is silt, and the lower part is silt loam. Areas that have been drained have a silty clay loam surface layer and are considered poorly drained.

This unit is used for livestock grazing, for hay and pasture, and as wetland wildlife habitat.

The main limitation for livestock grazing is seasonal wetness. Grazing when the soils are wet results in compaction of the upper part of the soils and poor tilth. Grazing should be delayed until the soils are firm enough to withstand trampling by livestock. Grazing should be deferred during the period of nesting for waterfowl.

The main limitations for hay and pasture are seasonal wetness, restricted load supporting capacity, and potential frost action.

Many areas of this unit have been diked and drained, and most climatically adapted crops can be grown. Because of wetness and a high potential for frost action, there is a risk of winterkill and other damage to seedlings. In summer, irrigation is needed for maximum production of hay and pasture plants. Irrigation water management is needed to prevent the buildup of a high water table.

3. Lakeview-Goose Lake

Occasionally flooded, and rarely flooded and seasonally ponded, poorly drained and moderately well drained soils; on flood plains and low lake terraces

This map unit is in Goose Lake and Chewaucan Valleys (fig. 2). The native vegetation on the Lakeview soils is mainly grasses, shrubs, and forbs. The native vegetation on the Goose Lake soils is mainly water-tolerant grasses and forbs. Slopes are 0 to 2 percent. Elevation is 4,500 to 5,000 feet. The mean annual precipitation is about 8 to 18 inches, the mean annual air temperature is 45 to 50 degrees F, and the frost-free period is 70 to 110 days.

Figure 2.—Area of general soil map unit 3, in Goose Lake Valley, in foreground. Lasere soils are on benches, and Bullump, Booth, and Nuss soils are in background. The town of Lakeview is in background.

This unit makes up about 2 percent of the survey area. It is about 40 percent Lakeview soils and 30 percent Goose Lake soils. The remaining 30 percent is Stockdrive, Pit, and Ozamis soils on low lake terraces and alluvial flats.

Lakeview soils are on flood plains and are very deep and moderately well drained. The surface layer is silty clay loam. The subsoil is sandy clay loam and clay loam. These soils are subject to occasional flooding.

Goose Lake soils are on low lake terraces and are very deep and poorly drained. The surface layer is silt loam. The subsoil is silty clay and clay loam.

These soils are subject to frequent ponding and rare flooding.

This unit is used mainly as cropland, for livestock grazing, and as wildlife habitat.

The main limitations for cropland and livestock grazing are flooding, permeability, and seasonal wetness.

Most climatically adapted crops can be grown on the Lakeview soils if they are protected from flooding. Stream corridors along areas of the Lakeview soils are subject to cutting and filling during periods of flooding. In summer, irrigation is needed for maximum production of most crops. Suitable irrigation methods include sprinkler, furrow, and border systems. Because of the slow permeability in the lower part of the Goose Lake soils, the application of water needs to be controlled to prevent water from ponding on the surface and damaging crops.

Grazing should be managed to maintain or increase the abundance of plants that help to stabilize streambanks and moderate water temperatures. Maintaining a buffer zone along the watercourses can protect streambanks. Grazing on the Goose Lake soils should be deferred during the period of nesting for waterfowl. Grazing on the Goose Lake soils should be delayed until late in spring when forage plants have achieved sufficient growth or until the soils are adequately drained and are firm enough to withstand trampling by livestock. Surface drains on the Goose Lake soils reduce the length of the periods of ponding, maintain the level of the water table, and inhibit the growth of less palatable water-tolerant plants.

Playas and saline and sodic soils on alluvial flats and low lake terraces in warm basins

This group consists of three map units. It makes up about 14 percent of the survey area. The map units are used primarily for livestock grazing and as wildlife habitat.

4. Playas

Poorly drained, very strongly alkaline, barren areas that receive 8 to 10 inches of precipitation; on alluvial flats

This map unit is near Summer and Coleman Lakes (fig. 3). Slopes are 0 to 5 percent. Elevation is 4,200 to 4,800 feet. The mean annual precipitation is about 8 to 10 inches, the mean annual air temperature is 45 to 50 degrees F, and the frost-free period is 90 to 110 days.

Figure 3.—Area of general soil map unit 4 on barren, salt-crusted alluvial flats. Reese soils on vegetated alluvial flats in foreground.

This unit makes up about 2 percent of the survey area. It is about 80 percent Playas. The remaining 20 percent is Helphenstein, Reese, Alvodest, Turpin, and Boravall soils on low lake terraces and alluvial flats and Kewake soils on adjacent alkaline dunes.

Playas are very deep and poorly drained. They are seasonally ponded and do not support vegetation.

This unit is used seasonally as wetland wildlife habitat.

5. Reese-Mesman-Kewake

Poorly drained, well drained, and excessively drained, very strongly alkaline to moderately alkaline soils that receive 8 to 10 inches of precipitation; on alluvial flats and low lake terraces

This map unit is in Warner and Chewaucan Valleys (see fig. 4, next page). The native vegetation is mainly salt-tolerant grasses, shrubs, and forbs. The Reese and Mesman soils have slopes of 0 to 5 percent, and the Kewake soils have slopes of 1 to 15 percent.

Elevation is 4,200 to 4,800 feet. The mean annual precipitation is about 8 to 10 inches, the mean annual air temperature is 45 to 50 degrees F, and the frost-free period is 90 to 110 days.

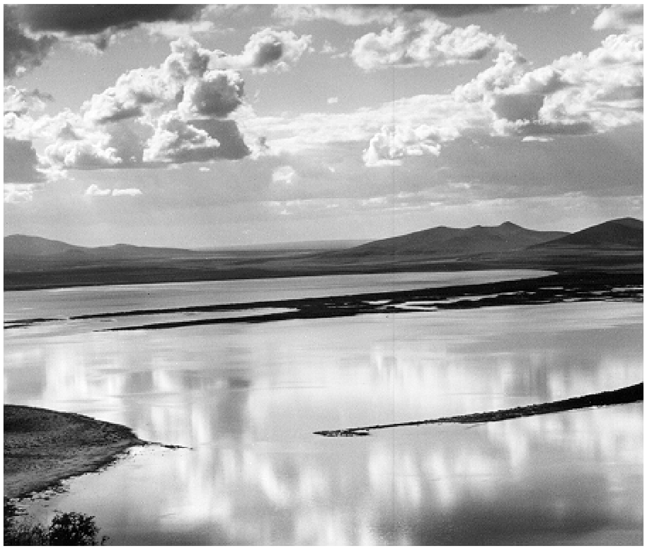


Figure 4.—Area of general soil map unit 5 in Warner Valley. Frequent seasonal ponding from snowmelt is characteristic of the alluvial flats.

This unit makes up about 11 percent of the survey area. It is about 35 percent Reese soils, 30 percent Mesman soils, and 10 percent Kewake soils. The remaining 25 percent is Playas and Ozamis, Turpin, Icene, and Boravall soils on alluvial flats and low lake terraces and Als soils on dunes.

Reese soils are frequently ponded and are very deep and poorly drained. They are on alluvial flats. The surface layer is very strongly alkaline very fine sandy loam. The subsoil is clay loam, coarse sandy loam, and loam.

Mesman soils are on low lake terraces in areas slightly higher than the Reese soils. Mesman soils are very deep and well drained. The surface layer is strongly alkaline fine sandy loam. The upper part of the subsoil is sandy clay loam, silt loam, and very fine sandy loam, and the lower part is silt loam and consists of fractured, consolidated sediment.

Kewake soils are on sand dunes on terraces. These soils are very deep and excessively drained. The surface layer is moderately alkaline fine sand. The substratum is fine sand.

This unit is used mainly for livestock grazing and as wildlife habitat. Some areas are used as cropland.

The main limitations for livestock grazing are salinity, sodicity, available water capacity, seasonal wetness on the Reese soils, and the hazard of wind erosion on the Kewake soils.

Especially on the Reese soils, grazing should be delayed until the soils are firm and the preferred forage plants have grown enough to withstand grazing pressure. Excess sodium in the soils results in nutrient imbalances and a caustic root environment. Dispersion and crusting reduce the water intake rate and restrict seedling emergence and survival. Range recovery is slow because of the salinity and sodicity. Low precipitation and low available water capacity because of the salinity limit forage production and seedling survival. Sufficient plant cover should be maintained on the surface to prevent wind erosion, especially on the Kewake soils.

The main limitations for cropland are salinity, sodicity, available water capacity, permeability, and wind erosion.

The salinity and sodicity of the soils in this unit limit the kinds of crops that can be grown. The soils tie up large amounts of phosphorus, which limits the amount that is available to plants. In summer, irrigation is needed for maximum production of hay or other crops. Sprinkler irrigation is best suited to this unit. If the soils are irrigated, the available water capacity can be increased by leaching salts below the root zone. Drainage is needed on the Reese soil so that the salts can be leached. Salts can be leached by applying irrigation water. The slow permeability of the Reese and Mesman soils and the rapid permeability of the Kewake soils should be considered in determining the rate of application of irrigation water. Removing salts without applying proper amounts of soil amendments causes dispersion and crusting of the soil surface. Crop residue should be maintained on the soil surface to minimize wind erosion, especially in areas of the Kewake soils.

6. Thunderegg-Stockdrive

Poorly drained and somewhat poorly drained, very strongly alkaline to moderately alkaline soils that receive 14 to 18 inches of precipitation; on low lake terraces

This map unit is in Goose Lake Valley. The native vegetation is mainly water-tolerant grasses, forbs, rushes, and sedges. Slopes are 0 to 1 percent. Elevation is 4,690 to 4,760 feet. The mean annual precipitation is about 14 to 18 inches, the mean annual air temperature is 45 to 48 degrees F, and the frost-free period is 70 to 110 days.

This unit makes up about 1 percent of the survey area. It is about 35 percent Thunderegg soils and 30 percent Stockdrive soils. The remaining 35 percent is Tandy and Ozamis soils on alluvial flats and Lakeview soils on flood plains.

Thunderegg soils are very deep and poorly drained. The surface layer is moderately alkaline fine sandy loam. The upper part of the subsoil is silty clay loam and loam, and the lower part is stratified sand and gravel.

Stockdrive soils are very deep and somewhat poorly drained. The surface layer is very strongly alkaline fine sandy loam. The upper part of the subsoil is loam, silty clay loam, and fine sandy loam, the middle part is stratified sand and gravel, and the lower part is silty clay loam.

This unit is used mainly for livestock grazing and as wetland wildlife habitat. A few areas are used for native meadow hay.

The main limitations for livestock grazing are salinity, sodicity, available water capacity, and seasonal wetness.

Grazing should be deferred during the period of nesting for waterfowl. Because the soils in this unit are saturated and ponded in spring, they should be allowed to drain adequately before grazing to prevent damage to the soil and plants. Salts reduce the amount of water available to plants and restrict seedling survival. The soils tie up large amounts of phosphorus, which limits the amount available to plants.

Soils on lake terraces and flood plains in cool basins

This group consists of two map units. It makes up about 3 percent of the survey area. The map units are used primarily for livestock grazing and hay.

7. Mudpot-Spangenburg

Poorly drained and well drained soils; on lake terraces

This map unit is in Guano Valley. The native vegetation is mainly water-tolerant grasses and forbs on the Mudpot soils and shrubs, grasses, and forbs on the Spangenburg soils. Slopes are 0 to 2 percent. Elevation is 5,000 to 5,300 feet. The mean annual precipitation is about 8 to 10 inches, the mean annual air temperature is 45 to 47 degrees F, and the frost-free period is 70 to 90 days.

This unit makes up about 2 percent of the survey area. It is about 45 percent Mudpot soils and 35 percent Spangenburg soils. The remaining 20 percent is Berdugo, Langslet, and Swalesilver soils on low lake terraces and Bicondoa soils on flood plains.

Mudpot soils are on lake terraces are very deep and poorly drained. They are frequently ponded. The surface layer and subsoil are silty clay.

Spangenburg soils are on lake terraces and are very deep and well drained. The surface layer is very fine sandy loam. The subsoil is clay and silty clay loam. The substratum is extremely gravelly coarse sand.

This unit is used mainly for livestock grazing and as wetland wildlife habitat.

The main limitations for livestock grazing are seasonal ponding on the Mudpot soils, permeability, depth to a claypan in the Spangenburg soils, and shrink-swell potential.

Grazing should be deferred during the period of nesting for waterfowl. Grazing should be delayed until the soils are adequately drained and are firm enough to withstand trampling by livestock. Crusting of the soil surface reduces infiltration and restricts seedling emergence and survival. The soils expand when wet and contract when dry, which can rip and tear plant roots and damage structures. Root penetration and water movement are limited by the clayey texture of the Mudpot soils and the dense clay layer in the Spangenburg soils. The vegetation on the Mudpot soils is unstable because of the periods of ponding. Low precipitation limits forage production and seedling survival.

8. Welch-Degarmo

Poorly drained soils; on flood plains

This map unit is in the Big Valley, Bull Prairie, Camas Prairie, and Crane Lake areas. The native vegetation is mainly water-tolerant grasses and forbs, rushes, and sedges. Slopes are 0 to 2 percent. Elevation is 5,800 to 6,500 feet. The mean annual precipitation is about 12 to 16 inches, the mean annual air temperature is 43 to 45 degrees F, and the frost-free period is 50 to 70 days.

This unit makes up about 1 percent of the survey area. It is about 45 percent Welch soils and 25 percent Degarmo soils. The remaining 30 percent is Cressler soils in upland basins, Swalesilver soils on terraces, and Sherval soils in concave areas of forested mountains.

Welch soils are very deep and poorly drained. The upper part of the surface layer is silty clay loam, and the lower part is clay loam. The substratum is clay loam.

Degarmo soils are very deep and poorly drained. The surface layer is silt loam. The subsoil is silty clay loam and gravelly clay loam. The substratum is cobbly loamy sand and extremely gravelly loamy sand.

This unit is used mainly for livestock grazing and as wetland wildlife habitat.

The main limitation for livestock grazing is seasonal wetness.

Grazing should be deferred during the period of nesting for waterfowl. Because of the seasonal wetness, cold temperatures in winter, and cool temperatures in spring, grazing should be delayed until late in spring to allow the soils to drain adequately before grazing to prevent damage to the soils and plants. Stream corridors are subject to cutting and filling during periods of flooding. Grazing should be managed to maintain or increase the abundance of plants that help to stabilize streambanks and moderate water temperatures.

Soils on middle and high lake terraces, wave-cut benches, and fans in warm basins

This group consists of three map units. It makes up about 9 percent of the survey area. The map units are used primarily as cropland, for livestock grazing, and as homesites.

9. Drews

Very deep, well drained soils that receive 14 to 18 inches of precipitation; on middle lake terraces

This map unit is mainly in Goose Lake Valley (fig. 5). In uncultivated areas, the native vegetation is mainly shrubs, grasses, and forbs. Slopes generally are less than 15 percent, but they range to 30 percent. Elevation is 4,700 to 5,000 feet. The mean annual precipitation is about 14 to 18 inches, the mean annual air temperature is 45 to 48 degrees F, and the frost-free period is 70 to 110 days.

Figure 5.—Crop residue management and stripcropping in an area of general soil map unit 9.

This unit makes up about 2 percent of the survey area. It is about 80 percent Drews soils. The remaining 20 percent is Deter, Donica, and Drewsgap soils on lake terraces and Lakeview soils on flood plains.

Drews soils are very deep and well drained. The surface layer is loam. The subsoil is clay loam and gravelly clay loam. The substratum is very gravelly loam.

This unit is used mainly as cropland, for livestock grazing, and as homesites.

This unit is well suited to use as cropland. The main limitations are steepness of slope and the hazard of erosion.

Because of limited precipitation, the soils in this unit are not suited to continuous cropping unless irrigation. Suitable irrigation methods include sprinkler and border systems. Irrigation water management is needed to control runoff and erosion. The risk of erosion can be reduced by maintaining crop residue on the soil surface, stripcropping, cross-slope farming, and keeping the soil surface rough.

The main limitation for homesite development is slope in some areas. Excavation increases the risk of water erosion. Establishing plant cover on the cuts and fills reduces erosion. Irrigation is needed for the establishment and maintenance of landscape plantings.

10. Lasere-Salisbury-Oxwall

Moderately deep, and moderately deep and shallow to a hardpan, well drained soils that receive 14 to 18 inches of precipitation; on high lake terraces and wave-cut benches

This map unit is mainly in Goose Lake Valley. In uncultivated areas, the native vegetation is mainly shrubs, grasses, and forbs. Slopes generally are less than 15 percent, but they range to as much as 50 percent. Elevation is 4,700 to 5,300 feet. The mean annual precipitation is about 14 to 18 inches, the mean annual air temperature is 45 to 48 degrees F, and the frost-free period is 70 to 110 days.

This unit makes up about 2 percent of the survey area. It is about 35 percent Lasere soils, 30 percent Salisbury soils, and 20 percent Oxwall soils. The remaining 15 percent is Donica, Drewsgap, and Drews soils on middle lake terraces and Lorella soils on foot slopes.

Lasere soils are on wave-cut benches and have slopes of 2 to 50 percent. They are moderately deep to bedrock and are well drained. These soils have a claypan at a depth of 5 to 10 inches. The surface layer is loam. The subsoil is silty clay and silty clay loam.

Salisbury soils are on high lake terraces and have slopes of 0 to 15 percent. They are moderately deep to a hardpan and are well drained. These soils have a claypan at a depth of 10 to 20 inches. The surface layer is loam. The subsoil is clay and clay loam over a hardpan. The substratum is silt loam.

Oxwall soils are on high lake terraces and have slopes of 0 to 5 percent. They are shallow to a hardpan and are well drained. These soils have a claypan at a depth of 5 to 12 inches. The surface layer is gravelly loam. The next layer is gravelly clay loam. The subsoil is gravelly clay over a hardpan. The substratum is stratified very gravelly sandy loam and very gravelly loam.

This unit is used for livestock grazing and as cropland.

The main limitations for livestock grazing are permeability, depth to the claypan, depth to bedrock, depth to the hardpan, shrink-swell potential, and water erosion in the steeper areas.

The claypan and hardpan in these soils restrict rooting depth. The surface layer is saturated following snowmelt because of the slow permeability of the subsoil. These soils expand when wet and contract when dry, which makes special design of fences necessary. Grazing should be delayed in spring until the soil surface is firm and the preferred forage plants can withstand grazing pressure.

The main limitations for cropland are depth to the claypan, permeability, depth to the hardpan, depth to bedrock, shrink-swell potential, and water erosion in the steeper areas.

Because of the limited precipitation, continuous cropping without irrigation is not suitable. Suitable irrigation methods include sprinkler and border systems. Because of the slow permeability, the application of irrigation water needs to be managed to avoid ponding of the surface or the buildup of a perched water table. Subsoiling or deep plowing to rip the hardpan in the Salisbury and Oxwall soils can increase the effective rooting depth and improve internal drainage.

11. McConnel-Wildhill

Very deep and moderately deep, somewhat excessively drained and well drained soils that receive 8 to 10 inches of precipitation; on high lake terraces and fans

This map unit is in Warner and Chewaucan Valleys (fig. 6). The native vegetation is mainly shrubs, grasses, and forbs. Slopes are 0 to 50 percent. Elevation is 4,400 to 5,200 feet. The mean annual precipitation is about 8 to 10 inches, the mean annual air temperature is 47 to 50 degrees F, and the frost-free period is 90 to 110 days.

Figure 6.—Area of general soil map unit 11 in Chewaucan Valley. Note higher lake terrace at base of tableland.

This unit makes up about 5 percent of the survey area. It is about 55 percent McConnel soils and 20 percent Wildhill soils. The remaining 25 percent is McNye soils on bedrock-controlled lake terraces, Mesman and Icene soils on low lake terraces, Pait soils on colluvial fans and foot slopes, and Zorravista and Als soils on dunes.

McConnel soils are on high lake terraces and fans and are very deep and somewhat excessively drained. The surface layer typically is very gravelly sandy loam. The upper part of the subsoil is very gravelly coarse sandy loam. The lower part of the subsoil and the substratum are extremely gravelly loamy coarse sand.

Wildhill soils are on bedrock-controlled lake terraces and are moderately deep and well drained. The surface layer is very stony loam. The subsoil is extremely stony loam and extremely gravelly loam.

This unit is used mainly for livestock grazing. A few areas of the McConnel soils are used for irrigated hay, mainly alfalfa.

The main limitations for livestock grazing are the available water capacity, water erosion in the steeper areas, permeability, risk of seepage, wind erosion on the McConnel soils, and depth to bedrock and surface stones on the Wildhill soils.

Low precipitation and low available water capacity limit forage production and seedling survival. The soils

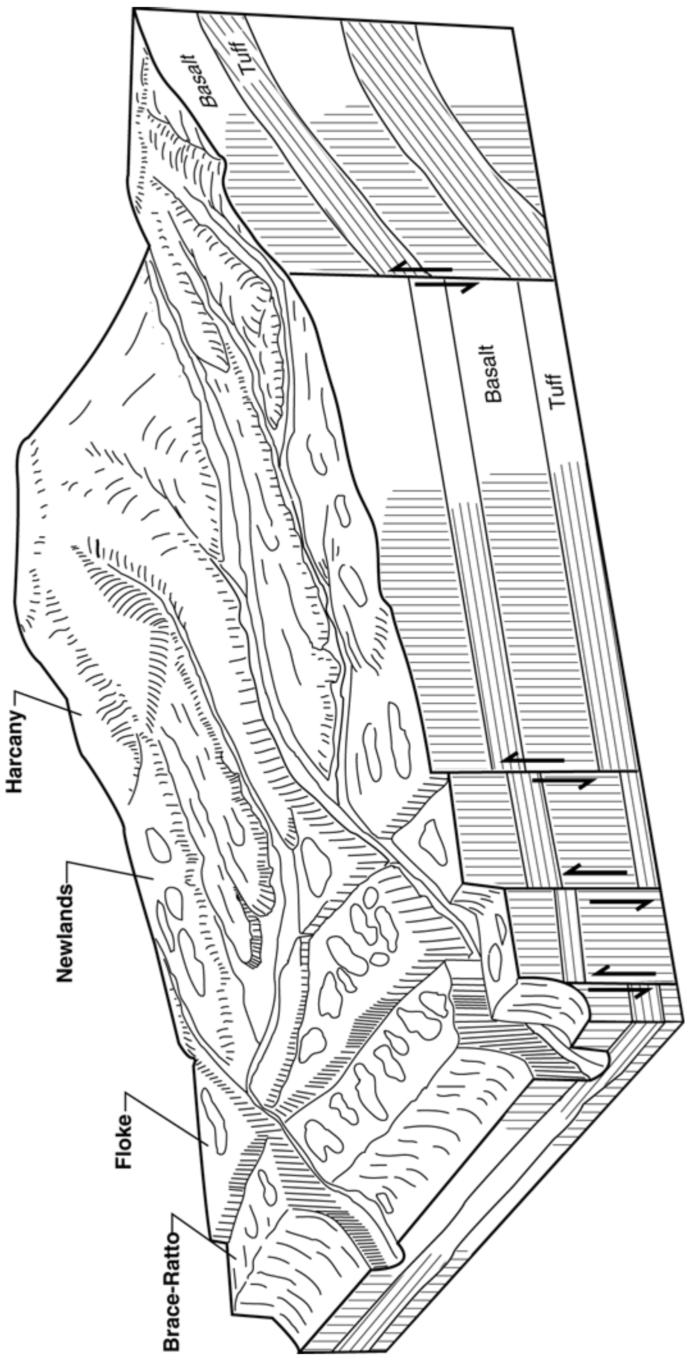


Figure 7.—Soil-landform relationships on grass- and shrub-covered tablelands and mountains.

in this unit are suited to grazing in winter. Rock fragments restrict the placement of fenceposts. If the vegetation is removed from the McConnel soils, wind erosion is a concern. The very stony surface layer of the Wildhill soils restricts the operation of ground seeding equipment. The risk of seepage on the McConnel soils and the depth to bedrock in the Wildhill soils restrict the development of water impoundments.

The main limitations for irrigated hay are the low available water capacity, permeability, and hazard of wind erosion.

Sprinkler irrigation systems are best suited to the soils in this unit because of the rapid water intake rate and the very rapid permeability of the substratum. Irrigation water needs to be applied at frequent intervals to ensure adequate soil moisture for plant growth and to reduce deep percolation. Gravel in the surface layer causes rapid wear of tillage equipment. If the vegetation is removed, wind erosion is a concern.

Soils on grass- and shrub-covered tablelands

This group consists of three map units. It makes up about 38 percent of the survey area (see fig. 7, previous page). The map units are used primarily for livestock grazing and as wildlife habitat.

12. Ratto-Brace

Soils that are shallow and moderately deep to a hardpan, receive 8 to 12 inches of precipitation, and support dominantly Wyoming big sagebrush; on tablelands

This map unit is along the eastern boundary of the survey area. The native vegetation is mainly shrubs, grasses, and forbs. Slopes generally are 2 to 20 percent. Elevation is 4,800 to 6,000 feet. The mean annual precipitation is about 8 to 12 inches, the mean annual air temperature is 43 to 47 degrees F, and the frost-free period is 50 to 90 days.

This unit makes up about 15 percent of the survey area. It is about 50 percent Ratto soils and 35 percent Brace soils. The remaining 15 percent is Floke, Raz, and Coglin soils on tablelands.

Ratto soils are shallow to a hardpan and are well drained. The surface layer is very cobbly loam. The upper part of the subsoil is gravelly clay loam and clay loam over a hardpan, and the lower part is gravelly loamy sand.

Brace soils are moderately deep to a hardpan and are well drained. The surface layer is loam. The upper part of the subsoil is silty clay loam, and the lower part is extremely gravelly loam over a hardpan.

This unit is used for livestock grazing and as wildlife habitat.

The main limitations for livestock grazing are the depth to a hardpan, available water capacity, hazard of water erosion, permeability, shrink-swell potential of the Ratto soils, and depth to bedrock in the Brace soils.

Cold soil temperatures and a short growing season limit the period of plant growth. Low available water capacity and low precipitation limit forage production and seedling survival. Grazing should be delayed until late in spring when forage plants have achieved sufficient growth. The shallow depth and high shrink-swell potential of the subsoil in the Ratto soils limit the placement of fenceposts and make special design of fences necessary. The hardpan in the Ratto soils restricts rooting depth. The risk of erosion can be minimized by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface.

13. Freznik-Floke-Anawalt

Moderately deep and shallow soils that receive 10 to 12 inches of precipitation and support dominantly low sagebrush; on tablelands

This map unit is in the eastern part of the survey area, extending from Hart Mountain National Antelope Refuge south to the Oregon and Nevada state lines. The native vegetation is mainly low shrubs, grasses, and forbs. Slopes typically are 2 to 15 percent, but they range to 30 percent. Elevation is 4,700 to 6,400 feet. The mean annual precipitation is about 10 to 12 inches, the mean annual air temperature is 43 to 45 degrees F, and the frost-free period is 50 to 70 days.

This unit makes up about 15 percent of the survey area. It is about 40 percent Freznik soils, 30 percent Floke soils, and 15 percent Anawalt soils. The remaining 15 percent is Deseed, Pearlwise, Locane, and Ratto soils on tablelands; Rock outcrop; and Rubble land.

Freznik soils are moderately deep to bedrock and are well drained. These soils have a claypan at a depth of 1 inch to 5 inches. The surface layer is very stony loam. The subsoil is clay and clay loam.

Floke soils are shallow to a hardpan and moderately deep to bedrock and are well drained. These soils have a claypan at a depth of 2 to 10 inches. The surface layer typically is very stony loam. The subsoil is clay and clay loam.

Anawalt soils are shallow to bedrock and are well drained. These soils have a claypan at a depth of 3 to

10 inches. The surface layer is loam. The subsoil is clay.

This unit is used for livestock grazing and as wildlife habitat.

The main limitations for livestock grazing are the available water capacity, stones on the surface of the Floke and Freznik soils, depth to the claypan, permeability, and shrink-swell potential.

Cold soil temperatures and a short growing season limit the period of plant growth. Grazing should be delayed until late in spring when forage plants have achieved sufficient growth. The surface layer is saturated following snowmelt because of the slow permeability of the subsoil. The low available water capacity limits forage production and seedling survival. The claypan restricts rooting depth. The shallow depth to a hardpan or to bedrock and the high shrink-swell potential of the subsoil limit placement of fenceposts and make special design of fences necessary. The very stony surface layer of the Floke and Freznik soils restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used. The risk of erosion can be minimized by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface.

14. Carryback-Hart

Moderately deep and deep soils that receive 12 to 16 inches of precipitation and support dominantly low sagebrush; on tablelands

This map unit is east of the Warner Mountains and west of Warner Valley. The native vegetation is mainly low shrubs, grasses, and forbs. Slopes typically are 0 to 15 percent, but they range to as much as 50 percent in a few areas. Elevation is 5,300 to 6,400 feet. The mean annual precipitation is about 12 to 16 inches, the mean annual air temperature is 43 to 45 degrees F, and the frost-free period is 50 to 70 days.

This unit makes up about 8 percent of the survey area. It is about 45 percent Carryback soils and 40 percent Hart soils. The remaining 15 percent is Newlands and Mascamp soils on mountain toe slopes, Coglin soils on tablelands and relict fan piedmonts, Ninemile soils on tablelands, Erakatak soils on hillsides, Rock outcrop, and Rubble land.

Carryback soils are on tablelands and are moderately deep and well drained. These soils have a claypan at a depth of 4 to 10 inches. The surface layer is very cobbly loam. The subsoil is clay. The substratum is silty clay loam over calcareous silt loam and loam.

Hart soils are on relict fan piedmonts on tablelands and are deep and well drained. These soils have a claypan at a depth of 4 to 10 inches. The surface layer is very gravelly loam. The upper part of the subsoil is clay, and the lower part is calcareous very gravelly loam, very gravelly silty clay loam, and extremely gravelly loam.

This unit is used for livestock grazing and as wildlife habitat.

The main limitations for livestock grazing are the depth to the claypan, permeability, shrink-swell potential, calcareous layer, and hazard of water erosion on the Hart and Carryback soils and the depth to bedrock and surface stones on the Carryback soils.

Cold soil temperatures and a short growing season limit the period of plant growth. Grazing should be delayed until late in spring when forage plants have achieved sufficient growth. The surface layer is saturated following snowmelt because of the slow permeability of the subsoil. The claypan and calcareous layer restrict rooting depth. The high shrink-swell potential of the subsoil makes special design of fences necessary. Rock fragments on surface of the Carryback soils restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used. The risk of erosion can be minimized by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface.

Rock outcrop and soils on grass- and shrub-covered hills, mountains, and lake terraces

This group consists of five map units. It makes up about 16 percent of the survey area (see fig. 7, page 30). The map units are used primarily for livestock grazing and as wildlife habitat and watershed.

15. Lorella-Chewaucan-Rock outcrop

Rock outcrop, and shallow and deep soils that receive 10 to 14 inches of precipitation and support dominantly Wyoming big sagebrush; on warm hills and lake terraces

This map unit is in Chewaucan Valley. The native vegetation is mainly shrubs, grasses, and forbs. Slopes typically are 2 to 30 percent, but they range to as much as 70 percent. Elevation is 4,200 to 5,000 feet. The mean annual precipitation is about 10 to 14 inches, the mean annual air temperature is 45 to 48 degrees F, and the frost-free period is 70 to 110 days.

This unit makes up about 1 percent of the survey area. It is about 35 percent Lorella soils, 25 percent Chewaucan soils, and 20 percent Rock outcrop. The remaining 20 percent is Lasere soils on wave-cut benches on hills, McConnel and Mesman soils on lake terraces, Itca soils on mountainsides, and Redcanyon soils on hills and associated escarpments.

Lorella soils are on hillsides and are shallow and well drained. The surface layer is very stony loam. The subsoil is very cobbly clay loam.

Chewaucan soils are on uplifted, bedrock-controlled lake terraces and are deep and well drained. The surface layer is very cobbly silty clay loam. The upper part of the subsoil is silty clay loam, and the lower part is calcareous loam and is firm and brittle.

Rock outcrop consists of interbedded basalt and tuff.

This unit is used for livestock grazing and as wildlife habitat.

The main limitations for livestock grazing are the depth to bedrock, available water capacity, permeability, hazards of water and wind erosion, and shrink-swell potential on the Lorella soils and the rock fragments on the surface, calcareous layer, and hazard of water erosion on the Chewaucan soils.

The low precipitation and low available water capacity of the Lorella soils limit forage production and seedling survival. The shallow depth to bedrock in the Lorella soils restricts rooting depth, limits placement of fenceposts, and makes special design of fences necessary. The firm, brittle calcareous layer in the Chewaucan soils may restrict rooting depth. The very cobbly surface layer of the Chewaucan soils may restrict the operation of ground seeding equipment. The risk of erosion can be minimized by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface.

16. Felcher-Rock outcrop-Riddleranch

Rock outcrop, and moderately deep soils that receive 8 to 12 inches of precipitation and support dominantly Wyoming big sagebrush; on warm and cool side slopes of mountains

This map unit is mainly surrounding Warner Valley (fig. 8). The native vegetation is mainly shrubs, grasses, and forbs. Slopes typically are 30 to 70 percent, but they range to as little as 5 percent. Elevation is 5,000 to 6,000 feet. The mean annual precipitation is about 8 to 12 inches, the mean annual air temperature is 43 to 47 degrees F, and the frost-free period is 50 to 90 days.

Figure 8.—Area of general soil map unit 16 on escarpment of fault-block mountain. Felcher soils are on south-facing slopes, and Riddleranch soils are on north-facing slopes.

This unit makes up about 4 percent of the survey area. It is about 40 percent Felcher soils, 25 percent Rock outcrop, and 20 percent Riddleranch soils. The remaining 15 percent is Westbutte soils on north-facing mountainsides at higher elevations, Fitzwater soils on south-facing mountainsides, and Pait soils on fans and mountain foot slopes.

Felcher soils are on south-facing mountainsides and are moderately deep and well drained. The surface layer is very stony clay loam. The subsoil is very cobbly loam.

Rock outcrop consists of interbedded basalt and tuff.

Riddleranch soils are on north-facing mountainsides and are moderately deep and well drained. The surface layer is very gravelly loam. The subsoil is extremely cobbly loam.

This unit is used mainly as wildlife habitat and watershed and for livestock grazing.

The main limitations for livestock grazing are the steepness of slope, hazard of water erosion, depth to bedrock, rock fragments, and available water capacity.

The low available water capacity limits forage production and seedling survival. The depth to bedrock and content of rock fragments throughout the profile restrict rooting depth and the placement of fenceposts. The growing season of the Riddleranch soils begins later in spring and moisture is available until later in summer on these soils than on the Felcher soils. The risk of erosion can be minimized by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface. Slope and the areas of Rock outcrop restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

17. Ninemile-Newlands

Shallow and deep soils that receive 12 to 16 inches of precipitation and support dominantly low sagebrush and mountain big sagebrush; on cool benches and foot slopes of tablelands and mountains

This map unit is on Hart Mountain and on the eastern slopes of the Warner Mountains. The native vegetation is mainly shrubs, grasses, and forbs. Slopes generally are 2 to 15 percent, but they range to as much as 50 percent. Elevation is 5,300 to 6,500 feet. The mean annual precipitation is about 12 to 16 inches, the mean annual air temperature is 43 to 45 degrees F, and the frost-free period is 50 to 70 days.

This unit makes up about 4 percent of the survey area. It is about 50 percent Ninemile soils and 30 percent Newlands soils. The remaining 20 percent is Mascamp soils on mountain foot slopes, Westbutte soils on mountainsides, Hart soils on fan piedmonts, and Madeline soils on tablelands.

Ninemile soils are on benches on tablelands and mountains. These soils are shallow and well drained. These soils have a claypan at a depth of 3 to 7 inches. The surface layer is extremely gravelly loam. The subsoil is clay and gravelly clay. These soils support dominantly low sagebrush.

Newlands soils are on mountain foot slopes and are deep and well drained. The surface layer is loam. The subsoil is clay loam and gravelly clay loam. These soils support dominantly mountain big sagebrush.

This unit is used for livestock grazing and as wildlife habitat.

The main limitations for livestock grazing are the slope and hazard of water erosion on the Newlands and Ninemile soils and the available water capacity, depth to the claypan, permeability, depth to bedrock, and shrink-swell potential of the Ninemile soils.

Cold soil temperatures and a short growing season limit the period of plant growth. Grazing should be delayed until late in spring when forage plants have achieved sufficient growth. Because of the slow permeability of the subsoil in the Ninemile soils, the surface layer is saturated following snowmelt. The shallow depth to bedrock in the Ninemile soils limits the placement of fenceposts. The high shrink-swell potential in the subsoil of the Ninemile soils makes special design of fences necessary. The risk of erosion can be minimized by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface.

18. Harcany-Fitzwater

Very deep soils that receive 12 to 16 inches of precipitation and support dominantly mountain big sagebrush; on cool benches and side slopes of mountains

This map unit is on Hart Mountain. The native vegetation is mainly grasses, forbs, and shrubs. Slopes typically are 15 to 50 percent, but they range from 0 to 70 percent. Elevation is 5,800 to 7,000 feet. The mean annual precipitation is about 12 to 16 inches, the mean annual air temperature is 43 to 45 degrees F, and the frost-free period is 50 to 70 days.

This unit makes up about 2 percent of the survey area. It is about 55 percent Harcany soils and 30 percent Fitzwater soils. The remaining 15 percent is Riddleranch soils on south-facing mountainsides, Westbutte soils on north-facing mountainsides, Newlands soils on mountain foot slopes, Sherval soils that support aspen and are in concave pockets where snow accumulates, and Rock outcrop.

Harcany soils are on north-facing mountainsides and mountaintops and are very deep and well drained. The surface layer is very gravelly loam. The next layer is extremely cobbly loam. The substratum is extremely stony loam.

Fitzwater soils are on south-facing mountainsides and mountaintops and are very deep and well drained. The surface layer is extremely stony loam or loam. The subsoil is extremely cobbly clay loam. The substratum is extremely cobbly loam.

This unit is used as wildlife habitat and for livestock grazing.

The main limitations for livestock grazing are the available water capacity, hazard of water erosion, slope, and content of rock fragments.

Cold soil temperatures and a short growing season limit the period of plant growth. Grazing should be delayed until late in spring when forage plants have achieved sufficient growth. The low available water capacity limits forage production and seedling survival. The high content of rock fragments throughout the soils restricts rooting depth and the placement of fenceposts. The risk of erosion can be minimized by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface. Rock fragments on the surface restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

19. Booth-Bullump-Nuss

Shallow, moderately deep, and very deep soils that receive 14 to 18 inches of precipitation and support low sagebrush and mountain big sagebrush; on cool benches and side slopes of hills and mountains

This map unit is surrounding Goose Lake Valley and on the west side of Chewaucan Valley. The native vegetation on the Booth and Bullump soils is mainly shrubs, grasses, and forbs. The native vegetation on the Nuss soils is mainly shrubs, grasses, forbs, and scattered western juniper and ponderosa pine. Slopes typically are 5 to 50 percent, but they range from 0 to 70 percent. Elevation is 5,000 to 6,500 feet. The mean annual precipitation is about 14 to 18 inches, the mean annual air temperature is 45 to 47 degrees F, and the frost-free period is 50 to 70 days.

This unit makes up about 5 percent of the survey area. It is about 35 percent Booth soils, 25 percent Bullump soils, and 20 percent Nuss soils. The remaining 20 percent is Royst soils on hills, Lorella soils on south-facing slopes on hills, Winterim soils on plateaus and mountains, and Rock outcrop.

Booth soils are on hillsides, mountainsides, and benches and are moderately deep and well drained. These soils have a claypan at a depth of 1 to 7 inches. The surface layer is very stony loam. The subsoil is clay. These soils support dominantly low sagebrush.

Bullump soils are on hillsides and mountainsides and are very deep and well drained. The surface layer is extremely gravelly loam. The subsoil is very gravelly clay loam. The substratum is extremely gravelly loam. These soils support dominantly mountain big sagebrush.

Nuss soils are on hillsides and are shallow and well drained. The surface layer is gravelly loam. The subsoil is clay loam. These soils support dominantly mountain big sagebrush.

This unit is used mainly for livestock grazing and as wildlife habitat and watershed.

The main limitations for livestock grazing are the slope and hazard of water erosion on the Booth, Bullump, and Nuss soils; the depth to the claypan, permeability, and shrink-swell potential of the Booth soils; the depth to bedrock and available water capacity of the Booth and Nuss soils; and the rock fragments on the surface of the Booth and Bullump soils.

Cold soil temperatures and a short growing season limit the period of plant growth. Grazing should be delayed until late in spring when forage plants have achieved sufficient growth. Because of the slow permeability of the subsoil in the Booth soils, the surface layer is saturated following snowmelt. The depth to bedrock in the Booth and Nuss soils and the claypan in the Nuss soils restrict rooting depth. Rock fragments on the surface of the Booth and Bullump soils restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used. The shallow depth of the Nuss soils and the rock fragments in the Bullump soils limit placement of fenceposts. The high shrink-swell potential of the subsoil in the Booth soils makes special design of fences necessary. The risk of erosion can be minimized by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface.

Soils on forested mountains, plateaus, and hills

This group consists of four map units. It makes up about 11 percent of the survey area. The map units are used primarily for timber harvesting and livestock grazing and as wildlife habitat and watershed.

20. Winterim-Royst

Deep and moderately deep soils that support dominantly ponderosa pine and western juniper; on hills, plateaus, and mountainsides

This map unit is on the eastern slopes of the Warner Mountains. The native vegetation is mainly ponderosa pine, western juniper, shrubs, grasses, and forbs. Slopes typically are 0 to 40 percent, but they range to 60 percent. Elevation is 5,000 to 6,500 feet. The mean annual precipitation is about 14 to 32 inches, the mean annual air temperature is 45 to 47 degrees F, and the frost-free period is 50 to 70 days.

This unit makes up about 2 percent of the survey area. It is about 45 percent Winterim soils and 35 percent Royst soils. The remaining 20 percent is Nuss soils on hills, Rock outcrop, and Booth and Merlin soils on tablelands.

Winterim soils are deep and well drained. The surface layer is very gravelly loam. The subsoil is gravelly clay loam and very gravelly clay. These soils receive about 20 to 32 inches of precipitation and support dominantly ponderosa pine.

Royst soils are moderately deep and well drained. The surface layer is very stony loam. The subsoil is extremely stony clay. These soils receive about 14 to 20 inches of precipitation and support dominantly western juniper with scattered ponderosa pine.

This unit is used for livestock grazing and timber harvesting and as wildlife habitat and watershed. The Winterim soils are used primarily for timber harvesting, and the Royst soils are used primarily for livestock grazing.

The main limitations for livestock grazing are the permeability, available water capacity, hazard of water erosion, shrink-swell potential, content of rock fragments, and depth to bedrock.

Cold soil temperatures and a short growing season limit the period of plant growth. Grazing should be delayed until late in spring when forage plants have achieved sufficient growth. The rock fragments throughout the soil restrict the placement of fenceposts. The subsoil expands when wet and contracts when dry, which makes special design of fences necessary. The low available water capacity limits forage production and seedling survival. The bedrock restricts rooting depth. The risk of erosion can be minimized by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface.

The main limitations for timber harvesting are the slope, hazard of water erosion, shrink-swell potential, permeability, and content of rock fragments.

Wet, unsurfaced roads and skid trails are slippery and sticky. The high content of clay and rock fragments in the subsoil make tree planting difficult. The clayey subsoil restricts permeability. Cuts and fills slough when the soils are wet. A buffer zone should be maintained around riparian areas to protect the quality and quantity of the water.

Vehicle access should be restricted to periods when the soil is dry or frozen to prevent puddling and rutting of the soil surface. Using designated skid trails and low-pressure ground equipment and avoiding logging in spring when the soils are wet help to reduce compaction and erosion. Mechanical piling of slash material should be minimized. The risk of erosion on skid trails and temporary roads can be reduced by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface. The use of shade cards on south-facing slopes increases seedling survival.

21. Winterim-Mound-Polander

Deep soils that support dominantly ponderosa pine and white fir; on mountainsides and plateaus

This map unit is surrounding Goose Lake Valley and west of Chewaucan Valley. The native vegetation is mainly conifers, shrubs, grasses, and forbs. Slopes typically are 15 to 70 percent, but they range from 0 to 70 percent. Elevation is mainly 5,000 to 6,500 feet, but it is as much as 7,200 feet on south-facing slopes. The mean annual precipitation is about 18 to 32 inches, the mean annual air temperature is 45 to 47 degrees F, and the frost-free period is 50 to 70 days.

This unit makes up about 4 percent of the survey area. It is about 40 percent Winterim soils, 20 percent Mound soils, and 20 percent Polander soils. The remaining 20 percent is Royst and Nuss soils on hills, Booth soils on foot slopes and benches, Twelvemile soils on north-facing mountainsides at the higher elevations, and Woodchopper and Rogger soils on plateaus.

Winterim soils are on south-facing mountainsides at the lower elevations. These soils are deep and well drained and formed in material weathered from basalt and tuff. The surface layer is very gravelly loam. The subsoil is gravelly clay loam and very gravelly clay. These soils support dominantly ponderosa pine.

Mound soils are on south-facing mountainsides at the higher elevations and on north-facing mountainsides. These soils are deep and well drained and formed in material weathered from basalt and tuff. The surface layer is stony loam. The subsoil is very cobbly clay loam and very cobbly clay. The substratum is clay loam. These soils support dominantly mixed white fir and ponderosa pine.

Polander soils are on north- and south-facing mountainsides. These soils are deep and well drained and formed in material weathered from tuff and rhyolite. The surface layer and subsoil are sandy loam. The substratum is cobbly loam. These soils support dominantly mixed white fir and ponderosa pine.

This unit is used mainly for timber harvesting and as watershed and wildlife habitat. Areas on south-facing slopes at the lower elevations and logged areas are used for livestock grazing.

The main limitations for livestock grazing are the slope, hazard of water erosion, permeability, and content of rock fragments.

Cold soil temperatures and a short growing season limit the period of plant growth. Grazing should be delayed until late in spring when forage plants have achieved sufficient growth. The risk of erosion can be minimized by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface. The growing season of soils on south-facing slopes begins earlier in spring than that of soils on north-facing slopes. Droughtiness in areas on south-facing slopes is a concern earlier in the growing season in these areas than in areas on north-facing slopes.

The main limitations for timber harvesting are the slope and hazard of water erosion on all the soils and the permeability, content of rock fragments, and shrink-swell potential of the Winterim and Mound soils.

Wet, unsurfaced roads and skid trails on the Winterim and Mound soils are slippery and sticky, and those on the Polander soils are soft. Dry, unsurfaced roads and skid trails on the Polander soil are dusty. The clayey subsoil in the Winterim and Mound soils restricts permeability. The content of rock fragments and high content of clay in the subsoil of the Winterim and Mound soils can make tree planting difficult. Artificial or natural shade increases seedling survival on south-facing slopes. Cuts and fills in the Winterim and Mound soils slough when wet. Accumulations of snow on north-facing slopes can bend or break small trees. A buffer zone should be maintained around riparian areas to protect the quality and quantity of the water, and disturbance of these areas should be minimized. Trees should not be felled into or skidded through riparian areas.

To help reduce compaction and erosion in areas that have slopes of less than 40 percent, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soils are wet. To minimize soil displacement, use cable yarding systems in areas that have slopes of more than 40 percent. Mechanical piling of slash should be minimized. Heavy equipment causes soil compaction and disturbance and exposes the soil. Slash should be maintained on the soil to reduce sheet and rill erosion. The risk of erosion on skid trails and temporary roads can be reduced by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the surface. The use of shade cards on south-facing slopes increases seedling survival.

22. Woodchopper-Rogger

Very deep and moderately deep soils that support dominantly white fir and ponderosa pine; on plateaus and mountains

This map unit is on the Warner Mountains. The native vegetation is mainly conifers, shrubs, grasses, and forbs. Slopes typically are 0 to 40 percent, but they range to 60 percent. Elevation is 5,500 to 7,200 feet. The mean annual precipitation is about 28 to 32 inches, the mean annual air temperature is 45 to 47 degrees F, and the frost-free period is 50 to 70 days.

This unit makes up about 4 percent of the survey area. It is about 45 percent Woodchopper soils and 35 percent Rogger soils. The remaining 20 percent is Bullump and Polander soils on mountainsides, Hallihan and Hammersley soils on north-facing mountainsides, Winterim soils on south-facing mountainsides and plateaus at the lower elevations, and Sherval soils in concave areas on mountainsides.

Woodchopper soils are very deep and well drained and formed in material weathered from basalt, andesite, and tuff. The surface layer is gravelly loam. The subsoil is cobbly clay loam, clay, and gravelly clay.

Rogger soils are moderately deep and well drained and formed in material weathered from basalt, andesite, and tuff. The surface layer is very gravelly fine sandy loam. The subsoil is very cobbly loam.

This unit is used mainly for timber harvesting and as wildlife habitat and watershed.

The main limitations for timber harvesting are the hazard of water erosion and slope of all the soils; the permeability of the Woodchopper soils; and the available water capacity, depth to bedrock, and content of rock fragments in the Rogger soils.

Wet, unsurfaced roads and skid trails on the Woodchopper soils are slippery and sticky, and those on the Rogger soils are firm. Rock fragments in the Rogger soils make tree planting difficult. The bedrock in the Rogger soils restricts rooting depth. The clayey subsoil in the Woodchopper soils restricts permeability. Cuts and fills on the Woodchopper soils slough when wet, and those on the Rogger soils ravel when dry. Artificial or natural shade increases seedling survival on south-facing slopes. Accumulation of snow on north-facing slopes can bend or break small trees. A buffer zone should be maintained around riparian areas to maintain the quality and quantity of the water, and disturbance of these areas should be minimized. Trees should not be felled into or skidded through riparian areas.

To help reduce compaction, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen upper layer, and avoid logging in spring when the soils are wet. Mechanical piling of slash should be minimized. Heavy equipment causes soil compaction and disturbance and exposes the soil. Slash should be maintained on the soil to reduce sheet and rill erosion. The risk of erosion on skid trails and temporary roads can be reduced by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface. Because the Rogger soils are droughty, use of larger than normal planting stock, a higher planting rate, shade cards, or additional plantings may be needed.

23. Twelvemile-Xerolls

Very deep to shallow soils that support dominantly white fir, ponderosa pine, and mountain big sagebrush; on mountains

This map unit is on the west side of the Warner Mountains. The native vegetation on the Twelvemile soils is conifers, shrubs, grasses, and forbs, and the native vegetation on the Xerolls is shrubs, grasses, and forbs. Slopes typically are 0 to 60 percent, but they range to as much as 80 percent. Elevation is 5,000 to 8,400 feet. The mean annual precipitation is about 18 to 38 inches, the mean annual air temperature is 45 to 47 degrees F, and the frost-free period is 50 to 70 days.

This unit makes up about 1 percent of the survey area. It is about 40 percent Twelvemile soils and 35 percent Xerolls. The remaining 25 percent is Winterim soils on south-facing mountainsides at the lower elevations, Rock outcrop, Polander soils on mountainsides, Rogger soils on plateaus and mountainsides, Longjohn soils that are at the higher elevations and support dominantly whitebark pine and lodgepole pine, and Hallihan and Hammersley soils that are on north-facing slopes at the higher elevations and support dominantly lodgepole pine.

Twelvemile soils are very deep and somewhat excessively drained and formed in material weathered from rhyolite. Slopes are 0 to 60 percent. The surface layer is very gravelly fine sandy loam. The subsoil is very gravelly fine sandy loam and very cobbly fine sandy loam. The substratum is very cobbly sandy loam. These soils support dominantly mixed white fir and ponderosa pine.

Xerolls are shallow to very deep and are somewhat excessively drained to well drained. These soils formed in material weathered from basalt, andesite, and tuff. Slopes are 0 to 80 percent. The texture and content of rock fragments in the surface layer and subsoil are highly variable. These soils support dominantly mountain big sagebrush.

This unit is used as watershed and wildlife habitat, for timber harvesting in areas of the Twelvemile soils, and for livestock grazing in areas of the Xerolls.

The main limitations for livestock grazing are the slope and hazard of water erosion and the depth to bedrock, available water capacity, and rock fragments in some areas.

Cold soil temperatures and a short growing season limit the period of plant growth. Grazing should be delayed until late in spring when forage plants have achieved sufficient growth. Uniform distribution of livestock is difficult because of the slope or the lack of permanent water developments. The depth to bedrock and content of rock fragments restrict rooting depth and the placement of fenceposts in some areas. The low available water capacity limits forage production and seedling survival in some areas. The areas of soils that are shallow or droughty provide forage suitable for livestock grazing earlier in the year but for a shorter period of time than the areas of deeper soils. The earlier growing season in the areas of soils on south-facing slopes allows for earlier grazing in these areas than in areas of soils on north-facing slopes. Soils on north-facing slopes have moisture available for plant growth later in summer than do those on south-facing slopes, which allows for a later grazing period.

The steepness of slope and rock fragments on the surface restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used. The risk of erosion can be minimized by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface.

The main limitations for timber harvesting are the slope, hazard of water erosion, available water capacity, and content of rock fragments.

Wet, unsurfaced roads and skid trails are firm. Dry, unsurfaced roads and skid trails are dusty. Accumulation of snow, particularly on north-facing slopes, can bend and break small trees. Cuts and fills ravel when dry. Rock fragments make tree planting difficult. A buffer zone should be maintained around riparian areas to protect the quality and quantity of the water. Management should be designed to minimize soil disturbance. Trees should not be felled into or skidded through riparian areas.

To help reduce compaction and erosion in areas that have slopes of less than 40 percent, use designated skid trails and low-pressure ground equipment and log only in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer. To minimize soil displacement, use cable yarding systems in areas that have slopes of more than 40 percent. Logging should be deferred in spring when the soils are wet to reduce displacement and erosion. Mechanical piling of slash should be minimized. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintaining slash on the soil surface helps to reduce sheet and rill erosion. The risk of erosion on temporary roads can be reduced by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface. Because the Twelvemile soils are droughty, larger than normal planting stock, a higher planting rate, shade cards on south-facing slopes, or additional plantings may be needed.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given under the heading "Use and Management of the Soils."

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 taxonomic 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 unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called similar inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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 landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit 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 series***. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into ***soil phases***. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Drews loam, 5 to 15 percent slopes, is a phase of the Drews series.

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

A ***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 maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Drews-Oxwall complex, 0 to 5 percent slopes, is an example.

An ***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 uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Booth-Nuss-Royst association, 40 to 60 percent south slopes, is an example.

This survey includes ***miscellaneous areas***. Such areas have little or no soil material and support little or no vegetation. Playas is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

In the map unit descriptions that follow, a semitabular format is used. In this format a boldface heading (for example, **Composition**) is used to identify the kind of information grouped directly below it. Introducing each item of information under the heading is an italicized term or phrase (for example, ***Position on landscape:***) that identifies or describes the information. Many of the boldface headings and introductory terms or phrases are self-explanatory; however, some of them need further explanation. These explanations are provided in the following paragraphs, generally in the order in which they are used in the map unit descriptions.

Composition is given for the components identified in the name of the map unit as well as for the contrasting inclusions.

Inclusions are areas of components (soils or miscellaneous areas) that differ from the components for which the unit is named. Inclusions can be either similar or contrasting. ***Similar inclusions*** are components that differ from the components for which the unit is named but that for purposes of use and management can be considered to be the same as the named components. Note that in the “Composition” paragraph a single percentage is provided for a named soil and the similar inclusions because their use and management are similar.

Position on landscape refers to the dominant position or positions on which the component is located. In naming landscape positions, an effort has been made to give the specific position of the component rather than a general position that could encompass other components. In some instances, however, the component is distributed over a larger landscape to such a degree that it is more nearly accurate to name the larger landscape positions rather than the local ones.

Typical profile is a vertical, two-dimensional section of the soil extending from the surface to a restrictive layer or to a depth of 60 inches or more.

Depth class is an adjective term (for example, moderately deep) for the depth of the soil.

Permeability is 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.

Available water capacity is the capacity of the soil to hold water available for use by most plants. It commonly is expressed as inches of water per inch of soil (see “Glossary”).

Hazard of water erosion refers to the hazard if protective plant cover is removed. The hazard of erosion is constant and cannot be increased or reduced.

Contrasting inclusions are components that differ sufficiently from the components for which the unit is named that they would have different use and management if they were extensive enough to be managed separately. For most uses, contrasting inclusions have limited effect on use and management. Inclusions generally are in small areas, and they could not be mapped separately because of the scale used. Some small areas of strongly contrasting inclusions are identified by a special symbol on the detailed soil maps. A few inclusions may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the inclusions on the landscape.

Major uses are the dominant uses at the time the major part of the fieldwork for this survey was completed.

Major management factors are those factors that affect the use of the soils for the major uses. The soil-related factors are limiting, whereas the climatic factors can be either limiting or nonlimiting. The major management factors may apply to the entire unit or to a given component of the unit.

General management considerations provide additional perspective on the suitability and limitations of the unit for the major uses. They may apply to the entire unit or to a given component of the unit.

Suitable management practices are practices that can be used to overcome the main limitations of the unit for the major uses. They may apply to the entire unit or to a given component of the unit.

Soil Descriptions

1C—Als-Icene complex, 0 to 15 percent slopes

Composition

Als soil and similar inclusions—50 percent
Icene soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Als Soil

Position on landscape: Sand dunes in lake basins that have slopes of 1 to 15 percent
Parent material: Kind—eolian sand over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 45 inches—very dark grayish brown fine sand
45 to 65 inches—dark brown fine sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Excessively drained
Permeability: Rapid over moderate
Available water capacity: About 4 inches
Hazard of erosion: By water—slight or moderate; by wind—very severe
Sodicity: Slightly sodic or moderately sodic

Characteristics of the Icene Soil

Position on landscape: Lake terraces that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—very dark grayish brown fine sandy loam
5 to 10 inches—dark brown silt loam
10 to 28 inches—dark brown loam
28 to 65 inches—dark brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to dense, consolidated lacustrine sediment
Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: February through April—24 to 72 inches; rest of year—more than 72 inches
Salinity: Upper 10 inches—slightly saline or moderately saline; below this depth—strongly saline
Sodicity: Upper 10 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

- Kewake soils that are on dunes on lake terraces but do not have basin big sagebrush in the potential plant community
- Helphenstein soils that are on lake terraces and have black greasewood and inland saltgrass in the potential plant community but do not support shadscale
- Small playas that are 12 to 24 inches wide

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Als soil—wind erosion, slope, available water capacity, sodicity
Icene soil—available water capacity, salinity, sodicity, permeability, depth to dense, consolidated lacustrine sediment, wind erosion

Dominant Vegetation in Potential Plant Community

Als soil—Indian ricegrass, basin big sagebrush, black greasewood, fourwing saltbush, needleandthread, basin wildrye
Icene soil—shadscale, black greasewood, basin wildrye, Indian ricegrass

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- Excess sodium in the Icene soil results in nutrient imbalances and a caustic root environment.

• Salts in the Icene soil reduce the amount of water available to plants and restrict seedling survival.
• Dense, consolidated lacustrine sediment in the Icene soil restricts rooting depth.
• Water movement is rapid through the upper part of the Als soil and slow through the Icene soil.
• Dispersion and crusting of the surface of the Icene soil reduce infiltration and restrict seedling emergence and survival.
• The soils in this unit are subject to wind erosion if the vegetation is removed or degraded.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Range seeding controls blowing and drifting sand on the Als soil.
• This unit generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.
• This unit is suited to grazing in winter.

Suitable management practices:
• Delay grazing in spring until the Icene soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
• If the Als soil is seeded, select plants that tolerate droughtiness and slight or moderate sodicity.
• If the Icene soil is seeded, select plants that tolerate droughtiness, strong sodicity, and slight or moderate salinity.

2C—Als-Mesman complex, 0 to 15 percent slopes

Composition

Als soil and similar inclusions—50 percent
Mesman soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Als Soil

Position on landscape: Sand dunes in lake basins that have slopes of 2 to 15 percent
Parent material: Kind—eolian sand over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 45 inches—very dark grayish brown fine sand
45 to 65 inches—dark brown fine sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Excessively drained
Permeability: Rapid over moderate
Available water capacity: About 4 inches
Hazard of erosion: By water—slight or moderate; by wind—very severe
Sodicity: Slightly sodic or moderately sodic

Characteristics of the Mesman Soil

Position on landscape: Lake terraces that have slopes of 0 to 2 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—dark brown fine sandy loam
9 to 20 inches—brown sandy clay loam
20 to 25 inches—brown silt loam
25 to 35 inches—brown very fine sandy loam
35 to 60 inches—brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to dense, consolidated lacustrine sediment
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion: By water—slight or moderate; by wind—moderate
Salinity: Upper 9 inches—slightly saline; below this depth—strongly saline
Sodicity: Upper 9 inches—moderately sodic; below this depth—slightly sodic or moderately sodic

Contrasting Inclusions

• Icene and Helphenstein soils that are on adjacent lake terraces and do not have big sagebrush in the potential plant community

Major Uses

Livestock grazing, cropland, hayland, wildlife habitat

Major Management Factors

Als soil—wind erosion, slope, available water capacity, sodicity

Mesman soil—available water capacity, permeability, salinity, sodicity, wind erosion, depth to dense, consolidated lacustrine sediment

Dominant Vegetation in Potential Plant Community

Als soil—basin big sagebrush, black greasewood, Indian ricegrass, needleandthread, basin wildrye, fourwing saltbush

Mesman soil—basin big sagebrush, spiny hopsage, black greasewood, Indian ricegrass, basin wildrye

Livestock Grazing

General management considerations:

• The low precipitation and low available water capacity limit forage production and seedling survival.
• Excess sodium in the Mesman soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface of the Mesman soil reduce infiltration and restrict seedling emergence and survival.
• Salts in the Mesman soil reduce the amount of water available to plants and restrict seedling survival.
• Dense, consolidated lacustrine sediment in the Mesman soil restricts rooting depth.
• Water movement is rapid through the upper part of the Als soil and slow through the Mesman soil.
• The soils in this unit are subject to wind erosion if the vegetation is removed or degraded.
• This unit is suited to grazing in winter.
• Range seeding controls blowing and drifting sand on the Als soil.

Suitable management practices:

• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Als soil is seeded, select plants that tolerate slight or moderate sodicity and droughtiness.
• If the Mesman soil is seeded, select plants that tolerate slight salinity, moderate sodicity, and droughtiness in summer.

Cropland and Hayland

General management considerations:

• Because of the limited precipitation, the soils in this unit are not suited to continuous cropping unless they are irrigated.
• Sprinkler irrigation is most efficient and best suited to this unit.
• Light, frequent applications of irrigation water are needed on the Als soil because of the rapid permeability in the upper part of the soil.
• Leveling is needed for uniform application of water.
• To avoid exposing the lower layers that are saline and sodic, land leveling that involves only shallow cuts is best suited.
• The concentration of salts and sodium limits the selection of crops.
• The soils in this unit tie up large amounts of phosphorus, which limits the amount that is available to plants.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• Removing salts from the Mesman soil without applying proper amounts of soil amendments causes dispersion and crusting of the soil surface.
• If the soils are irrigated, the available water capacity can be increased by leaching salts below the root zone.
• The dense, consolidated lacustrine sediment in the Mesman soil is softened by applying irrigation water.
• The Als soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.
• Because of the concentration of salts in the Mesman soil, the selection of trees and shrubs suitable for windbreaks and environmental plantings is limited and the seedling mortality rate is severe.
• Continuous cultivation, use of mulch, or application of herbicides to control competing vegetation on the Mesman soil helps to ensure the establishment and survival of seedlings.

Suitable management practices:

• Irrigate during the dry period in summer.
• Reduce the content of sodium by applying proper amounts of soil amendments and leaching salts with carefully applied irrigation water.
• Reduce crusting and compaction of the soil surface by returning crop residue to the soil, keeping tillage at a minimum, and regularly adding organic matter.
• Reduce the risk of wind erosion by planting crops in narrow strips at right angles to the prevailing wind, maintaining crop residue on the surface, planting field windbreaks, maintaining a plant cover, and limiting the width of strips of unprotected soils.

3A—Alvodest-Playas complex, 0 to 1 percent slopes

Composition

Alvodest soil and similar inclusions—55 percent
Playas—30 percent
Contrasting inclusions—15 percent

Characteristics of the Alvodest Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 2 inches—very dark grayish brown silt loam
2 to 14 inches—dark brown silt loam
14 to 25 inches—dark grayish brown silty clay
25 to 32 inches—dark brown and very dark grayish brown silty clay loam
32 to 60 inches—dark brown and very dark gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: December through April—6 inches above the surface to 36 inches below the surface; rest of year—more than 36 inches
Shrink-swell potential: High between depths of 14 and 60 inches
Salinity: Strongly saline
Sodicity: Strongly sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of Playas

Position on landscape: Basin floors
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Reference profile:
0 to 6 inches—silty clay loam
6 to 60 inches—stratified silty clay and silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Very slow
Hazard of erosion by wind: None to severe, depending on the time of year
Depth to seasonal high water table: December through April—12 inches above the surface to 12 inches below the surface; rest of year—more than 12 inches
Shrink-swell potential: High
Salinity: Moderately saline to strongly saline
Sodicity: Strongly sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

• Helphenstein soils that are on adjacent, higher lying lake terraces
• Reese soils that are on adjacent alluvial flats and have alkali sacaton in the potential plant community
• Als soils that are on sand dunes and have basin big sagebrush in the potential plant community

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Alvodest soil—available water capacity, salinity, sodicity, wetness, permeability, wind erosion, shrink-swell potential, frost action
Playas—available water capacity, salinity, sodicity, seasonal wetness, permeability, wind erosion, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Alvodest soil—black greasewood, inland saltgrass, basin wildrye

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction of the surface layer.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• The moderately saline or strongly saline, strongly sodic surface layer severely limits seedling survival.

• Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce infiltration, cause ponding, and restrict seedling emergence and survival.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• Variable yearly ponding results in an unstable plant community on the Playas.
• The Alvodest soil and the Playas expand when wet and contract when dry, which can rip and tear plant roots and damage structures.
• This unit is suited to grazing in winter.
• Plants are subject to winterkill and other damage because of the high potential for frost action.
• This unit generally are not suited to growing trees and shrubs for windbreaks and environmental plantings.

Suitable management practices:
• Allow the unit to drain adequately before grazing to prevent damage to the soil and plants.
• If the Alvodest soil is seeded, select plants that tolerate wetness, droughtiness in summer, strong salinity, and strong sodicity and that provide cover for nesting waterfowl.

4B—Anawalt loam, 2 to 8 percent slopes

Composition

Anawalt soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Anawalt Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 4,700 to 5,800 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown loam
4 to 9 inches—very dark grayish brown loam
9 to 17 inches—dark brown clay
17 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (12 to 20 inches) to bedrock, very shallow (3 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Shrink-swell potential: High between depths of 9 and 17 inches

Contrasting Inclusions

• Ratto and Oreneva soils that are on tablelands and have Wyoming big sagebrush in the potential plant community
• Soils that are similar to the Anawalt soil but have a surface layer that is less than 5 inches thick and a potential plant community that is dominantly Sandberg bluegrass

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, depth to bedrock, permeability, shrink-swell potential, available water capacity

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, low sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
• The bedrock and claypan restrict rooting depth.
• The surface layer is saturated following snowmelt.
• Past erosion has resulted in pedestaled plants and an erosion pavement.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The shallow depth limits placement of fenceposts and makes special design of fences necessary.
• The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots.
• Development of water impoundments is restricted by the shallow depth to bedrock.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the soil is seeded, select plants that tolerate

droughtiness, shrinking and swelling, and a cool growing season.

5C—Anawalt-Oreneva complex, 2 to 15 percent slopes

Composition

Anawalt soil and similar inclusions—50 percent
Oreneva soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Anawalt Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,300 to 5,700 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown loam
4 to 9 inches—very dark grayish brown loam
9 to 17 inches—dark brown clay
17 inches—tuff that has accumulations of silica and calcium carbonate in fractures
Depth class: Shallow (12 to 20 inches) to bedrock, very shallow (3 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 17 inches

Characteristics of the Oreneva Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 5,700 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—dark brown very gravelly loam
4 to 21 inches—dark brown very gravelly clay loam and very gravelly loam
21 inches—tuff that has accumulations of calcium carbonate and silica in fractures
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

- Soils that are similar to the Anawalt soil but have a surface layer that is less than 5 inches thick and a potential plant community that is dominantly Sandberg bluegrass
- Soils that are similar to the Oreneva soil but have bedrock at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Anawalt soil—depth to bedrock, depth to the claypan, shrink-swell potential, available water capacity, water erosion, permeability
Oreneva soil—depth to bedrock, permeability, available water capacity, water erosion

Dominant Vegetation in Potential Plant Community

Anawalt soil—bluebunch wheatgrass, low sagebrush, Sandberg bluegrass
Oreneva soil—Thurber needlegrass, Sandberg bluegrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The bedrock in the Oreneva soil restricts rooting depth.
- The claypan and bedrock in the Anawalt soil restrict rooting depth.
- The surface layer of the Anawalt soil is saturated following snowmelt.
- Pedestaled plants and an erosion pavement on the Anawalt soil are the result of past erosion.
- The shallow depth of the Anawalt soil limits placement of fenceposts.
- Development of water impoundments is restricted by the depth to bedrock.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- The Anawalt soil expands when wet and contracts when dry, which can rip and tear plant roots.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.

• Delay grazing until the Anawalt soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Anawalt soil is seeded, select plants that tolerate a cool growing season, shrinking and swelling, and droughtiness.
• If the Oreneva soil is seeded, select plants that tolerate droughtiness and a cool growing season.

6C—Anawalt-Pearlwise complex, 2 to 15 percent slopes

Composition

Anawalt soil and similar inclusions—50 percent
Pearlwise soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Anawalt Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,900 to 6,200 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown loam
4 to 9 inches—very dark grayish brown loam
9 to 17 inches—dark brown clay
17 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (12 to 20 inches) to bedrock, very shallow (3 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 17 inches

Characteristics of the Pearlwise Soil

Position on landscape: Depressional areas of tablelands
Parent material: Kind—residuum, colluvium; source—tuff, basalt
Elevation: 5,900 to 6,200 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—dark brown loam
4 to 25 inches—very dark grayish brown loam
25 to 35 inches—dark yellowish brown cobbly loam
35 inches—basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 5 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

• Freznik soils on tablelands
• Soils that are similar to the Pearlwise soil but have bedrock at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Anawalt soil—available water capacity, depth to bedrock, depth to the claypan, shrink-swell potential, permeability, water erosion
Pearlwise soil—available water capacity, depth to bedrock, water erosion

Dominant Vegetation in Potential Plant Community

Anawalt soil—bluebunch wheatgrass, low sagebrush, Sandberg bluegrass
Pearlwise soil—Idaho fescue, Thurber needlegrass, mountain big sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The claypan and bedrock in the Anawalt soil restrict rooting depth.
• The surface layer of the Anawalt soil is saturated following snowmelt.
• Development of water impoundments is restricted by the depth to bedrock.
• Pedestaled plants and an erosion pavement are the result of past erosion on the Anawalt soil.
• The shallow depth of the Anawalt soil limits placement of fenceposts.
• The subsoil of the Anawalt soil expands when wet and contracts when dry, which can rip and tear plant roots.
• Because of the high corrosivity of the Anawalt soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum,

galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until the Anawalt soil is firm and the preferred forage plants can withstand grazing pressure.
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Improve areas of the Pearlwise soil that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If the Anawalt soil is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.
- If the Pearlwise soil is seeded, select plants that tolerate a cool growing season.

7E—Argixerolls-Badland complex, 15 to 30 percent slopes

Composition

Argixerolls and similar inclusions—60 percent
Badland—25 percent
Contrasting inclusions—15 percent

Characteristics of Argixerolls

Position on landscape: Hillsides, foot slopes
Parent material: Kind—residuum, colluvium; source—tuff
Elevation: 4,300 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Reference profile:
0 to 12 inches—very dark grayish brown and dark brown loam
12 to 38 inches—olive brown clay loam and clay
38 inches—weathered tuff
Depth class: Shallow (10 to 20 inches) to very deep (60 inches or more) to soft bedrock
Drainage class: Well drained
Permeability: Moderate or slow
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Characteristics of Badland

Position on landscape: Hillsides, foot slopes
Kind of material: Weathered tuff

Contrasting Inclusions

- Rock outcrop
- Winterim soils that are on the upper part of slopes and have dominantly ponderosa pine and western juniper in the potential plant community
- Soils that have slopes of less than 15 percent or more than 30 percent
- Lasere soils that are on adjacent hills and have dominantly low sagebrush in the potential plant community
- Bullump soils that are on adjacent, north-facing hillsides and have dominantly mountain big sagebrush in the potential plant community

Major Use

Livestock grazing

Major Management Factors

Argixerolls—slope, water erosion, depth to bedrock, depth to the claypan, available water capacity
Badland—slope, water erosion, exposed tuffaceous rock

Dominant Vegetation in Potential Plant Community

Argixerolls—varies depending on the characteristics of the soils at a given site, but includes Idaho fescue, bluebunch wheatgrass, Sandberg bluegrass, Thurber needlegrass, mountain big sagebrush, Wyoming big sagebrush, low sagebrush, and antelope bitterbrush

Livestock Grazing

General management considerations:
- Seeding the more favorable areas of the Argixerolls is difficult because of the pattern in which they occur with the areas of Badland.
- The areas of Badland support little, if any, vegetation.

• Because of the lack of vegetation in the areas of Badland, the hazard of gully and sheet erosion is severe.
• This unit is subject to slumping because of the soft, highly weathered tuff.
• Restricting grazing allows for plant growth.

8A—Bicondoa silty clay loam, 0 to 2 percent slopes

Composition

Bicondoa soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Bicondoa Soil

Position on landscape: Flood plains in lake basins
Parent material: Kind—alluvium; source—basalt, tuff
Elevation: 5,000 to 5,300 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 4 inches—very dark brown silty clay loam
4 to 6 inches—very dark grayish brown gravelly loam
6 to 14 inches—very dark grayish brown silty clay loam
14 to 23 inches—dark gray silty clay
23 to 27 inches—dark grayish brown clay
27 to 32 inches—dark grayish brown silty clay
32 to 60 inches—dark yellowish brown silty clay
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: December through April—at the surface to 18 inches below the surface; rest of year—more than 18 inches
Frequency of flooding: Frequent for brief periods from January through April
Shrink-swell potential: High between depths of 14 and 60 inches
Carbonates: Upper 20 inches—slightly effervescent to strongly effervescent

Contrasting Inclusions

• Spangenburg soils that are on adjacent, higher lying lake terraces and have basin big sagebrush in the potential plant community

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Wetness, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Tufted hairgrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for wildlife.
• A seasonal high water table increases the amount of moisture in the soil.
• A high water table during the growing season restricts the rooting depth of non-water-tolerant plants.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• Plants on this soil are subject to winterkill and other damage because of a high potential for frost action.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of seasonal wetness.
• Spring planting may be delayed because of the seasonal wetness.

Suitable management practices:
• Delay grazing until the soil is adequately drained and is firm enough to withstand trampling by livestock.
• If the soil is seeded, select plants that tolerate seasonal wetness and that provide cover for waterfowl.

9C—Blizzard very cobbly silty clay loam, 0 to 15 percent slopes

Composition

Blizzard soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Blizzard Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 6,000 to 6,800 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—40 to 45 degrees F
Frost-free period—20 to 50 days

Typical profile:
0 to 1 inch—dark brown very cobbly silty clay loam
1 inch to 7 inches—dark brown silty clay
7 to 16 inches—dark brown cobbly clay
16 inches—fractured basalt
Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (1 to 4 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 1 inch and 16 inches

Contrasting Inclusions

• Devoy soils that are on tablelands and have mountain big sagebrush in the potential plant community
• Soils that are less than 10 inches thick to bedrock and have curlleaf mountainmahogany and mountain big sagebrush in the potential plant community
• Rock outcrop
• Soils that have an extremely stony surface layer and have western juniper in the potential plant community
• Soils that are 35 percent rock fragments or more throughout

Major Use

Livestock grazing

Major Management Factors

Rock fragments on the surface, depth to the claypan, depth to bedrock, permeability, available water capacity, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The shallow depth to bedrock limits the placement of fenceposts and makes special design of fences necessary.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The surface layer is saturated following snowmelt.
• The claypan and bedrock restrict rooting depth.
• The low available water capacity limits forage production and seedling survival.
• The shallow depth to bedrock limits construction of water impoundments.
• The very cobbly surface layer may restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the soil is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

10C—Booth gravelly loam, 2 to 15 percent slopes

Composition

Booth soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soil

Position on landscape: Foot slopes and benches on mountains and hills
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown gravelly loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 4 and 24 inches

Contrasting Inclusions

• Bullump soils that are on mountains and hills and have mountain big sagebrush in the potential plant community

• Nuss soils that are on hills and have mountain big sagebrush, curlleaf mountainmahogany, and scattered ponderosa pine in the potential plant community
• Soils that are similar to the Booth soil but have bedrock at a depth of 40 inches or more

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, permeability, depth to bedrock, available water capacity, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The bedrock and claypan restrict rooting depth.
• The surface layer is saturated following snowmelt.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The low available water capacity limits forage production and seedling survival.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The depth to bedrock limits construction of water impoundments.
• The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the soil is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

11C—Booth silty clay, 2 to 15 percent slopes, eroded

Composition

Booth soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soil

Position on landscape: Foot slopes and benches on mountains and hills
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown silty clay
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 24 inches

Contrasting Inclusions

• Bullump soils that are on mountains and hills and have mountain big sagebrush in the potential plant community
• Nuss soils that are on hills and have mountain big sagebrush, curlleaf mountainmahogany, and scattered ponderosa pine in the potential plant community
• Rock outcrop
• Soils that are similar to the Booth soil but have bedrock at a depth of 40 inches or more

Major Use

Livestock grazing

Major Management Factors

Clayey surface layer, permeability, depth to bedrock, shrink-swell potential, available water capacity, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The bedrock restricts rooting depth.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The soil expands when wet and contracts when dry,

which can rip and tear plant roots and damage structures and makes special design of fences necessary.
• Past erosion on this unit has exposed the clayey layer.
• A plant cover is difficult to establish because of the clayey layer.
• The depth to bedrock limits construction of water impoundments.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, and maintaining adequate plant cover.
• If the soil is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

12C—Booth very stony loam, 2 to 15 percent slopes

Composition

Booth soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soil

Position on landscape: Foot slopes and benches on mountains and hills
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 4 and 24 inches

Contrasting Inclusions

• Bullump soils that are on mountains and hills and have mountain big sagebrush in the potential plant community
• Nuss soils that are on hills and have mountain big sagebrush, curlleaf mountainmahogany, and scattered ponderosa pine in the potential plant community
• Soils that are similar to the Booth soil but have bedrock at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, permeability, depth to bedrock, shrink-swell potential, available water capacity, stones on the surface, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The bedrock and claypan restrict rooting depth.
• The surface layer is saturated following snowmelt.
• The low available water capacity limits forage production and seedling survival.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The very stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots.
• Special design of fences is needed because the soil expands when wet and contracts when dry and because of the rock fragments on the surface.
• Livestock herd and graze in the less stony areas of this unit.
• The depth to bedrock limits construction of water impoundments.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.

• If the soil is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

12E—Booth very stony loam, 15 to 30 percent slopes

Composition

Booth soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soil

Position on landscape: Foot slopes and benches on mountains and hills
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 24 inches

Contrasting Inclusions

• Bullump soils that are on mountains and hills and have mountain big sagebrush in the potential plant community
• Nuss soils that are on hills and have mountain big sagebrush, curlleaf mountainmahogany, and scattered ponderosa pine in the potential plant community
• Soils that are similar to the Booth soil but have bedrock at a depth of 40 to 60 inches
• Soils that have slopes of less than 15 percent or more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, permeability, depth to bedrock, water erosion, stones on the surface, slope, shrink-swell potential, available water capacity

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The bedrock and claypan restrict rooting depth.
• The surface layer is saturated following snowmelt.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• Livestock herd and graze in the less stony areas of the unit.
• The soil expands when wet and contracts when dry, which can rip and tear plant roots and damage structures and makes special design of fences necessary.
• The very stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the soil is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

13C—Booth complex, 2 to 15 percent slopes

Composition

Booth soil, thick surface, and similar inclusions—50 percent
Booth soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soils

Position on landscape: Foot slopes and benches on mountains and hills

Parent material: Kind—colluvium; source—basalt, rhyolite, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile of the Booth soil, thick surface:
0 to 12 inches—very dark brown very stony loam
12 to 24 inches—brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Typical profile of the Booth soil:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Booth soil, thick surface—moderately deep (20 to 40 inches) to bedrock, shallow (7 to 20 inches) to the claypan; Booth soil—moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High in the subsoil

Contrasting Inclusions

- Bullump soils that are on mountains and hills and have mountain big sagebrush in the potential plant community
- Nuss soils that are on hills and have mountain big sagebrush, curlleaf mountainmahogany, and scattered ponderosa pine in the potential plant community
- Rock outcrop
- Soils that are similar to the Booth soils but have a gravelly or cobbly surface layer
- Soils that have slopes of less than 2 percent or more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Stones on the surface, permeability, shrink-swell potential, depth to bedrock, water erosion, available water capacity, depth to the claypan

Dominant Vegetation in Potential Plant Community

Booth soil, thick surface—Idaho fescue, antelope bitterbrush, bluebunch wheatgrass
Booth soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The bedrock and claypan restrict rooting depth.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Livestock herd and graze in the less stony areas of the unit.
- The surface layer is saturated following snowmelt.
- Some areas of this unit have a thinner surface layer because of past erosion. These areas support dominantly low sagebrush.
- The depth to bedrock limits construction of water impoundments.
- The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soils are firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

13E—Booth complex, 15 to 30 percent slopes

Composition

Booth soil and similar inclusions—50 percent
Booth soil, thick surface, and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soils

Position on landscape: Foot slopes and benches on mountains and hills
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,000 to 6,500 feet

Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days

Typical profile of the Booth soil:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff

Typical profile of the Booth soil, thick surface:
0 to 12 inches—very dark brown very stony loam
12 to 24 inches—brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff

Depth class: Booth soil—moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan; Booth soil, thick surface—moderately deep (20 to 40 inches) to bedrock, shallow (7 to 20 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High in the subsoil

Contrasting Inclusions

• Royst soils that are on hills and have ponderosa pine in the potential plant community
• Nuss soils that are on hills and have mountain big sagebrush, curlleaf mountainmahogany, and scattered ponderosa pine in the potential plant community
• Rock outcrop
• Soils that have slopes of less than 15 percent or more than 30 percent
• Soils that are similar to the Booth soils but have a cobbly or gravelly surface layer
• Soils that are similar to the Booth soils but have bedrock at a depth of less than 20 inches and have more than 35 percent rock fragments in the lower part

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, stones on the surface, slope, permeability, shrink-swell potential, depth to bedrock, available water capacity, water erosion

Dominant Vegetation in Potential Plant Community

Booth soil—Idaho fescue, low sagebrush, bluebunch wheatgrass
Booth soil, thick surface—Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The surface layer is saturated following snowmelt.
• Livestock herd and graze in the less stony areas of the unit.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The very stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Some areas of this unit have a thinner surface layer because of past erosion. These areas support dominantly low sagebrush.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The bedrock and claypan restrict rooting depth.
• The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soils are firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

14F—Booth complex, 30 to 50 percent north slopes

Composition

Booth soil, thick surface, and similar inclusions—45 percent
Booth soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soils

Position on landscape: Hillsides, mountainsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile of the Booth soil, thick surface:
0 to 12 inches—very dark brown very stony loam
12 to 24 inches—brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Typical profile of the Booth soil:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Booth soil, thick surface—moderately deep (20 to 40 inches) to bedrock, shallow (7 to 20 inches) to the claypan; Booth soil—moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High in the subsoil

Contrasting Inclusions

- Royst soils that are on hills and have ponderosa pine in the potential plant community
- Nuss soils that are on hills and have mountain big sagebrush, curlleaf mountainmahogany, and scattered ponderosa pine in the potential plant community
- Rock outcrop
- Soils that have slopes of less than 30 percent or more than 50 percent
- Soils that are similar to the Booth soils but have a cobbly or gravelly surface layer
- Soils that are similar to the Booth soils but are less than 20 inches deep to bedrock and have more than 35 percent rock fragments in the lower part
- Soils that are on south-facing slopes

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, stones on the surface, permeability, shrink-swell potential, depth to bedrock, depth to the claypan, available water capacity

Dominant Vegetation in Potential Plant Community

Booth soil, thick surface—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush
Booth soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The surface layer is saturated following snowmelt.
- Livestock herd and graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- Livestock herd and graze in the less stony areas of the unit.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
- Some areas of this unit have a thinner surface layer because of past erosion. These areas support dominantly low sagebrush.
- The claypan and bedrock restrict rooting depth.
- The very stony surface layer and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.
- If this unit is disturbed, slopes are likely to be unstable.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate

droughtiness, shrinking and swelling, and a cool growing season.

15F—Booth complex, 30 to 50 percent south slopes

Composition

Booth soil and similar inclusions—45 percent
Booth soil, thick surface, and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soils

Position on landscape: Hillsides, mountainsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile of the Booth soil:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Typical profile of the Booth soil, thick surface:
0 to 12 inches—very dark brown very stony loam
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Booth soil—moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan; Booth soil, thick surface—moderately deep (20 to 40 inches) to bedrock, shallow (7 to 20 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High in the subsoil

Contrasting Inclusions

• Royst soils that are on hills and have ponderosa pine in the potential plant community
• Nuss soils that are on hills and have mountain big sagebrush, curlleaf mountainmahogany, and scattered ponderosa pine in the potential plant community
• Rock outcrop
• Soils that have slopes of less than 30 percent or more than 50 percent
• Soils that are similar to the Booth soils but have a cobbly or gravelly surface layer
• Soils that are similar to the Booth soils but have bedrock at a depth of less than 20 inches and have more than 35 percent rock fragments in the lower part
• Soils that are on north-facing slopes

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, stones on the surface, permeability, shrink-swell potential, depth to bedrock, available water capacity, depth to the claypan

Dominant Vegetation in Potential Plant Community

Booth soil—bluebunch wheatgrass, low sagebrush, Idaho fescue, Sandberg bluegrass, Thurber needlegrass
Booth soil, thick surface—bluebunch wheatgrass, mountain big sagebrush

Livestock Grazing

General management considerations:
• The surface layer is saturated following snowmelt.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of the unit.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Some areas of this unit have a thinner surface layer because of past erosion. These areas support dominantly low sagebrush.
• The claypan and bedrock restrict rooting depth.
• The very stony surface layer and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The earlier growing season in areas on south-facing slopes permits earlier grazing in these areas than in areas on north-facing slopes; however, droughtiness is a limitation earlier in the growing season in areas on south-facing slopes than in those on north-facing slopes.
• The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary

• If this unit is disturbed, slopes are likely to be unstable.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soils are firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

16C—Booth complex, 2 to 15 percent slopes, eroded

Composition

Booth soil and similar inclusions—50 percent
Booth soil, eroded, and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soils

Position on landscape: Foot slopes and benches on hills and mountains
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile of the Booth soil:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Typical profile of the Booth soil, eroded:
0 to 4 inches—very dark brown silty clay
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Booth soil—moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan; Booth soil, eroded—moderately deep (20 to 40 inches) to bedrock, claypan at the surface
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Booth soil—moderate; Booth soil, eroded—severe
Shrink-swell potential: High in the subsoil

Contrasting Inclusions

• Bullump soils that are on hills and mountains and have mountain big sagebrush in the potential plant community
• Nuss soils that are on hills and have mountain big sagebrush, curlleaf mountainmahogany, and scattered ponderosa pine in the potential plant community
• Rock outcrop
• Soils that are similar to the Booth soils but have bedrock at a depth of 40 to 60 inches
• Soils that are similar to the Booth soils but have a gravelly or cobbly surface layer

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, stones on the surface, permeability, depth to bedrock, shrink-swell potential, available water capacity, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The bedrock and claypan restrict rooting depth.
• The surface layer is saturated following snowmelt.
• Past erosion in areas of the Booth soil, eroded, has exposed the clayey layer.
• A plant cover is difficult to establish on the Booth soil, eroded, because of the clayey layer.
• The depth to bedrock limits construction of water impoundments.
• The soils expand when wet and contract when dry, which can rip and tear plant roots and damage structures and makes special design of fences necessary.

• Livestock herd and graze in the less stony areas of the unit.
• The very stony surface layer of the Booth soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soils are firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

17E—Booth-Nuss complex, 5 to 30 percent slopes

Composition

Booth soil and similar inclusions—55 percent
Nuss soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soil

Position on landscape: Foot slopes and benches of hills and mountains
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 24 inches

Characteristics of the Nuss Soil

Position on landscape: Hills
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown gravelly loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Bullump soils that are on hills and mountains and have mountain big sagebrush in the potential plant community
• Itca soils that are near the Booth soil
• Rock outcrop
• Soils that have slopes of less than 5 percent or more than 30 percent
• Soils that are similar to the Booth and Nuss soils but have a cobbly surface layer
• Soils that are similar to the Booth soil but have bedrock at a depth of 40 inches or more
• Soils that are similar to the Nuss soil but have bedrock at a depth of 4 to 10 inches

Major Use

Livestock grazing

Major Management Factors

Booth soil—water erosion, slope, depth to the claypan, depth to bedrock, stones on the surface, permeability, shrink-swell potential, available water capacity
Nuss soil—water erosion, slope, depth to bedrock, available water capacity

Dominant Vegetation in Potential Plant Community

Booth soil—Idaho fescue, low sagebrush, bluebunch wheatgrass
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Livestock herd and graze in the less stony areas of the unit.
- The bedrock restricts rooting depth.
- The claypan in the Booth soil restricts rooting depth.
- The surface layer of the Booth soil is saturated following snowmelt.
- Pedestaled plants and an erosion pavement on the Booth soil are the result of past erosion.
- The very stony surface layer of the Booth soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The subsoil of the Booth soil expands when wet and contracts when dry, which makes special design of fences necessary.
- The shallow depth of the Nuss soil limits placement of fenceposts.
- Seeding areas of the more favorable Nuss soil in this unit is difficult because of the pattern in which they occur with areas of the less favorable Booth soil.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Booth soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.
- Improve areas of the Nuss soil that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

18F—Booth-Nuss complex, 30 to 50 percent north slopes

Composition

Booth soil and similar inclusions—55 percent
Nuss soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soil

Position on landscape: Hillsides, mountainsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 24 inches

Characteristics of the Nuss Soil

Position on landscape: Hillsides
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown gravelly loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Bullump soils that are on hills and mountains and have mountain big sagebrush in the potential plant community
- Itca soils that are near the Booth soil
- Rock outcrop
- Soils that have slopes of less than 30 percent
- Soils on south-facing slopes
- Soils that are similar to the Booth and Nuss soils but have a cobbly surface layer
- Soils that are similar to the Booth soil but have bedrock at a depth of 40 inches or more
- Soils that are similar to the Nuss soil but have bedrock at a depth of 4 to 10 inches

Major Use

Livestock grazing

Major Management Factors

Booth soil—water erosion, slope, depth to the claypan, depth to bedrock, stones on the surface, permeability, shrink-swell potential, available water capacity
Nuss soil—water erosion, slope, depth to bedrock, available water capacity

Dominant Vegetation in Potential Plant Community

Booth soil—bluebunch wheatgrass, low sagebrush, Idaho fescue
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
• Livestock herd and graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of the unit.
• The bedrock restricts rooting depth.
• The claypan in the Booth soil restricts rooting depth.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The surface layer of the Booth soil is saturated following snowmelt.
• The subsoil of the Booth soil expands when wet and contracts when dry, which makes special design of fences necessary.
• The shallow depth of the Nuss soil limits placement of fenceposts.
• Slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Seeding areas of the more favorable Nuss soil in this unit is difficult because of the pattern in which they occur with areas of the less favorable Booth soil.
• If this unit is disturbed, slopes are likely to be unstable.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Booth soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.
• Improve areas of the Nuss soil that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

19F—Booth-Nuss complex, 30 to 50 percent south slopes

Composition

Booth soil and similar inclusions—55 percent
Nuss soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soil

Position on landscape: Hillsides, mountainsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 24 inches

Characteristics of the Nuss Soil

Position on landscape: Hillsides
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days

Typical profile:

0 to 3 inches—very dark grayish brown gravelly loam

3 to 17 inches—very dark grayish brown clay loam

17 to 19 inches—fractured, partially weathered tuff

19 inches—tuff

Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Bullump soils that are on hills and mountains and have mountain big sagebrush in the potential plant community
• Itca soils that are near the Booth soil
• Rock outcrop
• Soils that have slopes of less than 30 percent
• Soils on north-facing slopes
• Soils that are similar to the Booth and Nuss soils but have a cobbly surface layer
• Soils that are similar to the Booth soil but have bedrock at a depth of 40 inches or more
• Soils that are similar to the Nuss soil but have bedrock at a depth of 4 to 10 inches

Major Use

Livestock grazing

Major Management Factors

Booth soil—water erosion, slope, depth to the claypan, depth to bedrock, stones on the surface, permeability, shrink-swell potential, available water capacity

Nuss soil—water erosion, slope, depth to bedrock, available water capacity

Dominant Vegetation in Potential Plant Community

Booth soil—bluebunch wheatgrass, low sagebrush, Idaho fescue, Sandberg bluegrass, Thurber needlegrass

Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Livestock herd and graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of the unit.
• The bedrock restricts rooting depth.
• The claypan in the Booth soil restricts rooting depth.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The surface layer of the Booth soil is saturated following snowmelt.
• The subsoil of the Booth soil expands when wet and contracts when dry, which makes special design of fences necessary.
• The shallow depth of the Nuss soil limits placement of fenceposts.
• Slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Seeding areas of the more favorable Nuss soil in this unit is difficult because of the pattern in which they occur with areas of the less favorable Booth soil.
• The earlier growing season in the areas on south-facing slopes permits earlier grazing in these areas than in areas on north-facing slopes. Droughtiness is a limitation earlier in the growing season in areas on south-facing slopes than in areas on north-facing slopes.
• If this unit is disturbed, slopes are likely to be unstable.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Booth soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.
• Improve areas of the Nuss soil that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

20C—Booth-Rock outcrop complex, 2 to 15 percent slopes

Composition

Booth soil and similar inclusions—45 percent
Rock outcrop—40 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soil

Position on landscape: Foot slopes and benches on hills and mountains
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 90 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 4 and 24 inches

Characteristics of the Rock Outcrop

Position on landscape: Foot slopes and benches on hills and mountains
Kind of rock: Basalt, tuff

Contrasting Inclusions

- Bullump and Nuss soils that are on hills and mountains and have mountain big sagebrush in the potential plant community
- Soils that are similar to the Booth soil but have bedrock at a depth of 40 inches or more
- Rubble land

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, permeability, stones on the surface, shrink-swell potential, depth to bedrock, available water capacity, Rock outcrop

Dominant Vegetation in Potential Plant Community

Booth soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The bedrock and claypan restrict rooting depth.
- The surface layer of the Booth soil is saturated following snowmelt.
- The depth to bedrock limits construction of water impoundments.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- The very stony surface layer of the Booth soil and the areas of Rock outcrop restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

21F—Booth-Rock outcrop complex, 30 to 50 percent north slopes

Composition

Booth soil and similar inclusions—50 percent
Rock outcrop—35 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soil

Position on landscape: Hillsides, mountainsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay

12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff

Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 24 inches

Characteristics of the Rock Outcrop

Position on landscape: Hillsides, mountainsides, escarpments
Kind of rock: Basalt, tuff

Contrasting Inclusions

• Bullump soils that are on hills and mountains and have mountain big sagebrush in the potential plant community
• Deep soils that are along narrow stream channels and have basin wildrye and mountain big sagebrush in the potential plant community
• Itca soils that are near areas of the Booth soil
• Very shallow soils that are near areas of Rock outcrop
• Soils that have slopes of less than 30 percent or more than 50 percent
• Soils that are similar to the Booth soil but have a cobbly or gravelly surface layer
• Rubble land
• Soils on south-facing slopes that have dominantly bluebunch wheatgrass and low sagebrush or mountain big sagebrush in the potential plant community

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, stones on the surface, permeability, depth to bedrock, depth to the claypan, shrink-swell potential, available water capacity, Rock outcrop

Dominant Vegetation in Potential Plant Community

Booth soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
• Livestock herd and graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of the unit.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The claypan and bedrock in the Booth soil restrict rooting depth.
• The surface layer of the Booth soil is saturated following snowmelt.
• The areas of Rock outcrop and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• If the Booth soil is disturbed, slopes are likely to be unstable.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

22F—Booth-Rock outcrop complex, 30 to 50 percent south slopes

Composition

Booth soil and similar inclusions—45 percent
Rock outcrop—40 percent
Contrasting inclusions—15 percent

Characteristics of the Booth Soil

Position on landscape: Hillsides, mountainsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days

Typical profile:

0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff

Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 24 inches

Characteristics of the Rock Outcrop

Position on landscape: Hillsides, mountainsides, escarpments
Kind of rock: Basalt, tuff

Contrasting Inclusions

- Bullump soils that are on hillsides and mountainsides and have mountain big sagebrush in the potential plant community.
- Deep soils that are along narrow stream channels and have basin wildrye and mountain big sagebrush in the potential plant community.
- Itca soils that are near the Booth soils
- Very shallow soils that are near areas of Rock outcrop
- Soils that have slopes of less than 30 percent or more than 50 percent
- Soils that are similar to the Booth soil but that have a cobbly or gravelly surface layer.
- Rubble land
- Soils on north-facing slopes that have dominantly Idaho fescue and low sagebrush or mountain big sagebrush in the potential plant community

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, stones on the surface, permeability, depth to bedrock, depth to the claypan, shrink-swell potential, available water capacity, Rock outcrop

Dominant Vegetation in Potential Plant Community

Booth soil—bluebunch wheatgrass, low sagebrush, Idaho fescue, Sandberg bluegrass, Thurber needlegrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Livestock herd and graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- Livestock herd and graze in the less stony areas of the unit.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- The claypan and bedrock in the Booth soil restrict rooting depth.
- The surface layer of the Booth soil is saturated following snowmelt.
- The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
- The areas of Rock outcrop and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- If the Booth is disturbed, slopes are likely to be unstable.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

23C—Booth-Nuss-Royst association, 0 to 15 percent slopes

Composition

Booth soil and similar inclusions—40 percent
Nuss soil and similar inclusions—30 percent
Royst soil and similar inclusions—20 percent
Contrasting inclusions—10 percent

Characteristics of the Booth Soil

Position on landscape: Foot slopes and benches on hills and mountains
Parent material: Kind—colluvium; source—basalt, tuff

Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 4 and 24 inches

Characteristics of the Nuss Soil

Position on landscape: Convex areas of hills
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown stony loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—unweathered tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate

Characteristics of the Royst Soil

Position on landscape: Concave areas of hills
Parent material: Kind—residuum, colluvium; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
2 inches to 0—ponderosa pine needles and twigs, mountain big sagebrush leaves
0 to 4 inches—black very stony loam
4 to 27 inches—dark brown extremely stony clay
27 to 29 inches—fractured, partially weathered tuff
29 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 4 and 27 inches

Contrasting Inclusions

- Booth soils that have a thick surface layer and have mountain big sagebrush in the potential plant community
- Winterim soils that are near the upper elevations and are on north-facing slopes
- Rock outcrop
- Soils that have slopes of more than 15 percent
- Soils that are similar to the Nuss soil but have stones and cobbles throughout
- Soils that are similar to the Royst soil but have bedrock at a depth of 40 inches or more

Major Uses

Booth and Nuss soils—livestock grazing
Royst soil—livestock grazing, woodland

Major Management Factors

Booth soil—depth to the claypan, depth to bedrock, permeability, available water capacity, stones on the surface, shrink-swell potential, water erosion
Nuss soil—depth to bedrock, available water capacity, stones on the surface, water erosion
Royst soil—stones on the surface and in the soil, permeability, available water capacity, shrink-swell potential, water erosion, depth to bedrock

Dominant Vegetation in Potential Plant Community

Booth soil—Idaho fescue, low sagebrush, bluebunch wheatgrass
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass
Royst soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Ross sedge

Livestock Grazing

Booth, Nuss, and Royst soils

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The bedrock and claypan in the Booth soil restrict

rooting depth.
• The bedrock in the Nuss and Royst soils restricts rooting depth.
• The surface layer of the Booth soil is saturated following snowmelt.
• Livestock herd and graze in the less stony areas of the unit.
• The very stony or stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The subsoil in the Booth and Royst soils expands when wet and contracts when dry, which makes special design of fences necessary.
• The shallow depth to bedrock in the Nuss soil limits placement of fenceposts.
• The depth to bedrock limits construction of water impoundments.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Booth soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

Woodland

Royst soil

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190
General management considerations:
• Wet, unsurfaced roads and skid trails are firm.
• Cuts and fills are stable.
• The clayey subsoil restricts permeability.
• Rock fragments on the surface can make tree planting and the operation of ground seeding equipment difficult.
• Because this soil is hot in summer and droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• Reduce competing vegetation by mechanical or chemical treatment or by livestock grazing.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• To reduce compaction, use designated skid trails and low-pressure ground equipment and avoid logging in spring when the soil is wet.
• To reduce compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.

24E—Booth-Nuss-Royst association, 15 to 40 percent south slopes

Composition

Booth soil and similar inclusions—40 percent
Nuss soil and similar inclusions—30 percent
Royst soil and similar inclusions—20 percent
Contrasting inclusions—10 percent

Characteristics of the Booth Soil

Position on landscape: Foot slopes and less sloping areas on hills and mountains
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 24 inches

Characteristics of the Nuss Soil

Position on landscape: Convex areas, ridges, and more steeply sloping areas on hills
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown stony loam

3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff

Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Characteristics of the Royst Soil

Position on landscape: Concave areas on hills
Parent material: Kind—residuum, colluvium; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days

Typical profile:
2 inches to 0—ponderosa pine needles and twigs, mountain big sagebrush leaves
0 to 4 inches—black very stony loam
4 to 27 inches—dark brown extremely stony clay
27 to 29 inches—fractured, partially weathered tuff
29 inches—tuff

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 27 inches

Contrasting Inclusions

- Booth soils that have a thick surface layer and have mountain big sagebrush in the potential plant community
- Winterim soils that are near the higher elevations or are on north-facing slopes
- Rock outcrop
- Soils that have slopes of less than 15 percent or more than 40 percent
- Soils that are similar to the Nuss soil but have stones and cobbles throughout
- Soils that are similar to the Royst soil but have bedrock at a depth of 40 inches or more

Major Uses

Booth and Nuss soils—livestock grazing
Royst soil—livestock grazing, woodland

Major Management Factors

Booth soil—available water capacity, stones on the surface, water erosion, slope, depth to the claypan, depth to bedrock, permeability, shrink-swell potential
Nuss soil—available water capacity, stones on the surface, slope, water erosion, depth to bedrock
Royst soil—available water capacity, slope, water erosion, stones on the surface and in the soil, permeability, shrink-swell potential, depth to bedrock

Dominant Vegetation in Potential Plant Community

Booth soil—bluebunch wheatgrass, low sagebrush, Idaho fescue
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass
Royst soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Ross sedge

Livestock Grazing

Booth, Nuss, and Royst soils

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The bedrock and claypan in the Booth soil restrict rooting depth.
- The bedrock in the Nuss and Royst soils restricts rooting depth.
- The surface layer of the Booth soil is saturated following snowmelt.
- Livestock herd and graze in the less stony areas of the unit.
- The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
- The very stony or stony surface layer and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The subsoil in the Booth and Royst soils expands when wet and contracts when dry, which makes special design of fences necessary.
- The shallow depth to bedrock in the Nuss soil limits placement of fenceposts and makes special design of fences necessary.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Booth soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the

existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

Woodland

Royst soil

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield per acre (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
• Wet, unsurfaced roads and skid trails are firm.
• Cuts and fills slough when wet.
• The clayey subsoil restricts permeability.
• The rock fragments on the surface can make tree planting and the operation of ground seeding equipment difficult.
• Artificial or natural shade increases seedling survival.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
• Because soils on south-facing slopes are hotter in summer and droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• To reduce compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment and avoid logging in spring when the soil is wet.
• Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
• Reduce competing vegetation by mechanical or chemical treatment or by livestock grazing.
• Use shade cards to increases seedling survival.
• To reduce compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.

24G—Booth-Nuss-Royst association, 40 to 60 percent south slopes

Composition

Booth soil and similar inclusions—40 percent
Nuss soil and similar inclusions—30 percent
Royst soil and similar inclusions—20 percent
Contrasting inclusions—10 percent

Characteristics of the Booth Soil

Position on landscape: Less sloping areas on hillsides and mountainsides
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 24 inches

Characteristics of the Nuss Soil

Position on landscape: Convex areas and more steeply sloping areas on hillsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown stony loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Characteristics of the Royst Soil

Position on landscape: Concave areas on hills
Parent material: Kind—residuum, colluvium; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:

Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days

Typical profile:
2 inches to 0—ponderosa pine needles and twigs, mountain big sagebrush leaves
0 to 4 inches—black very stony loam
4 to 27 inches—dark brown extremely stony clay
27 to 29 inches—fractured, partially weathered tuff
29 inches—tuff

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 27 inches

Contrasting Inclusions

- Booth soils that have a thick surface layer and have mountain big sagebrush in the potential plant community
- Winterim soils that are near the higher elevations in this unit and are on north-facing slopes
- Rock outcrop
- Soils that have slopes of less than 40 percent or more than 60 percent
- Soils that are similar to the Nuss soil but have stones and cobbles throughout
- Soils that are similar to the Royst soil but have bedrock at a depth of 40 inches or more

Major Uses

Booth and Nuss soils—livestock grazing
Royst soil—livestock grazing, woodland

Major Management Factors

Booth soil—slope, water erosion, available water capacity, stones on the surface, depth to the claypan, depth to bedrock, permeability
Nuss soil—slope, water erosion, available water capacity, stones on the surface, depth to bedrock
Royst soil—slope, water erosion, available water capacity, stones on the surface and in the soil, permeability, depth to bedrock

Dominant Vegetation in Potential Plant Community

Booth soil—bluebunch wheatgrass, low sagebrush, Idaho fescue, Sandberg bluegrass, Thurber needlegrass
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass
Royst soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Ross sedge

Livestock Grazing

Booth, Nuss, and Royst soils

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The bedrock and claypan in the Booth soil restrict rooting depth.
- The bedrock in the Nuss and Royst soils restricts rooting depth.
- The surface layer of the Booth soil is saturated following snowmelt.
- Livestock herd and graze in the less stony areas of the unit.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
- The very stony or stony surface layer and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The subsoil of the Booth and Royst soils expands when wet and contracts when dry, which makes special design of fences necessary.
- The shallow depth to bedrock in the Nuss soil limits placement of fenceposts.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Booth soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

Woodland

Royst soil

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield per acre (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
- Wet, unsurfaced roads are firm.
- Cuts and fills slough when wet.
- The clayey subsoil restricts permeability.
- The rock fragments on the surface can make tree planting difficult.
- Artificial or natural shade increases seedling survival.
- To minimize soil displacement, cable yarding systems should be used.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- Competing vegetation can be reduced by mechanical or chemical treatment or by livestock grazing.
- Because the south-facing slopes are hotter in summer and droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
- To reduce compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
- Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
- Use shade cards to increase seedling survival.

25F—Booth-Rock outcrop association, 30 to 50 percent slopes

Composition

Booth soil, north slopes, and similar inclusions—35 percent
Booth soil, south slopes, and similar inclusions—30 percent
Rock outcrop—25 percent
Contrasting inclusions—10 percent

Characteristics of the Booth Soils

Position on landscape: North-facing and south-facing hillsides and mountainsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 24 inches

Characteristics of the Rock Outcrop

Position on landscape: Hillsides, mountainsides, escarpments
Kind of rock: Basalt, tuff

Contrasting Inclusions

- Bullump soils that are on hillsides and mountainsides and have mountain big sagebrush in the potential plant community
- Deep soils that are along narrow stream channels and have basin wildrye and mountain big sagebrush in the potential plant community
- Itca soils
- Very shallow soils near the Rock outcrop
- Soils that have slopes of less than 30 percent or more than 50 percent
- Rubble land
- Soils that are very cobbly or very gravelly loam in the upper part

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, stones on the surface, permeability, depth to bedrock, depth to the claypan, shrink-swell potential, Rock outcrop

Dominant Vegetation in Potential Plant Community

Booth soil, north slopes—Idaho fescue, low sagebrush, bluebunch wheatgrass
Booth soil, south slopes—bluebunch wheatgrass, low sagebrush, Idaho fescue

Livestock Grazing

General management considerations:
- The surface layer is saturated following snowmelt.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.

• Livestock herd and graze in the less stony areas of the unit.
• The claypan and bedrock restrict rooting depth.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• The very stony surface layer, areas of Rock outcrop, and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soils are firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

26A—Boravall silt loam, 0 to 1 percent slopes

Composition

Boravall soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Boravall Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 6 inches—dark grayish brown silt loam
6 to 12 inches—dark brown silt loam
12 to 19 inches—very dark gray and brown silty clay
19 to 36 inches—very dark gray and light yellowish brown silty clay
36 to 60 inches—light brownish yellow, brown, and very dark gray silt loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: December to June—6 inches above the surface to 36 inches below the surface; rest of year—more than 36 inches
Frequency of flooding: Rare
Shrink-swell potential: High between depths of 12 and 36 inches
Salinity: Upper 36 inches—strongly saline; below this depth—moderately saline
Sodicity: Strongly sodic
Carbonates: Strongly effervescent or violently effervescent

Contrasting Inclusions

• Crump soils that are on lower alluvial flats and have bulrushes and cattails in the potential plant community
• Pit soils that are on adjacent alluvial flats and have sedges and rushes in the potential plant community
• Icene soils that are on adjacent, higher lying lake terraces and have shadscale and black greasewood in the potential plant community

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Wetness, available water capacity, salinity, sodicity, permeability, shrink-swell potential, frost action

Dominant Vegetation in Potential Plant Community

Alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
• Salts reduce the amount of water available to plants and limit seedling survival.

• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• This soil is suited to grazing in winter.
• Plants on this soil are subject to winterkill and other damage because of the high potential for frost action.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If this soil is seeded, select plants that tolerate strong sodicity, strong salinity, wetness, and frost heaving and that provide cover for nesting waterfowl.

27A—Boulder Lake silty clay, 0 to 2 percent slopes

Composition

Boulder Lake soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Boulder Lake Soil

Position on landscape: Alluvial flats in lake basins and in depressional areas of tablelands
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—43 to 47 degrees F
Frost-free period—50 to 90 days
Typical profile:
0 to 2 inches—grayish brown silty clay
2 to 35 inches—grayish brown, mottled silty clay
35 to 60 inches—brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Very slow
Available water capacity: About 5 inches
Hazard of erosion by water: Slight
Depth to perched water table: December to June—6 inches above the surface to 18 inches below the surface; rest of year—more than 18 inches
Shrink-swell potential: High
Carbonates: Between depths of 28 and 42 inches—strongly effervescent; below this depth—violently effervescent

Contrasting Inclusions

• Mudpot soils that are on adjacent alluvial flats and do not have shrubs in the potential plant community

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Permeability, shrink-swell potential, wetness, clayey surface layer

Dominant Vegetation in Potential Plant Community

Nevada bluegrass, creeping wildrye, silver sagebrush

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• The soil expands when wet and contracts when dry, which can rip and tear plant roots.
• A high water table and ponding during the growing season restrict the rooting depth for non-water tolerant plants.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The soil expands when wet and contracts when dry, which makes special design of fences necessary.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If this unit is seeded, select plants that tolerate wetness, shrinking and swelling, and a cool growing season and that provide cover for nesting waterfowl.

28C—Brace-Coglin complex, 2 to 15 percent slopes

Composition

Brace soil and similar inclusions—55 percent
Coglin soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Brace Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 4,800 to 5,100 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 3 inches—dark brown loam
3 to 9 inches—dark brown cobbly loam
9 to 19 inches—dark brown silty clay loam
19 to 25 inches—yellowish brown extremely gravelly loam
25 to 35 inches—indurated hardpan
35 inches—basalt
Depth class: Moderately deep (20 to 37 inches) to the hardpan; moderately deep to bedrock (22 to 40 inches)
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Slight or moderate
Carbonates: Between depths of 19 and 25 inches—violently effervescent

Characteristics of the Coglin Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 4,800 to 5,100 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 2 inches—dark brown extremely stony loam
2 to 7 inches—dark brown clay
7 to 16 inches—dark yellowish brown silty clay loam
16 to 60 inches—dark yellowish brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock, very shallow (2 to 5 inches) to the claypan, shallow or moderately deep (10 to 30 inches) to secondary lime
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 2 and 7 inches
Carbonates: Between depths of 16 and 60 inches—strongly effervescent

Contrasting Inclusions

• Deseed soils that are near the higher elevations in this unit
• Freznik soils that are near the higher elevations and have low sagebrush in the potential plant community
• Raz soils
• Soils that are similar to the Coglin soil but have bedrock or a hardpan at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Brace soil—available water capacity, depth to the hardpan, calcareous layer, water erosion, depth to bedrock
Coglin soil—stones on the surface, calcareous layer, permeability, water erosion, shrink-swell potential, depth to the claypan

Dominant Vegetation in Potential Plant Community

Brace soil—bluebunch wheatgrass, Wyoming big sagebrush, Thurber needlegrass, Indian ricegrass, bottlebrush squirreltail
Coglin soil—black sagebrush, bottlebrush squirreltail, Sandberg bluegrass

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Seeding areas of the more favorable Brace soil in this unit is difficult because of the pattern in which they occur with areas of the less favorable Coglin soil.
• The calcareous lower layer in the Brace and Coglin soils and the thin surface layer and very shallow depth to the claypan in the Coglin soil restrict rooting depth.
• The surface layer of the Coglin soil is saturated following snowmelt.
• Crusting of the surface of the Coglin soil reduces infiltration and restricts seedling emergence and survival.

- The extremely stony surface layer of the Coglin soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The depth to bedrock in the Brace soil limits construction of water impoundments.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.

Suitable management practices:
- Delay grazing until the Coglin soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If the Brace soil is seeded, select plants that tolerate droughtiness.

29C—Brace-Raz complex, 2 to 15 percent slopes

Composition

Brace soil and similar inclusions—55 percent
Raz soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Brace Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 4,800 to 5,100 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 3 inches—dark brown loam
3 to 9 inches—dark brown cobbly loam
9 to 19 inches—dark brown silty clay loam
19 to 25 inches—yellowish brown extremely gravelly loam
25 to 35 inches—indurated hardpan
35 inches—basalt
Depth class: Moderately deep (20 to 37 inches) to the hardpan, moderately deep (22 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Slight or moderate
Carbonates: Between depths of 19 and 25 inches—violently effervescent

Characteristics of the Raz Soil

Position on landscape: Tablelands
Parent material: Kind—alluvium, colluvium; source—basalt, tuff
Elevation: 4,800 to 5,100 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 3 inches—dark brown very cobbly loam
3 to 13 inches—dark brown cobbly clay loam
13 to 18 inches—dark yellowish brown gravelly clay loam
18 to 21 inches—indurated hardpan
21 inches—basalt
Depth class: Shallow (10 to 18 inches) to the hardpan, moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate

Contrasting Inclusions

- Coglin soils that are on tablelands and have black sagebrush in the potential plant community
- Mudpot soils that are in small closed basins and do not have shrubs in the potential plant community
- Ratto soils that are on tablelands
- Soils that have slopes of less than 2 percent or more than 15 percent
- Soils that are similar to the Brace soil but have bedrock or a hardpan at a depth of 40 inches or more

Major Use

Livestock grazing

Major Management Factors

Brace soil—calcareous layer, available water capacity, depth to the hardpan, depth to bedrock, water erosion
Raz soil—depth to the hardpan, available water capacity, depth to bedrock, water erosion

Dominant Vegetation in Potential Plant Community

Brace and Raz soils—bluebunch wheatgrass, Wyoming big sagebrush, Thurber needlegrass, Indian ricegrass, bottlebrush squirreltail

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The hardpan in the Raz soil restricts rooting depth.
• The calcareous lower layer and hardpan in the Brace soil restrict rooting depth.
• The shallow depth to the hardpan in the Raz soil limits placement of fenceposts.
• Development of water impoundments is restricted by the depth to bedrock.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

30B—Buffaran gravelly loam, 0 to 5 percent slopes

Composition

Buffaran soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Buffaran Soil

Position on landscape: Fans
Parent material: Kind—alluvium; source—tuff, basalt, andesite, rhyolite
Elevation: 5,200 to 5,260 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 2 inches—brown and dark grayish brown gravelly loam
2 to 8 inches—dark grayish brown and dark yellowish brown clay loam
8 to 15 inches—dark yellowish brown clay loam
15 to 17 inches—dark yellowish brown gravelly clay loam
17 to 40 inches—indurated hardpan
40 to 60 inches—strongly cemented hardpan that includes weakly cemented material
Depth class: Shallow (14 to 20 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Slight
Shrink-swell potential: High between depths of 2 and 15 inches

Contrasting Inclusions

• Spangenburg soils that are on basin terraces and have basin wildrye and Indian ricegrass in the potential plant community
• Anawalt soils that are on higher tablelands and have low sagebrush in the potential plant community
• Jesse Camp soils that are on basin terraces and have basin wildrye and basin big sagebrush in the potential plant community
• Soils that have slopes of more than 5 percent and are adjacent to drainageways

Major Use

Livestock grazing

Major Management Factors

Depth to the hardpan, available water capacity, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Wyoming big sagebrush, Thurber needlegrass, Indian ricegrass, bottlebrush squirreltail

Livestock Grazing

General management considerations:
• The hardpan restricts rooting depth.
• Unless the hardpan is ripped, it limits construction of water impoundments.
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This soil is suited to grazing in winter.

Suitable management practices:
• If this soil is seeded, select plants that tolerate droughtiness.
• Improve areas that are heavily infested with

undesirable shrubs by railing, chaining, beating, or applying chemicals.

31E—Bullump very stony loam, 5 to 30 percent slopes

Composition

Bullump soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Bullump Soil

Position on landscape: Hillsides and mountainsides
Parent material: Kind—colluvium, residuum; source—tuff, rhyolite, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 11 inches—very dark grayish brown very stony loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly clay loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Moderate or severe

Contrasting Inclusions

- Booth soils that are on hillsides and mountainsides and have low sagebrush in the potential plant community
- Nuss soils that are on hillsides and have curlleaf mountainmahogany and scattered ponderosa pine in the potential plant community
- Soils that are similar to the Bullump soil but have bedrock at a depth of 20 to 40 inches
- Soils that have slopes of less than 5 percent or more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, stones on the surface

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Livestock herd and graze in the less stony areas of the unit.
- The very stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The rock fragments on the surface and in the soil restrict the placement of fenceposts.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate a cool growing season.

32E—Bullump gravelly loam, high elevation, 10 to 40 percent slopes

Composition

Bullump soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Bullump Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite, tuff
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—22 to 25 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
0 to 11 inches—very dark grayish brown gravelly loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly clay loam

42 to 60 inches—dark yellowish brown extremely gravelly loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Chocktoot, Hallihan, Hammersley, and Kittleson soils that are on north-facing slopes and have white fir and ponderosa pine in the potential plant community
• Soils that are similar to the Bullump soil but have bedrock at a depth of less than 60 inches
• Soils that have slopes of more than 40 percent

Major Use

Livestock grazing

Major Management Factors

Water erosion, slope

Dominant Vegetation in Potential Plant Community

Idaho fescue, mountain brome, common snowberry, lupine, mulesear wyethia, mountain big sagebrush, Ross sedge

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The remoteness of this unit and its proximity to forested areas make range seeding difficult.

Suitable management practices:
• Delay grazing until summer when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a short, cool growing season.

33G—Bullump gravelly loam, thin surface, 30 to 70 percent north slopes

Composition

Bullump soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Bullump Soil

Position on landscape: Hillsides and mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, rhyolite, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown gravelly loam
3 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly clay loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe or very severe

Contrasting Inclusions

• Bullump soils that are on mountainsides and have mountain big sagebrush in the potential plant community
• Redcanyon soils that are on south-facing slopes and have Wyoming big sagebrush in the potential plant community
• Rock outcrop

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on south-facing slopes.

- The thin surface layer restricts rooting depth.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- Slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The rock fragments in the soil restrict the placement of fenceposts.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate a cool growing season.

34G—Bullump-Nuss-Rock outcrop complex, 30 to 70 percent north slopes

Composition

Bullump soil and similar inclusions—35 percent
Nuss soil and similar inclusions—30 percent
Rock outcrop—20 percent
Contrasting inclusions—15 percent

Characteristics of the Bullump Soil

Position on landscape: Hillsides, mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite, tuff, basalt
Elevation: 6,000 to 7,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 11 inches—very dark grayish brown extremely gravelly loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly clay loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe or very severe

Characteristics of the Nuss Soil

Position on landscape: Hillsides
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 6,000 to 7,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown stony loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe or very severe

Characteristics of the Rock Outcrop

Position on landscape: Hillsides, mountainsides
Kind of rock: Tuff, basalt

Contrasting Inclusions

- Booth soils that are on less sloping hillsides and mountainsides and have low sagebrush in the potential plant community
- Soils that have slopes of less than 30 percent or more than 70 percent
- Rubble land
- Soils that are similar to the Bullump and Nuss soils but are very stony or very cobbly throughout
- Soils that are similar to the Nuss soil but have bedrock at a depth of 4 to 10 inches

Major Use

Livestock grazing

Major Management Factors

Bullump soil—water erosion, slope, Rock outcrop
Nuss soil—water erosion, slope, depth to bedrock, available water capacity, stones on the surface, Rock outcrop

Dominant Vegetation in Potential Plant Community

Bullump soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Sandberg bluegrass
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- The steepness of slope and areas of Rock outcrop restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The shallow depth to bedrock in the Nuss soil restricts rooting depth.
- The shallow depth of the Nuss soil, the rock fragments in the Bullump soil, and the areas of Rock outcrop limit placement of fenceposts and make special design of fences necessary.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

35F—Bullump-Nuss-Rock outcrop complex, 30 to 50 percent south slopes

Composition

Bullump soil and similar inclusions—40 percent
Nuss soil and similar inclusions—25 percent
Rock outcrop—20 percent
Contrasting inclusions—15 percent

Characteristics of the Bullump Soil

Position on landscape: Hillsides, mountainsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt, rhyolite
Elevation: 4,800 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 11 inches—very dark grayish brown extremely stony loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly clay loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Characteristics of the Nuss Soil

Position on landscape: Hillsides
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 4,800 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown stony loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Characteristics of the Rock Outcrop

Position on landscape: Hillsides, mountainsides, escarpments
Kind of rock: Tuff, basalt

Contrasting Inclusions

- Lorella soils that are on the lower part of slopes and have scattered western juniper in the potential plant community
- Winterim soils that are on the upper part of slopes and have ponderosa pine and western juniper in the potential plant community
- Royst soils that are on the upper part of hillsides and mountainsides and have scattered ponderosa pine in the potential plant community
- Booth soils that are on hillsides and mountainsides and have low sagebrush or mountain big sagebrush in the potential plant community
- Soils that are similar to the Bullump and Nuss soils but are very stony or very cobbly throughout
- Soils that have slopes of less than 30 percent
- Rubble land

Major Use

Livestock grazing

Major Management Factors

Bullump soil—slope, water erosion, stones on the surface, Rock outcrop
Nuss soil—slope, water erosion, depth to bedrock, available water capacity, Rock outcrop

Dominant Vegetation in Potential Plant Community

Bullump soil—bluebunch wheatgrass, mountain big sagebrush
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass

Livestock Grazing

General management considerations:

• Cold soil temperatures and a short growing season limit the period of plant growth.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• The bedrock in the Nuss soil restricts rooting depth.
• The steepness of slope, areas of Rock outcrop, and stones on the surface restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• The shallow depth of the Nuss soil, rock fragments in the Bullump soil, and areas of Rock outcrop limit placement of fenceposts and make special design of fences necessary.

Suitable management practices:

• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

36G—Bullump-Rock outcrop-Nuss complex, 20 to 70 percent south slopes

Composition

Bullump soil and similar inclusions—40 percent
Rock outcrop—25 percent
Nuss soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the Bullump Soil

Position on landscape: Hillsides and mountainsides that have slopes of 30 to 50 percent
Parent material: Kind—colluvium, residuum; source—tuff, basalt, rhyolite
Elevation: 4,800 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 11 inches—very dark grayish brown extremely stony loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly clay loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Characteristics of the Rock Outcrop

Position on landscape: Escarpments and mountainsides that have slopes of 50 to 70 percent
Kind of rock: Tuff, basalt

Characteristics of the Nuss Soil

Position on landscape: Hillsides that have slopes of 20 to 50 percent
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 4,800 to 6,600 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown stony loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Redcanyon soils that are on the lower part of hillsides and have Wyoming big sagebrush in the potential plant community
• Winterim soils that are on the upper part of mountainsides and have ponderosa pine and western juniper in the potential plant community
• Eglirim soils that are on colluvial fans near the base of slopes and have Wyoming big sagebrush in the potential plant community
• Royst soils that are on the upper part of hillsides and have scattered ponderosa pine in the potential plant community
• Lorella soils that are on the lower part of hillsides and mountainsides and have dominantly mountain big sagebrush in the potential plant community
• Booth soils that are on hillsides and mountainsides and have low sagebrush or mountain big sagebrush in the potential plant community
• Soils that are similar to the Bullump and Nuss soils but are very stony or very cobbly throughout
• Soils that have slopes of less than 20 percent
• Rubble land

Major Use

Livestock grazing

Major Management Factors

Bullump soil—slope, water erosion, stones on the surface, Rock outcrop
Nuss soil—slope, water erosion, depth to bedrock, Rock outcrop

Dominant Vegetation in Potential Plant Community

Bullump soil—bluebunch wheatgrass, mountain big sagebrush
Nuss soil—Idaho fescue, mountain big sagebrush, Cusick bluegrass, curlleaf mountainmahogany

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• The bedrock in the Nuss soil restricts rooting depth.
• The shallow depth of the Nuss soil, rock fragments in the Bullump soil, and areas of Rock outcrop limit placement of fenceposts and make special design of fences necessary.
• The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• The areas of Rock outcrop, stones on the surface, and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

37E—Bullump-Sherval complex, 5 to 30 percent slopes

Composition

Bullump soil and similar inclusions—65 percent
Sherval soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the Bullump Soil

Position on landscape: Hillsides, foot slopes
Parent material: Kind—colluvium, residuum; source—basalt, tuff, rhyolite
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 11 inches—very dark grayish brown very stony loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly clay loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Moderate or severe

Characteristics of the Sherval Soil

Position on landscape: Concave areas of

mountainsides and below escarpments on slopes of as much as 20 percent
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—18 to 22 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—30 to 50 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—partially decomposed grass and aspen leaves
0 to 9 inches—very dark grayish brown very cobbly loam
9 to 24 inches—dark brown very cobbly clay loam
24 to 38 inches—dark brown very gravelly clay loam
38 to 60 inches—dark yellowish brown very gravelly clay
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: About 6 inches
Hazard of erosion by water: Moderate or severe
Depth to seasonal high water table: January through June—12 to 24 inches; rest of year—more than 24 inches

Contrasting Inclusions

• Booth soils that are on hillsides and foot slopes and have low sagebrush in the potential plant community
• Nuss soils that are on hillsides and have curlleaf mountainmahogany in the potential plant community
• Soils that are similar to the Bullump soil but have bedrock at a depth of less than 60 inches

Major Use

Livestock grazing

Major Management Factors

Bullump soil—slope, water erosion, stones on the surface
Sherval soil—slope, water erosion, seasonal wetness, permeability

Dominant Vegetation in Potential Plant Community

Bullump soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush
Sherval soil—quaking aspen, Leiberg bluegrass, common snowberry, slender wheatgrass, big bluegrass, mountain big sagebrush

Livestock Grazing

General management considerations:
• Cold soil temperatures, a short growing season, and an extended period of snowpack on the Sherval soil limit the period of plant growth.
• The very stony surface layer of the Bullump soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be kept to a minimum.
• The water table in the Sherval soil rises if trees are removed.
• Development of springs for livestock and wildlife is feasible in areas of the Sherval soil.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Allow the Sherval soil to drain adequately before grazing to prevent damage to the soil and plants.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a cool growing season.

38F—Bullump-Lorella association, 30 to 50 percent slopes

Composition

Bullump soil and similar inclusions—50 percent
Lorella soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Bullump Soil

Position on landscape: North-facing slopes of hillsides and mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite, tuff, basalt
Elevation: 6,000 to 7,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:

0 to 11 inches—very dark grayish brown extremely gravelly loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly clay loam
42 to 60 inches—dark yellowish brown extremely gravelly loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Characteristics of the Lorella Soil

Position on landscape: South-facing slopes of hillsides and mountainsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 4 inches—dark brown very gravelly loam
4 to 19 inches—dark brown very cobbly clay loam
19 inches—tuff
Depth class: Shallow (10 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 11 and 19 inches

Contrasting Inclusions

• Booth soils that are on north-facing hillsides and mountainsides and have low sagebrush in the potential plant community
• Winterim soils that are on north-facing hillsides and mountainsides, are on the upper part of the slope, and have ponderosa pine and western juniper in the potential plant community
• Rock outcrop
• Lasere soils that are on south-facing hillsides and have low sagebrush in the potential plant community
• Nuss soils that are on south-facing hillsides and mountainsides, are on the upper part of the slope, and have curlleaf mountainmahogany and ponderosa pine in the potential plant community
• Soils that have slopes of less than 30 percent or more than 50 percent

Major Use

Livestock grazing

Major Management Factors

Bullump soil—slope, water erosion
Lorella soil—slope, water erosion, depth to bedrock, available water capacity, shrink-swell potential, permeability

Dominant Vegetation in Potential Plant Community

Bullump soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Sandberg bluegrass
Lorella soil—bluebunch wheatgrass, mountain big sagebrush

Livestock Grazing

General management considerations:
• Cold soil temperatures on the Bullump soil limit plant growth. Grazing should be delayed until the soil is warm and sufficient growth of forage plants is achieved.
• Livestock prefer to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The bedrock in the Lorella soil restricts rooting depth.
• The low available water capacity of the Lorella soil limits forage production and seedling survival.
• The shallow depth to bedrock in the Lorella soil and rock fragments on the Bullump soil limit placement of fenceposts and make special design of fences necessary.
• The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• If the Lorella soil is disturbed, slopes are likely to be unstable.

Suitable management practices:
• Delay grazing on the Bullump soil until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Bullump soil is seeded, select plants that tolerate a cool growing season.
• If the Lorella soil is seeded, select plants that tolerate droughtiness and shrinking and swelling.

• Manage unpalatable brushy plants on the Bullump soil in areas where they are abundant.

39G—Bullump-Rubble land association, 30 to 70 percent slopes

Composition

Bullump soil, south slopes, and similar inclusions—50 percent
Bullump soil, north slopes, and similar inclusions—20 percent
Rubble land—20 percent
Contrasting inclusions—10 percent

Characteristics of the Bullump Soils

Position on landscape: South-facing and north-facing mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite, tuff
Elevation: 6,000 to 7,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile of the Bullump soil, south slopes:
0 to 11 inches—very dark grayish brown extremely stony loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Typical profile of the Bullump soil, north slopes:
0 to 11 inches—very dark grayish brown extremely gravelly loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe or very severe

Characteristics of the Rubble land

Position on landscape: Mountainsides, escarpments
Kind of material: Tuff, rhyolite

Contrasting Inclusions

• Lasere soils that are on south-facing mountainsides and have low sagebrush in the potential plant community
• Nuss soils that are on north-facing hillsides and have curlleaf mountainmahogany and ponderosa pine in the potential plant community
• Booth soils that are on north-facing mountainsides and have low sagebrush in the potential plant community
• Soils that are similar to the Bullump soils but have bedrock at a depth of less than 60 inches
• Soils that have slopes of less than 30 percent
• Rock outcrop

Major Use

Livestock grazing

Major Management Factors

Water erosion, slope, stones on the surface

Dominant Vegetation in Potential Plant Community

Bullump soil, south slopes—bluebunch wheatgrass, mountain big sagebrush
Bullump soil, north slopes—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
• The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of the unit.
• The very stony surface layer, steepness of slope, and areas of Rubble land restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The rock fragments throughout the soils and the areas of Rubble land restrict the placement of fenceposts.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.

• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a cool growing season.

40B—Calimus silt loam, 0 to 5 percent slopes

Composition

Calimus soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Calimus Soil

Position on landscape: Lake basin terraces and alluvial fans
Parent material: Kind—alluvium; source—tuff, basalt, diatomite
Elevation: 4,300 to 5,000 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 2 inches—very dark grayish brown silt loam
2 to 30 inches—very dark gray silt loam
30 to 42 inches—dark grayish brown loamy sand
42 to 60 inches—dark grayish brown and very dark grayish brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 8 inches
Hazard of erosion: By water—slight; by wind—slight or moderate

Contrasting Inclusions

• Deter, Fordney, and Harriman soils that are on lake terraces
• Mesman soils that are on lower lake terraces and have basin big sagebrush and black greasewood in the potential plant community
• Lakeview soils that are on adjacent stream terraces
• McConnel soils that are on lower lake terraces

Major Uses

Livestock grazing, cropland

Major Management Factor

Wind erosion

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, basin wildrye, antelope bitterbrush, Idaho fescue

Livestock Grazing

General management considerations:
• The low precipitation limits forage production and seedling survival.
• This soil is subject to wind erosion if the plant cover is removed or degraded.
• This unit is suited to grazing in winter.
• If the plant cover is not sufficient to protect the soil from erosion, range seeding is needed.

Suitable management practices:
• If this unit is seeded, select plants that tolerate droughtiness.
• Manage unpalatable brushy plants in areas where these plants are abundant.
• Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is not suitable unless the soil is irrigated.
• Sprinkler irrigation is best suited to this soil.
• A wide variety of trees and shrubs can be used for windbreaks and environmental planting on this soil.

Suitable management practices:
• Reduce the risk of wind erosion by planting crops in narrow strips at right angles to the prevailing wind, maintaining crop residue on the surface, stripcropping, and keeping mulch on the surface.
• Irrigate during the dry period in summer.
• Reduce surface crusting and wind erosion by keeping tillage at a minimum and incorporating organic matter.
• Cultivate or apply herbicides to remove competing vegetation.

41C—Carryback very cobbly loam, 2 to 15 percent slopes

Composition

Carryback soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Carryback Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—dark brown very cobbly loam
2 to 8 inches—very dark grayish brown silty clay loam
8 to 15 inches—brown clay
15 to 22 inches—brown silty clay loam
22 to 27 inches—brown silt loam
27 to 33 inches—brown loam
33 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (4 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 8 and 15 inches
Carbonates: Between depths of 22 and 27 inches—slightly effervescent; below this depth—strongly effervescent

Contrasting Inclusions

- Newlands soils that are on mountain foot slopes and have mountain big sagebrush in the potential plant community
- Ninemile soils that are on tablelands and have dominantly Sandberg bluegrass and low sagebrush in the potential plant community
- Rock outcrop
- Soils that are similar to the Carryback soil but have a hardpan or bedrock at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Rock fragments on the surface, depth to the claypan, permeability, calcareous layer, water erosion, depth to bedrock, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The surface layer is saturated following snowmelt.
- The claypan, calcareous layer, and bedrock restrict rooting depth.
- The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.
- The depth to bedrock limits the construction of water impoundments.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- Livestock herd and graze in the less stony or cobbly areas of the unit.
- The very cobbly surface layer may restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

42B—Carryback complex, 0 to 5 percent slopes

Composition

Carryback soil, very cobbly, and similar inclusions—60 percent
Carryback soil, very stony, and similar inclusions—25 percent
Contrasting inclusions—15 percent

Characteristics of the Carryback Soils

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,400 feet
Climatic factors:

Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile of the Carryback soil, very cobbly:
0 to 2 inches—dark brown very cobbly loam
2 to 8 inches—very dark grayish brown silty clay loam
8 to 15 inches—brown clay
15 to 22 inches—brown silty clay loam
22 to 27 inches—brown silt loam
27 to 33 inches—brown loam
33 inches—tuff

Typical profile of the Carryback soil, very stony:
0 to 2 inches—dark brown very stony silty clay loam
2 to 8 inches—very dark grayish brown silty clay loam
8 to 15 inches—brown clay
15 to 22 inches—brown silty clay loam
22 to 27 inches—brown silt loam
27 to 33 inches—brown loam
33 inches—tuff

Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow or shallow (4 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Shrink-swell potential: High between depths of 8 and 15 inches
Carbonates: Between depths of 22 and 27 inches—slightly effervescent; below this depth—strongly effervescent

Contrasting Inclusions

- Rock outcrop
- Pearlwise soils that are on tablelands and have mountain big sagebrush in the potential plant community
- Freznik soils that are on tablelands and are at the lower elevations

Major Use

Livestock grazing

Major Management Factors

Carryback soil, very cobbly—depth to the claypan, permeability, depth to bedrock, calcareous layer, shrink-swell potential
Carryback soil, very stony—stones on the surface, depth to the claypan, permeability, depth to bedrock, calcareous layer, shrink-swell potential

Dominant Vegetation in Potential Plant Community

- Carryback soil, very cobbly—Idaho fescue, low sagebrush, bluebunch wheatgrass
- Carryback soil, very stony—low sagebrush, Sandberg bluegrass, Idaho fescue, western juniper

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The claypan, calcareous layer, and bedrock restrict rooting depth.
- The surface layer is saturated following snowmelt.
- The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.
- The depth to bedrock limits the construction of water impoundments.
- The very stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

43C—Carryback-Rock outcrop complex, 5 to 15 percent slopes

Composition

Carryback soil and similar inclusions—50 percent
Rock outcrop—35 percent
Contrasting inclusions—15 percent

Characteristics of the Carryback Soil

Position on landscape: Tablelands

Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—dark brown very cobbly loam
2 to 8 inches—very dark grayish brown silty clay loam
8 to 15 inches—brown clay
15 to 22 inches—brown silty clay loam
22 to 27 inches—brown silt loam
27 to 33 inches—brown loam
33 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow or shallow (4 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 8 and 15 inches
Carbonates: Between depths of 22 and 27 inches—slightly effervescent; below this depth—strongly effervescent

Characteristics of the Rock Outcrop

Position on landscape: Tablelands
Kind of rock: Basalt, tuff

Contrasting Inclusions

• Newlands soils that are on mountain toe slopes and have mountain big sagebrush in the potential plant community
• Ninemile soils that are on adjacent tablelands and have dominantly Sandberg bluegrass and low sagebrush in the native plant community

Major Use

Livestock grazing

Major Management Factors

Rock fragments on the surface, depth to the claypan, permeability, calcareous layer, water erosion, depth to bedrock, shrink-swell potential, Rock outcrop

Dominant Vegetation in Potential Plant Community

Carryback soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Seeding of the Carryback soil is difficult because of the pattern in which it occurs with the areas of Rock outcrop.
• Livestock herd and graze in the less stony areas of the unit.
• The claypan and bedrock restrict rooting depth.
• The depth to bedrock limits the construction of water impoundments.
• The surface layer is saturated following snowmelt.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

44C—Chewaucan very cobbly silty clay loam, 2 to 15 percent slopes

Composition

Chewaucan soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Chewaucan Soil

Position on landscape: Bedrock-controlled lake terraces
Parent material: Kind—lacustrine deposits; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—12 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days

Typical profile:
0 to 5 inches—dark brown very cobbly silty clay loam
5 to 10 inches—dark brown silty clay loam
10 to 24 inches—dark yellowish brown silty clay loam
24 to 44 inches—dark yellowish brown loam
44 inches—basalt

Depth class: Deep (40 to 60 inches) to bedrock, moderately deep (20 to 40 inches) to a firm brittle layer
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Slight or moderate
Carbonates: Between depths of 24 and 44 inches—strongly effervescent

Contrasting Inclusions

- Redcanyon soils that are on south- and north-facing escarpments
- Lasere soils that are on hills and have low sagebrush in the potential plant community
- Rock outcrop
- McConnel soils that are on lower lake basin terraces
- Soils that have slopes of less than 2 percent or more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Rock fragments on the surface, calcareous layer, water erosion

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Idaho fescue, antelope bitterbrush

Livestock Grazing

General management considerations:
- The firm, brittle calcareous lower layer may restrict rooting depth.
- The very cobbly surface layer may restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

45E—Chocktoot very gravelly loam, 15 to 40 percent north slopes

Composition

Chocktoot soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Chocktoot Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff, volcanic ash
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days

Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
2 inches to 0—white fir needles
0 to 12 inches—dark brown and very dark grayish brown very gravelly loam
12 to 36 inches—dark brown very gravelly clay loam
36 to 60 inches—dark brown very gravelly loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Hallihan, Hammersley, and Kittleson soils that are on adjacent mountainsides
- Soils that are similar to the Chocktoot soils but have less than 35 percent rock fragments throughout
- Soils that have southerly aspects or have slopes of more than 40 percent
- Soils that are similar to the Chocktoot soils but have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Cold summer temperatures, content of rock fragments, slope, water erosion

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine

Woodland

Estimated growth at culmination of mean annual increment: 77 cubic feet per acre per year for white fir at age 70

General management considerations:
• Accumulations of snow can bend or break small trees.
• Cuts and fills are stable.
• Rock fragments limit tree planting.
• Wet, unsurfaced roads and skid trails are firm.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management activities within this zone should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• Because this soil is cold in summer, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
• Mechanical piling of slash should be minimized. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash material on the soil surface to reduce sheet and rill erosion.

Suitable management practices:
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
• To reduce compaction, adjust yarding operations to the content of soil moisture, organic matter, and rock fragments in the surface layer.
• To reduce compaction and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring.

45G—Chocktoot very gravelly loam, 40 to 60 percent north slopes

Composition

Chocktoot soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Chocktoot Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff, volcanic ash
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
2 inches to 0—white fir needles
0 to 12 inches—dark brown and very dark grayish brown very gravelly loam
12 to 36 inches—dark brown very gravelly clay loam
36 to 60 inches—dark brown very gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Hallihan, Hammersley, and Kittleson soils that are on adjacent mountainsides
• Soils that are similar to the Chocktoot soil but have less than 35 percent rock fragments throughout
• Soils that have southerly aspects or slopes of less than 40 percent
• Soils that are similar to the Chocktoot soil but have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Cold summer temperatures, content of rock fragments, slope, water erosion

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine

Woodland

Estimated growth at culmination of mean annual increment: 77 cubic feet per acre per year for white fir at age 70

General management considerations:
• Accumulations of snow can bend or break small trees.
• Cuts and fills are stable.
• The rock fragments limit tree planting.
• Wet, unsurfaced roads are firm.
• Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
• Because this soil is cold in summer, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.
• Cable yarding systems minimize soil displacement.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
• To minimize compaction and erosion, avoid logging in spring.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
• Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.

46E—Chocktoot-Kittleson complex, 15 to 40 percent north slopes

Composition

Chocktoot soil and similar inclusions—50 percent
Kittleson soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Chocktoot Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff, volcanic ash
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
2 inches to 0—white fir needles
0 to 12 inches—dark brown and very dark grayish brown very gravelly loam
12 to 36 inches—dark brown very gravelly clay loam
36 to 60 inches—dark brown very gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Characteristics of the Kittleson Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
3 inches to 0—white fir needles
0 to 44 inches—dark brown sandy loam
44 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Hallihan and Hammersley soils that are on adjacent mountainsides
• Soils that have southerly aspects or slopes of more than 40 percent

Major Use

Woodland

Major Management Factors

Chocktoot soil—cold temperatures in summer, rock fragments, slope, water erosion
Kittleson soil—cold temperatures in summer, slope, water erosion, depth to bedrock

Dominant Vegetation in Potential Plant Community

Chocktoot and Kittleson soils—white fir, ponderosa pine

Woodland

Estimated growth at culmination of mean annual increment: Chocktoot soil—77 cubic feet per acre per year for white fir at age 70; Kittleson soil—57 cubic feet per acre per year for white fir at age 70

General management considerations:
• Accumulations of snow can bend or break small trees.
• Cuts and fills are stable.
• Rock fragments limit tree planting on the Chocktoot soil.
• Wet, unsurfaced roads and skid trails on the Chocktoot soil are firm, and those on the Kittleson soil are soft.
• Dry, unsurfaced roads and skid trails on the Kittleson soil are dusty.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• Because the soils in this unit are cold in summer, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
• Mechanical piling of slash should be minimized. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.

Suitable management practices:
• To minimize compaction, adjust yarding operations to the content of moisture and organic matter in the surface layer.
• To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
• Reduce the risk of erosion and displacement of the Kittleson soil by limiting vehicle access to periods when the soil is dry or frozen.

47C—Corral fine sandy loam, 2 to 15 percent slopes

Composition

Corral soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Corral Soil

Position on landscape: Dissected fans
Parent material: Kind—residuum, colluvium; source—tuff
Elevation: 5,300 to 5,600 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 5 inches—brown fine sandy loam
5 to 13 inches—dark yellowish brown sandy clay loam
13 inches—yellowish brown soft tuff that has calcium carbonate in fractures
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 2 inches
Hazard of erosion: By water—moderate; by wind—moderate

Contrasting Inclusions

• Outcroppings of tuffaceous sediment
• Brace and Ratto soils that are on tablelands
• Soils that are similar to the Corral soil but have tuffaceous sediment at a depth of 20 to 40 inches

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, available water capacity, wind erosion

Dominant Vegetation in Potential Plant Community

Thurber needlegrass, Sandberg bluegrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
- The fine sandy loam surface layer is subject to wind erosion if the plant cover is removed.
- The bedrock restricts rooting depth.
- The low available water capacity limits forage production and seedling survival.
- The shallow depth limits placement of fenceposts and makes special design of fences necessary.
- The depth to bedrock limits construction of water impoundments.
- Range seeding controls blowing and drifting sand.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness.
- Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

48C—Corral fine sandy loam, low precipitation, 2 to 15 percent slopes

Composition

Corral soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Corral Soil

Position on landscape: Dissected fans
Parent material: Kind—colluvium, residuum; source—tuff
Elevation: 5,000 to 5,300 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 5 inches—brown fine sandy loam
5 to 13 inches—dark yellowish brown sandy clay loam
13 inches—yellowish brown soft tuff that has calcium carbonate in fractures
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 2 inches
Hazard of erosion: By water—moderate; by wind—moderate

Contrasting Inclusions

- Outcroppings of tuffaceous sediment
- Brace and Ratto soils that are on tablelands
- Soils that are similar to the Corral soil but have tuffaceous sediment at a depth of 20 to 40 inches

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, available water capacity, wind erosion

Dominant Vegetation in Potential Plant Community

Indian ricegrass, Wyoming big sagebrush, Thurber needlegrass, needleandthread

Livestock Grazing

General management considerations:
- The fine sandy loam surface layer is subject to wind erosion if the plant cover is removed.
- The bedrock restricts rooting depth.
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The shallow depth limits placement of fenceposts and makes special design of fences necessary.
- The depth to bedrock limits construction of water impoundments.
- This unit is suited to grazing in winter.
- Range seeding controls blowing and drifting sand.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness.
- Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

49C—Coztur very gravelly sandy loam, 2 to 15 percent slopes

Composition

Coztur soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Coztur Soil

Position on landscape: Tablelands

Parent material: Kind—residuum, colluvium; source—basalt, tuff
Elevation: 5,300 to 5,800 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—very dark grayish brown very gravelly sandy loam
2 to 9 inches—dark grayish brown gravelly sandy loam
9 to 15 inches—dark yellowish brown gravelly clay loam
15 inches—basalt
Depth class: Shallow (14 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 2 inches
Hazard of erosion: By water—moderate; by wind—slight or moderate

Contrasting Inclusions

• Anawalt soils that are on tablelands and have low sagebrush in the potential plant community
• Rock outcrop
• Soils that are similar to the Coztur soil but have bedrock at a depth of more than 20 inches
• Soils that have slopes of more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Available water capacity, gravel, depth to bedrock, wind erosion, water erosion

Dominant Vegetation in Potential Plant Community

Thurber needlegrass, Sandberg bluegrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The bedrock restricts rooting depth.
• The low available water capacity limits forage production and seedling survival.
• The shallow depth limits placement of fenceposts and makes special design of fences necessary.
• The depth to bedrock limits construction of water impoundments.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

50A—Cressler silty clay loam, 0 to 2 percent slopes

Composition

Cressler soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Cressler Soil

Position on landscape: Upland basins
Parent material: Kind—alluvium; source—basalt
Elevation: 5,500 to 6,800 feet
Climatic factors:
Mean annual precipitation—22 to 26 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—30 to 50 days
Typical profile:
0 to 6 inches—very dark grayish brown silty clay loam
6 to 15 inches—very dark brown silty clay
15 to 38 inches—grayish brown silty clay
38 to 48 inches—brown clay loam
48 to 60 inches—brown extremely stony clay
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat poorly drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: December to June—6 inches above the surface to 36 inches below the surface; rest of year—more than 36 inches
Frequency of flooding: Rare
Shrink-swell potential: High between depths of 6 and 60 inches
Load supporting capacity when wet: Low

Contrasting Inclusions

• Soils that are similar to the Cressler soil but have bedrock at a depth of more than 60 inches

• Soils that are similar to the Cressler soil but are very poorly drained or are moderately well drained or well drained because of the erosional downcutting and entrenching of the stream channel

Major Uses

Livestock grazing (fig. 9), wildlife habitat

Figure 9.—Area of Cressler silty clay loam, 0 to 2 percent slopes, in mountain meadow. This soil provides forage for livestock late in summer and in fall. Rogger and Woodchopper soils are on forested mountains.

Major Management Factors

Wetness, shrink-swell, potential frost action

Dominant Vegetation in Potential Plant Community

Tufted hairgrass

Livestock Grazing

General management considerations:

• Because the water on the surface is from snowmelt in spring, the amount and duration is dependent on the winter snowpack.
• This unit provides food and cover for wildlife.
• Grazing should be deferred during the period of nesting for waterfowl.
• A high water table during the growing season restricts the rooting depth of non-water-tolerant plants.
• Periodic inundation increases the amount of moisture available for plants and thus increases the production of forage.
• Plants are subject to winterkill and other damage because of the high potential for frost action.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• Grazing should be managed to maintain or increase the abundance of plants that help to stabilize streambanks, reduce erosion, and moderate water temperatures.

Suitable management practices:

• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• Reduce streambank erosion and improve the quality and quantity of the water by fencing along riparian areas.
• Delay grazing until late in summer when forage plants have achieved sufficient growth.
• If this unit is seeded, select plants that tolerate wetness and frost heaving and that provide cover for wildlife.

51A—Crump muck, 0 to 1 percent slopes

Composition

Crump soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Crump Soil

Position on landscape: Concave areas of alluvial flats adjacent to open water areas in lake basins
Parent material: Kind—silty lacustrine sediment; source—basalt, tuff
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 8 inches—black muck
8 to 13 inches—black silt
13 to 60 inches—very dark grayish brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Very poorly drained
Permeability: Moderate
Available water capacity: About 14 inches
Hazard of erosion by water: None or slight
Depth to water table: 12 inches above the surface to 42 inches below the surface throughout the year

Frequency of flooding: Rare
Load supporting capacity when wet: Low

Contrasting Inclusions

• Ozamis, Pit, and Reese soils that are on adjacent, slightly higher alluvial flats
• Soils that are similar to the Crump soil but have a thick organic layer as much as 18 inches thick

Major Uses

Wildlife habitat, livestock grazing, hayland

Major Management Factors

Wetness, load supporting capacity, frost action

Dominant Vegetation in Potential Plant Community

Rushes, sedges, cattails

Livestock Grazing

General management considerations:
• Because the water on the surface is from snowmelt in spring, the amount and duration varies. During years when the winters are wet, ponding lasts until midsummer or late in summer. During years when the winters are dry, ponding lasts only for short periods in spring.
• This unit provides food and cover for wetland wildlife (fig. 10).

Figure 10.—Area of Crump muck, 0 to 1 percent slopes, used as habitat for wetland wildlife. Escarpment of Hart Mountain in background.

• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction of the surface layer and poor tilth.
• A high water table during the growing season and spring ponding restrict rooting depth.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If this unit is seeded, select plants that tolerate periods of inundation and frost heaving and that provide cover for nesting waterfowl.

Hayland

General management considerations:
• Wetness limits access for hay operations.
• Unless the soil is adequately drained, machinery will compact the surface and become embedded because of the low load supporting capacity of the soil.
• Because of the high amount of organic matter in the surface layer, the risk of wind erosion is increased if the plant cover is removed when the soil is dry.
• Wetness limits the choice of hay and pasture plants and increases the risk of winterkill.
• Plants are subject to winterkill and other damage because of a high potential for frost action.
• Hay operations are restricted to periods late in summer or early in fall because of seasonal wetness.
• Minimizing disturbance of the surface maintains the plant cover and reduces the risk of wind erosion.

52A—Crump silty clay loam, drained, 0 to 1 percent slopes

Composition

Crump soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Crump Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—silty lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 8 inches—black silty clay loam
8 to 13 inches—black silt
13 to 60 inches—very dark grayish brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock

Drainage class: Very poorly drained
Permeability: Moderate
Available water capacity: About 13 inches
Hazard of erosion by water: None or slight
Depth to water table: 24 to 48 inches throughout the year
Frequency of flooding: Rare

Contrasting Inclusions

• Ozamis and Pit soils that are on adjacent, slightly higher alluvial flats
• Soils that are similar to the Crump soil but have an organic layer as much as 18 inches thick

Major Uses

Hayland, cropland, livestock grazing, wildlife habitat

Major Management Factors

Wetness, slope, frost action

Dominant Vegetation in Potential Plant Community

Spikerush, dock, Baltic rush, povertyweed, mat muhly, bottlebrush squirreltail

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife early in spring.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• Because this unit is nearly level, drainage is difficult to maintain.
• This unit is suited to grazing in winter.
• Drainage ditches need to be maintained to remove surface water.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If this unit is seeded, select plants that tolerate wetness and frost heaving.

Hayland and Cropland

General management considerations:
• Most climatically adapted crops can be grown if adequate drainage is maintained.
• Because this unit is nearly level, drainage is difficult to maintain.
• The seasonal high water table provides moisture for hay and pasture plants.
• Supplemental irrigation is needed for most crops late in summer.
• Suitable irrigation methods include sprinkler and border systems.
• Wetness limits the choice of plants, restricts the period for haying, and increases the risk of winterkill.
• Maintaining the drainage systems allows the soil to drain more effectively.
• Maintaining surface and subsurface drains prevents ponding on the surface, keeps the water table at a suitable level, and allows for earlier access for haying operations.
• Plants are subject to winterkill and other damage because of a high potential for frost action.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of wetness.
• The seedling mortality rate is moderate because the soil is very poorly drained.
• Cultivation or application of herbicides helps to control competing vegetation.
• Regulating the rate of application of irrigation water prevents a rise in the level of the water table.

53A—Crump-Boravall complex, drained, 0 to 1 percent slopes

Composition

Crump soil and similar inclusions—55 percent
Boravall soil and similar inclusions—35 percent
Contrasting inclusions—10 percent

Characteristics of the Crump Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—silty lacustrine sediment; source—basalt, tuff
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 8 inches—black silty clay loam
8 to 13 inches—black silt
13 to 60 inches—very dark grayish brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Very poorly drained
Permeability: Moderate
Available water capacity: About 13 inches
Hazard of erosion by water: None or slight
Depth to water table: 24 to 48 inches throughout the year
Frequency of flooding: Rare

Characteristics of the Boravall Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 6 inches—dark grayish brown silt loam
6 to 12 inches—dark brown silt loam
12 to 19 inches—very dark gray and brown silty clay
19 to 36 inches—very dark gray and light yellowish brown silty clay
36 to 60 inches—light yellowish brown and very dark gray silt loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: March through July—18 to 36 inches; rest of year—more than 36 inches
Frequency of flooding: Rare
Shrink-swell potential: High between depths of 12 and 36 inches
Salinity: Upper 12 inches—strongly saline; below this depth—moderately saline
Sodicity: Strongly sodic
Carbonates: Strongly effervescent or violently effervescent

Contrasting Inclusions

• Ozamis, Pit, and Reese soils that are on adjacent, slightly higher alluvial flats

Major Uses

Hayland, cropland, wildlife habitat, livestock grazing

Major Management Factors

Crump soil—wetness, slope, frost action
Boravall soil—wetness, available water capacity, slope, salinity, sodicity, permeability, frost action, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Crump soil—spikerush, dock, Baltic rush, povertyweed, mat muhly, bottlebrush squirreltail
Boravall soil—inland saltgrass, basin wildrye, alkali sacaton, alkali bluegrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife early in spring.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• Because the soil is nearly level, drainage is difficult to maintain.
• Salts in the Boravall soil reduce the amount of water available to plants and limit seedling survival.
• The strongly sodic surface layer of the Boravall soil severely limits seedling survival.
• Excess sodium in the Boravall soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface reduces infiltration and restricts seedling emergence and survival.
• This unit is suited to grazing in winter.
• Drainage ditches need to be maintained to remove surface water.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If the Crump soil is seeded, select plants that tolerate wetness and frost heaving.
• If the Boravall soil is seeded, select plants that tolerate wetness, strong salinity and sodicity, and frost heaving and that provide cover for nesting waterfowl.

Hayland and Cropland

General management considerations:
• The concentration of salts and sodium in the Boravall soil limits the production of some hay and pasture plants.
• The salinity and sodicity of the Boravall soil limit the kinds of crops that can be grown.
• The Boravall soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
• Wetness limits the choice of hay and pasture plants, restricts the period of haying, and increases the risk of winterkill.
• Because the soil is nearly level, drainage is difficult to maintain.
• The seasonal high water table provides moisture for crops and hay and pasture plants.
• Supplemental irrigation water is needed for most crops late in summer.
• Suitable irrigation methods include sprinkler and border systems.

• Because of the high corrosivity of the Boravall soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Maintaining the drainage systems allows the soil to drain more effectively.
• Maintaining surface and subsurface drains prevents ponding on the surface, keeps the water table at a suitable level, and allows for earlier access for haying operations.
• Unless proper amounts of soil amendments are applied, removing salts from the Boravall soil causes dispersion and crusting of the surface.
• Dispersion and crusting of the surface of the Boravall soil reduces infiltration and limits seedling emergence and survival.
• Plants are subject to winterkill and other damage because of a high potential for frost action.
• Trees and shrubs for windbreaks and environmental plantings on the Crump soil should be tolerant of wetness.
• Because the Crump soil is very poorly drained, the seedling mortality rate is moderate.
• Because of the salinity and sodicity of the Boravall soil, trees and shrubs suitable for windbreaks and environmental plantings are limited and the seedling mortality rate is severe.
• Cultivation or application of herbicides helps to control competing vegetation.

Suitable management practices:
• Regulate the application rate of irrigation water to prevent a rise in the level of the water table and an increase in the upward movement of salts and sodium.
• Reduce the content of sodium in the Boravall soil by applying proper amounts of soil amendments, leaching out the salts, and carefully applying irrigation water.

54A—Crump-Ozamis complex, drained, 0 to 1 percent slopes

Composition

Crump soil and similar inclusions—45 percent
Ozamis soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Crump Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—thin layer of highly decomposed organic material over silty lacustrine sediment; source—basalt, tuff
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 8 inches—black silty clay loam
8 to 13 inches—black silt
13 to 60 inches—very dark grayish brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Very poorly drained
Permeability: Moderate
Available water capacity: About 13 inches
Hazard of erosion by water: None or slight
Depth to water table: 24 to 48 inches throughout the year
Frequency of flooding: Rare

Characteristics of the Ozamis Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 10 inches—black silty clay loam
10 to 34 inches—dark gray silt loam
34 to 36 inches—very pale brown coarse pumice sand
36 to 60 inches—dark gray very fine sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: None or slight
Depth to water table (artificially lowered): March through June—18 to 48 inches; rest of year—more than 48 inches
Frequency of flooding: Rare

Contrasting Inclusions

• Pit and Reese soils that are on adjacent alluvial flats in basins

Major Uses

Hayland, cropland, livestock grazing, wildlife habitat

Major Management Factors

Crump and Ozamis soils—wetness, slope, frost action

Dominant Vegetation in Potential Plant Community

Crump soil—spikerush, dock, Baltic rush, povertyweed, mat muhly, bottlebrush squirreltail
Ozamis soil—tufted hairgrass, Nebraska sedge, Baltic rush, northern mannagrass, reedgrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife early in spring.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• Because the unit is nearly level, drainage is difficult to maintain.
• The low precipitation limits forage production and seedling survival.
• This unit is suited to grazing in winter.

Suitable management practices:
• Maintain drainage ditches to remove surface water.
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If this unit is seeded, select plants that tolerate wetness and frost heaving.

Hayland and Cropland

General management considerations:
• Most climatically adapted crops can be grown if adequate drainage is maintained.
• Because the unit is nearly level, drainage is difficult to maintain.
• The seasonal high water table provides moisture for crops and hay and pasture plants.
• Supplemental irrigation water is needed for most crops late in summer.
• Suitable irrigation methods include sprinkler and border systems.
• Wetness limits the choice of hay and pasture plants, restricts the period for haying, and increases the risk of winterkill.
• Because of the high corrosivity of the Ozamis soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Plants are subject to winterkill and other damage because of the high potential for frost action.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of wetness.
• Cultivation or application of herbicides helps to control competing vegetation.

Suitable management practices:
• Maintain surface and subsurface drains to prevent ponding of the surface, keep the water table at a suitable level, and allow for earlier access for haying operations.
• Maintain the drainage systems to allow the soil to drain more effectively.
• Regulate the application of irrigation water to prevent a rise in the level of the water table.

55A—Crump-Pit complex, 0 to 1 percent slopes

Composition

Crump soil and similar inclusions—50 percent
Pit soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Crump Soil

Position on landscape: Concave areas of alluvial flats adjacent to open water areas in lake basins
Parent material: Kind—decomposed organic material over silty lacustrine sediment; source—basalt, tuff
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 8 inches—black muck
8 to 13 inches—black silt
13 to 60 inches—very dark grayish brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Very poorly drained
Permeability: Moderate
Available water capacity: About 14 inches
Hazard of erosion by water: None or slight
Depth to water table: 12 inches above the surface to 42 inches below the surface throughout the year
Frequency of flooding: Rare
Load supporting capacity when wet: Low

Characteristics of the Pit Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—alluvium over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet

Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—black silty clay
5 to 24 inches—black clay
24 to 40 inches—very dark grayish brown clay
40 to 60 inches—very dark grayish brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: None or slight
Depth to water table: December to May—6 inches above the surface to 36 inches below the surface; rest of year—more than 36 inches
Frequency of flooding: Rare
Shrink-swell potential: High in the upper 40 inches

Contrasting Inclusions

• Ozamis and Reese soils that are on adjacent, higher lying alluvial flats

Major Uses

Wildlife habitat, hayland, livestock grazing

Major Management Factors

Crump soil—wetness, load supporting capacity, frost action
Pit soil—wetness, shrink-swell potential, permeability, frost action, clayey surface layer

Dominant Vegetation in Potential Plant Community

Crump soil—rushes, sedges, cattails
Pit soil—spikerush, dock, Baltic rush, povertyweed, mat muhly, bottlebrush squirreltail

Livestock Grazing

General management considerations:
• Because the water on the surface is from snowmelt in spring, the amount and duration varies. During years when the winters are wet, ponding extends into midsummer or late in summer. During years when the winters are dry, ponding lasts for only short periods in spring.
• This unit provides food and cover for wetland wildlife.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction of the surface layer.
• A high water table during the growing season and ponding in spring restrict rooting depth.
• The Pit soil is very sticky when wet.
• The Pit soil expands when wet and contracts when dry, which can rip and tear plant roots and makes special design of fences necessary.
• This unit is suited to grazing in winter.

Suitable management practices:
• Delay grazing until the soils are adequately drained and are firm enough to withstand trampling by livestock.
• If the Crump soil is seeded, select plants that tolerate periods of inundation and frost heaving and that provide cover for nesting waterfowl.
• If the Pit soil is seeded, select plants that tolerate shrinking and swelling, periods of inundation, and frost heaving and that provide cover for nesting waterfowl.

Hayland

General management considerations:
• Wetness limits the period of access for haying operations.
• Unless the soils are adequately drained, machinery will compact the surface of the soils and become embedded because of the low load supporting capacity of the Crump soil and the clayey surface of the Pit soil.
• Wetness limits the choice of hay and pasture plants and increases the risk of winterkill.
• Because of the high corrosivity of the Pit soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Haying operations are restricted to periods late in summer or early in fall because of seasonal wetness.
• Plants are subject to winterkill and other damage because of the high potential for frost action.

56A—Crump-Reese complex, 0 to 1 percent slopes

Composition

Crump soil and similar inclusions—50 percent
Reese soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Crump Soil

Position on landscape: Concave areas on alluvial flats adjacent to open water areas in lake basins
Parent material: Kind—decomposed organic material over silty lacustrine sediment; source—basalt, tuff
Elevation: 4,200 to 4,800 feet

Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 8 inches—black muck
8 to 13 inches—black silt
13 to 60 inches—very dark grayish brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Very poorly drained
Permeability: Moderate
Available water capacity: About 14 inches
Hazard of erosion by water: None or slight
Depth to water table: 12 inches above the surface to 42 inches below the surface throughout the year
Frequency of flooding: Rare
Load supporting capacity when wet: Low

Characteristics of the Reese Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—black silty clay
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: None or slight
Depth to high water table: March through July—12 to 36 inches; rest of year—more than 36 inches
Frequency of flooding: Rare
Salinity: Upper 10 inches—strongly saline; below this depth—moderately saline or slightly saline
Sodicity: Upper 33 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

• Ozamis soils that are on adjacent, slightly higher alluvial flats
• Icene soils that are on slightly higher lake terraces and have shadscale and black greasewood in the potential plant community

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Crump soil—wetness, load supporting capacity, frost action
Reese soil—wetness, salinity, sodicity, available water capacity, permeability, frost action, clayey surface layer

Dominant Vegetation in Potential Plant Community

Crump soil—rushes, sedges, cattails
Reese soil—alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction of the surface layer and poor tilth.
• Because the water on the surface of the Crump soil is from snowmelt in spring, the amount and duration varies. During years when the winters are wet, ponding lasts until midsummer or late in summer. During years when the winters are dry, ponding lasts only for short periods in spring.
• Plant growth on the Crump soil is restricted by the high water table during the growing season and by ponding.
• Salts in the Reese soil reduce the amount of water available to plants, and the sodic surface layer restricts seedling survival.
• Excess sodium in the Reese soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce the infiltration rate and restrict seedling emergence and survival.
• This unit is suited to grazing in winter.

Suitable management practices:
• Allow the unit to drain adequately before grazing to prevent damage to the soils and plants.
• If the Crump soil is seeded, select plants that tolerate inundation and frost heaving and that provide cover for nesting waterfowl.
• If the Reese soil is seeded, select plants that tolerate strong salinity and sodicity, wetness, and frost heaving.

Hayland

General management considerations:
• Wetness limits the period of access for haying operations.
• Wetness limits the choice of hay and pasture plants and increases the risk of winterkill.
• Unless the soils are adequately drained, machinery will compact the surface of the soils and become embedded because of the low load supporting capacity of the Crump soil and the clayey surface layer of the Reese soil.
• Because of the high amount of organic matter in the surface layer of the Crump soil, removing the plant cover when the soil is dry increases the risk of wind erosion.
• The concentration of salts and sodium in the Reese soil limits the production of some hay and pasture plants.
• The Reese soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
• Because of the high corrosivity of the Reese soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Haying operations are restricted to periods late in summer or early in fall because of seasonal wetness.
• Minimize disturbance of the surface of the Crump soil to maintain the plant cover and reduce the risk of wind erosion.
• Plants are subject to winterkill and other damage because of the high potential for frost action.

57A—Degarmo-Welch complex, 0 to 2 percent slopes

Composition

Degarmo soil and similar inclusions—50 percent
Welch soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Degarmo Soil

Position on landscape: Narrow flood plains on tablelands in areas slightly higher than the Welch soil
Parent material: Kind—alluvium; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—10 to 16 inches
Mean annual air temperature—43 to 47 degrees F
Frost-free period—50 to 90 days
Typical profile:
0 to 11 inches—black silt loam
11 to 17 inches—black silty clay loam
17 to 28 inches—very dark gray silty clay loam
28 to 35 inches—very dark gray gravelly clay loam
35 to 42 inches—very dark gray cobbly loamy sand
42 to 60 inches—dark brown extremely gravelly loamy sand
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (24 to 35 inches) to stratified sand and gravel
Drainage class: Somewhat poorly drained
Permeability: Moderately slow over rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: March through June—18 to 36 inches; rest of year—more than 36 inches
Frequency of flooding: Frequent for brief periods in March through June

Characteristics of the Welch Soil

Position on landscape: Narrow flood plains on tablelands in areas slightly lower than the Degarmo soil
Parent material: Kind—alluvium; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—10 to 16 inches
Mean annual air temperature—43 to 47 degrees F
Frost-free period—50 to 90 days
Typical profile:
0 to 9 inches—black silty clay loam
9 to 27 inches—black clay loam
27 to 62 inches—very dark brown clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 10 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: November through June—12 to 18 inches; rest of year—more than 18 inches
Frequency of flooding: Frequent for brief periods in March through June

Contrasting Inclusions

• Welch soils that are in small basins and are ponded during the growing season
• Swalesilver soils that are on adjacent, slightly higher lake terraces and have dominantly silver sagebrush in the potential plant community
• Soils that are similar to the Degarmo and Welch soils

but are moderately well drained or well drained because of erosional downcutting and entrenching of stream channels
• Soils that are similar to the Degarmo soil but have stratified sand and gravel at a depth of less than 24 inches

Major Uses

Livestock grazing, hayland (fig. 11), wildlife habitat

Figure 11.—Native meadow hay in an area of Degarmo-Welch complex, 0 to 2 percent slopes, in center. Ninemile soils that support low sagebrush are on adjacent tablelands.

Major Management Factors

Degarmo soil—wetness, frost action, permeability
Welch soil—wetness, frost action

Dominant Vegetation in Potential Plant Community

Degarmo soil—slender wheatgrass, Leiberg bluegrass
Welch soil—tufted hairgrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for wildlife.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• A high water table during the growing season restricts the rooting depth of non-water-tolerant plants.
• Periodic flooding increases the amount of moisture available for plants and the production of forage.
• Stream channels are subject to cutting and filling during periods of flooding.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• Grazing should be managed to maintain or increase the abundance of plants to stabilize streambanks, reduce the risk of erosion, and keep water temperatures moderate.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Maintain adequate plant cover in fall to protect the soil from erosion during flooding in spring.
• Streambank erosion can be reduced and the quality and quantity of water can be improved by fencing along riparian areas.
• If this unit is seeded, select plants that tolerate wetness and frost heaving and that provide cover for wildlife.

Hayland

General management considerations:
• If the vegetation is removed and the soil surface is exposed, the risk of erosion is high during periods of flooding in spring.
• Unless the soil is drained, wetness limits the rooting depth for non-water-tolerant hay and pasture plants.
• The seasonal high water table provides supplemental moisture for plants.
• Irrigation water may be needed late in summer or early in fall.
• Suitable irrigation methods include border and sprinkler systems.
• Plants are subject to winterkill and other damage because of the high potential for frost action.
• Trees and shrubs suitable for windbreaks and environmental plantings on the Degarmo soil should be tolerant of droughtiness late in summer and early in fall.
• The Welch soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings.

Suitable management practices:
• Maintain plant cover to prevent erosion during periods of flooding in spring.
• Seed only hay and pasture plants that tolerate periodic flooding and seasonal wetness.

58C—Deppy-Tumtum complex, 5 to 15 percent slopes

Composition

Deppy soil and similar inclusions—45 percent
Tumtum soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Deppy Soil

Position on landscape: Alluvial fans, lake basin terraces
Parent material: Kind—alluvium; source—tuff, basalt
Elevation: 4,800 to 5,000 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark grayish brown very cobbly loam
4 to 8 inches—dark grayish brown clay loam
8 to 11 inches—brown clay loam
11 to 24 inches—strongly cemented, fractured hardpan
24 to 60 inches—dark yellowish brown gravelly sandy loam
Depth class: Shallow (10 to 20 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Sodicity: Moderately sodic
Carbonates: Between depths of 8 and 11 inches—slightly effervescent; in the hardpan—strongly effervescent; below the hardpan—violently effervescent

Characteristics of the Tumtum Soil

Position on landscape: Alluvial fans, lake basin terraces
Parent material: Kind—alluvium; source—basalt, tuff
Elevation: 4,800 to 5,000 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 3 inches—dark brown cobbly loam
3 to 14 inches—dark yellowish brown clay loam
14 to 22 inches—dark yellowish brown, indurated hardpan
22 to 60 inches—dark yellowish brown gravelly sandy loam
Depth class: Very shallow or shallow (9 to 16 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Sodicity: Slightly sodic
Carbonates: In the hardpan—slightly effervescent; below the hardpan—violently effervescent

Contrasting Inclusions

- Brace and Raz soils that are on adjacent tablelands
- Soils that have slopes of less than 5 percent or more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Deppy soil—available water capacity, depth to the hardpan, sodicity, water erosion
Tumtum soil—available water capacity, depth to the hardpan, water erosion

Dominant Vegetation in Potential Plant Community

Deppy soil—shadscale, bud sagebrush, Indian ricegrass, bottlebrush squirreltail
Tumtum soil—Thurber needlegrass, Wyoming big sagebrush, Indian ricegrass, bottlebrush squirreltail, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The cemented hardpan restricts rooting depth.
- The low precipitation and low available water capacity limit forage production and seedling survival.
- Excess sodium in the Deppy soil results in nutrient imbalances and a caustic root environment.
- Dispersion and crusting of the surface layer of the Deppy soil reduce infiltration and restrict seedling emergence and survival.
- The shallow depth to the hardpan limits placement of fenceposts and makes special design of fences necessary.
- Unless the hardpan is ripped, it limits the construction of water impoundments.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and sodicity.

59F—Deppy-Rubble land complex, 30 to 50 percent slopes

Composition

Deppy soil and similar inclusions—60 percent
Rubble land—25 percent
Contrasting inclusions—15 percent

Characteristics of the Deppy Soil

Position on landscape: Alluvial fans
Parent material: Kind—alluvium, colluvium; source—basalt
Elevation: 4,300 to 5,000 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark grayish brown extremely stony loam
4 to 8 inches—dark grayish brown clay loam
8 to 11 inches—brown clay loam
11 to 24 inches—strongly cemented, fractured hardpan
24 to 60 inches—dark yellowish brown gravelly sandy loam
Depth class: Shallow (10 to 20 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 2 inches
Hazard of erosion by water: Severe
Sodicity: Moderately sodic
Carbonates: Between depths of 8 and 11 inches—slightly effervescent; in the hardpan—strongly effervescent; below the hardpan—violently effervescent

Characteristics of the Rubble Land

Position on landscape: Hillsides
Parent material: Kind—colluvium; source—tuff, basalt

Contrasting Inclusions

• McNye soils that are on lake terraces
• Soils that have slopes of less than 30 percent or more than 50 percent
• Soils that are similar to the Deppy soil but have a hardpan at a depth of 20 to 40 inches or less than 10 inches

Major Use

Livestock grazing

Major Management Factors

Available water capacity, depth to the hardpan, stones on the surface, slope, sodicity, water erosion, Rubble land

Dominant Vegetation in Potential Plant Community

Deppy soil—shadscale, bud sagebrush, Indian ricegrass, bottlebrush squirreltail

Livestock Grazing

General management considerations:
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of the unit.
• The low precipitation and low available water capacity limit forage production and seedling survival.
• The hardpan restricts rooting depth.
• Excess sodium results in nutrient imbalances and a caustic root environment.
• Dispersion and crushing of the surface layer reduce infiltration and restrict seedling emergence and survival.
• The shallow depth to the hardpan and the areas of Rubble land limit placement of fenceposts and make special design of fences necessary.
• The extremely stony surface layer, steepness of slope, and areas of Rubble land restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• The unit is suited to grazing in winter.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Deppy soil is seeded, select plants that tolerate droughtiness and moderate sodicity.

60G—Derapter-Rock outcrop complex, 30 to 70 percent south slopes

Composition

Derapter soil and similar inclusions—60 percent
Rock outcrop—30 percent
Contrasting inclusions—10 percent

Characteristics of the Derapter Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,200 to 7,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 12 inches—dark brown very stony sandy loam
12 to 17 inches—brown very stony sandy clay loam
17 to 23 inches—dark yellowish brown very stony sandy clay loam
23 to 31 inches—yellowish brown very stony sandy clay loam
31 to 51 inches—dark yellowish brown very gravelly sandy loam
51 inches—fractured basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Carbonates: Strongly effervescent between depths of 31 and 51 inches

Characteristics of the Rock Outcrop

Position on landscape: Escarpments
Kind of rock: Basalt, tuff

Contrasting Inclusions

- Hart soils that are on fans and have low sagebrush and Idaho fescue in the potential plant community
- Ninemile soils that are on tablelands and have low sagebrush and Idaho fescue in the potential plant community
- Westbutte soils that are on north-facing mountainsides and have Idaho fescue in the potential plant community
- Fitzwater and Riddleranch soils that are on south-facing mountainsides
- Rubble land

Major Use

Livestock grazing

Major Management Factors

Stones on the surface and in the soil, slope, water erosion, available water capacity, calcareous layer, Rock outcrop

Dominant Vegetation in Potential Plant Community

Derapter soil—bluebunch wheatgrass, mountain big sagebrush

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- The low available water capacity limits forage production and seedling survival.
- The rock fragments on the surface and throughout the soil and the areas of Rock outcrop restrict the placement of fenceposts.
- Because the growing season begins earlier on the south-facing slopes than on the north-facing slopes, the south-facing slopes are suitable for grazing earlier. However, droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
- The very stony surface layer, areas of Rock outcrop, and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness.

61C—Deseed silt loam, 2 to 15 percent slopes

Composition

Deseed soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Deseed Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium over residuum; source—tuff, basalt

Elevation: 5,400 to 5,800 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—dark grayish brown silt loam
3 to 9 inches—brown silty clay loam
9 to 19 inches—dark yellowish brown clay
19 to 25 inches—yellowish brown clay loam
25 to 28 inches—very pale brown cobbly loam
28 inches—fractured tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, shallow (7 to 12 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 25 inches

Contrasting Inclusions

• Freznik and Anawalt soils that are on tablelands and have dominantly low sagebrush in the potential plant community
• Stringers of Rubble land that extend downslope
• Soils that have slopes of less than 2 percent or more than 15 percent
• Soils that are similar to the Deseed soil but have bedrock at a depth of 40 to 60 inches
• Soils that are similar to the Deseed soil but 15 to 30 percent of the surface is covered with rock fragments

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, permeability, depth to bedrock, water erosion, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The bedrock and claypan restrict rooting depth.
• The depth to bedrock limits construction of water impoundments.
• The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and damage structures and makes special design of fences necessary.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling and a cool growing season.

62C—Deseed-Freznik complex, 2 to 15 percent slopes

Composition

Deseed soil and similar inclusions—50 percent
Freznik soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Deseed Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium over residuum; source—tuff, basalt
Elevation: 5,400 to 5,800 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—dark grayish brown silt loam
3 to 9 inches—brown silty clay loam
9 to 19 inches—dark yellowish brown clay
19 to 25 inches—yellowish brown clay loam
25 to 28 inches—very pale brown cobbly loam
28 inches—fractured tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, shallow (7 to 12 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 25 inches

Characteristics of the Freznik Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium over residuum; source—tuff, basalt

Elevation: 5,400 to 5,800 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark grayish brown very stony loam
7 to 25 inches—dark yellowish brown clay
25 to 32 inches—yellowish brown clay loam
32 inches—slightly fractured basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (5 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Upper 7 inches—moderate; below this depth—very slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 7 and 25 inches

Contrasting Inclusions

- Freznik soils that are on tablelands, have a surface layer that is less than 7 inches thick, and have dominantly Sandberg bluegrass in the potential plant community
- Rock outcrop
- Soils that have slopes of more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Deseed soil—depth to the claypan, shrink-swell potential, permeability, depth to bedrock, water erosion
Freznik soil—stones on the surface, depth to the claypan, shrink-swell potential, permeability, depth to bedrock, water erosion, available water capacity

Dominant Vegetation in Potential Plant Community

Deseed soil—bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass
Freznik soil—bluebunch wheatgrass, low sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The claypan and bedrock restrict rooting depth.
- Seeding areas of the more favorable Deseed soil in this unit is difficult because of the pattern in which they occur with areas of the less favorable Freznik soil.
- The very stony surface layer of the Freznik soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The depth to bedrock limits construction of water impoundments.
- Livestock herd and graze in the less stony areas of the unit.
- The surface layer of the Freznik soil is saturated following snowmelt.
- The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and makes special design of fences necessary.
- Pedestaled plants and an erosion pavement on the Freznik soil are the result of past erosion.
- The low available water capacity in the surface layer of the Freznik soil limits forage production and seedling survival.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Freznik soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

63F—Deseed association, 2 to 50 percent slopes

Composition

Deseed soil and similar inclusions—50 percent
Deseed soil, south-facing, and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Deseed Soils

Position on landscape: Tablelands that have slopes of 2 to 30 percent, south-facing hillsides that have slopes of 30 to 50 percent
Parent material: Kind—colluvium over residuum; source—tuff, basalt
Elevation: 4,900 to 5,500 feet

Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—dark grayish brown very cobbly loam
3 to 9 inches—brown silty clay loam
9 to 19 inches—dark yellowish brown clay
19 to 25 inches—yellowish brown clay loam
25 to 28 inches—very pale brown cobbly loam
28 inches—fractured tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow or shallow (7 to 12 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 9 and 25 inches

Contrasting Inclusions

• Freznik and Anawalt soils that are on tablelands and have low sagebrush in the potential plant community
• Rock outcrop
• Strips of Rubble land that extend downslope
• Soils that have slopes of more than 50 percent
• Soils that are similar to the Deseed soils but have bedrock at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Deseed soil—cobbles on the surface, depth to the claypan, depth to bedrock, water erosion, permeability, shrink-swell potential
Deseed soil, south-facing—water erosion, slope, depth to the claypan, cobbles on the surface, depth to bedrock, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Deseed soil—Thurber needlegrass, Sandberg bluegrass, Wyoming big sagebrush
Deseed soil, south-facing—bluebunch wheatgrass, antelope bitterbrush

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The bedrock and claypan restrict rooting depth.
• Slope and the depth to bedrock limit construction of water impoundments.
• The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and makes special design of fences necessary.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• The very cobbly surface layer may restrict the use of ground seeding equipment in the more gently sloping areas.
• Slope in areas of the Deseed soil, south-facing, restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Because the growing season begins earlier on the steeper, south-facing slopes than in the less sloping areas, grazing can also begin earlier on the south-facing slopes. However, droughtiness is a limitation earlier in the growing season on the south-facing slopes.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling and a cool growing season.

64B—Deter loam, 0 to 5 percent slopes

Composition

Deter soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Deter Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt, diatomite
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 7 inches—very dark brown loam
7 to 19 inches—dark brown clay loam

19 to 34 inches—dark reddish brown clay
34 to 46 inches—reddish brown gravelly clay
46 to 60 inches—dark brown gravelly clay loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 7 and 46 inches

Contrasting Inclusions

• Drews and Drewsgap soils that are on adjacent lake terraces
• Oxwall soils that are on adjacent, higher lying lake terraces and have low sagebrush in the potential plant community
• Salisbury soils that are on adjacent, higher lying lake terraces
• Soils that are similar to the Deter soil but have bedrock or a hardpan at a depth of 40 to 60 inches

Major Uses

Cropland, livestock grazing, homesites

Major Management Factors

Permeability, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The surface layer is saturated following snowmelt because of the slow permeability of the subsoil.
• The clayey subsoil restricts rooting depth.

Suitable management practices:
• If this unit is seeded, select plants that tolerate shrinking and swelling.
• Seed on the contour to reduce the risk of erosion.
• Delay grazing until the surface layer is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated. A suitable cropping system includes small grain and summer fallow.
• Suitable irrigation methods include border and sprinkler systems.
• If border irrigation is used, leveling is needed for uniform application of water.
• To avoid exposing the subsoil, land smoothing that involves only shallow cuts is best suited.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Minimizing tillage and returning crop residue to the soil increase the water intake rate and reduce soil compaction.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings on this soil.
• The seedling mortality rate is severe because the high content of clay causes moisture stress.
• Cultivation or application of herbicides helps to control competing vegetation.

Suitable management practices:
• Irrigate during the dry period in summer.
• Manage irrigation water to prevent the buildup of a perched water table and to minimize runoff.

Homesites

General management considerations:
• The quality of roadbeds and road surfaces can be adversely affected by shrinking and swelling of the subsoil.
• Consider the depth to which frost penetrates in designing footings and road bases.
• Septic tank absorption fields function poorly because the slow permeability of the subsoil restricts the movement and filtration of effluent.
• Irrigation is needed for the establishment and maintenance of lawn grasses, shrubs, vines, shade trees, and ornamental trees.

Suitable management practices:
• Prevent structural damage that results from shrinking and swelling by allowing for it in designing and building foundations, concrete structures, and paved areas and by backfilling with material that has low shrink-swell potential.
• Design septic tanks to compensate for the slow permeability of the subsoil by increasing the size of the absorption field and backfilling trenches with more porous material.

64C—Deter loam, 5 to 15 percent slopes

Composition

Deter soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Deter Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt, diatomite
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 7 inches—very dark brown loam
7 to 19 inches—dark brown clay loam
19 to 34 inches—dark reddish brown clay
34 to 46 inches—reddish brown gravelly clay
46 to 60 inches—dark brown gravelly clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion: By water—moderate; by wind—slight or moderate
Shrink-swell potential: High between depths of 7 and 46 inches

Contrasting Inclusions

• Drews and Drewsgap soils that are on adjacent lake terraces
• Oxwall soils that are on adjacent, higher lying lake terraces and have low sagebrush in the potential plant community
• Salisbury soils that are on adjacent, higher lying lake terraces
• Soils that are similar to the Deter soil but have a hardpan or bedrock at a depth of 40 to 60 inches

Major Uses

Cropland, livestock grazing

Major Management Factors

Slope, water erosion, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The surface layer is saturated following snowmelt because of the slow permeability of the subsoil.
• The clayey subsoil restricts rooting depth.

Suitable management practices:
• If this unit is seeded, select plants that tolerate shrinking and swelling.
• Seed on the contour or across the slope where practical.
• Delay grazing until the surface layer is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
• Minimize the risk of erosion by preserving existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated. A suitable cropping system includes small grain and summer fallow.
• Because of the slope, this soil is best suited to sprinkler irrigation.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Irrigation water management is needed to prevent the buildup of a perched water table and to minimize erosion.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings on this soil.
• The seedling mortality rate is severe because the high content of clay causes moisture stress.
• Cultivation or application of herbicides helps to control competing vegetation.

Suitable management practices:
• Irrigate during the dry period in summer.
• Use minimum tillage and return crop residue to the soil to increase the water intake rate and reduce soil compaction.
• Reduce the risk of erosion by chiseling stubble fields on the contour or across the slope in fall.

65B—Deter loam, low precipitation, 0 to 5 percent slopes

Composition

Deter soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Deter Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt, diatomite

Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 7 inches—very dark brown loam
7 to 19 inches—dark brown clay loam
19 to 34 inches—dark reddish brown clay
34 to 46 inches—reddish brown gravelly clay
46 to 60 inches—dark brown gravelly clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 7 and 46 inches

Contrasting Inclusions

• Mesman soils that are on adjacent, lower lying lake terraces
• Harriman soils that are on adjacent lake terraces
• Lasere soils that are on adjacent hills and have low sagebrush in the potential plant community
• McConnel soils that are on adjacent, lower lying gravelly lake terraces
• Soils that are similar to the Deter soil but have a hardpan or bedrock at a depth of 40 to 60 inches

Major Uses

Cropland, livestock grazing

Major Management Factors

Permeability, shrink-swell potential, droughtiness, water erosion

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Idaho fescue, antelope bitterbrush

Livestock Grazing

General management considerations:
• The clayey subsoil restricts rooting depth.
• The low precipitation limits forage production and seedling survival.

Suitable management practices:
• If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.
• Seed on the contour to reduce the risk of erosion.
• Delay grazing until the surface layer is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated.
• Suitable irrigation methods include border and sprinkler systems.
• If border irrigation is used, leveling is needed for uniform application of water.
• To avoid exposing the subsoil, land smoothing that involves only shallow cuts is best suited.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Irrigation water management is needed to prevent the buildup of a perched water table and to minimize runoff.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings on this soil.
• The seedling mortality rate is severe because the high content of clay causes moisture stress.
• Cultivation or application of herbicides helps to control competing vegetation.

Suitable management practices:
• Irrigate during the dry period in summer.
• Use minimum tillage and return crop residue to the soil to increase the water intake rate and reduce soil compaction.

65C—Deter loam, low precipitation, 5 to 15 percent slopes

Composition

Deter soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Deter Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt, diatomite
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 7 inches—very dark brown loam
7 to 19 inches—dark brown clay loam
19 to 34 inches—dark reddish brown clay

34 to 46 inches—reddish brown gravelly clay
46 to 60 inches—dark brown gravelly clay loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 7 and 46 inches

Contrasting Inclusions

• Mesman soils that are on adjacent, lower lying lake terraces
• Harriman soils that are on adjacent lake terraces
• Lasere soils that are on adjacent hills and have low sagebrush in the potential plant community
• McConnel soils that are on adjacent, lower lying gravelly lake terraces
• Soils that are similar to the Deter soil but have a hardpan or bedrock at a depth of 40 to 60 inches

Major Uses

Cropland, livestock grazing

Major Management Factors

Slope, water erosion, permeability, shrink-swell potential, droughtiness

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Idaho fescue, antelope bitterbrush

Livestock Grazing

General management considerations:
• The clayey subsoil restricts rooting depth.
• The low precipitation limits forage production and seedling survival.

Suitable management practices:
• If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.
• Seed on the contour or across the slope where practical.
• Delay grazing until the surface layer is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated.
• Because of the slope, this soil is best suited to sprinkler irrigation.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Irrigation water management is needed to prevent the buildup of a perched water table and to minimize erosion.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings on this soil.
• The seedling mortality rate is severe because the high content of clay causes moisture stress.
• Cultivation or application of herbicides helps to control competing vegetation.

Suitable management practices:
• Irrigate during the dry period in summer.
• Use minimum tillage and return crop residue to the soil to increase the water intake rate and reduce soil compaction.
• Reduce the risk of erosion by chiseling stubble fields on the contour or across the slope in fall.

66C—Devada-Deseed complex, 2 to 15 percent slopes

Composition

Devada soil and similar inclusions—50 percent
Deseed soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Devada Soil

Position on landscape: Tablelands
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 4,900 to 5,800 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days

Typical profile:
0 to 3 inches—dark grayish brown very cobbly loam
3 to 7 inches—dark brown gravelly clay
7 to 18 inches—dark brown clay
18 inches—basalt

Depth class: Shallow (12 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Upper 7 inches—moderately rapid; below this depth—slow
Available water capacity: About 2 inches

Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 1 inch and 18 inches

Characteristics of the Deseed Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium over residuum; source—tuff, basalt
Elevation: 4,900 to 5,800 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 3 inches—dark grayish brown silt loam
3 to 9 inches—brown silty clay loam
9 to 19 inches—dark yellowish brown clay
19 to 25 inches—yellowish brown clay loam
25 to 28 inches—very pale brown cobbly loam
28 inches—fractured tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow or shallow (7 to 12 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 25 inches

Contrasting Inclusions

- Oreneva soils that are in steeper areas
- Madeline and Ninemile soils that are on higher lying tablelands
- Old Camp soils that are on lower lying tablelands
- Soils that have slopes of less than 2 percent or more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Devada soil—depth to the claypan, depth to bedrock, available water capacity, permeability, shrink-swell potential, water erosion
Deseed soil—depth to the claypan, permeability, shrink-swell potential, depth to bedrock, water erosion

Dominant Vegetation in Potential Plant Community

Devada soil—bluebunch wheatgrass, low sagebrush, Sandberg bluegrass
Deseed soil—bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
- The surface layer of the Devada soil is saturated following snowmelt.
- The claypan and bedrock in the Devada soil severely restrict rooting depth.
- The low available water capacity of the Devada soil limits forage production and seedling survival.
- The shallow depth to bedrock in the Devada soil limits the construction of water impoundments and the placement of fenceposts.
- The subsoil of the soils in this unit expands when wet and contracts when dry, which makes special design of fences necessary.
- Pedestaled plants and an erosion pavement on the Devada soil are the result of past erosion.
- Because of the high corrosivity of the Deseed soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Devada soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.
- Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

67C—Devoy-Blizzard complex, 2 to 15 percent slopes

Composition

Devoy soil and similar inclusions—50 percent
Blizzard soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Devoy Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium over residuum; source—basalt, tuff
Elevation: 6,300 to 6,800 feet
Climatic factors:

Mean annual precipitation—12 to 16 inches
Mean annual air temperature—40 to 45 degrees F
Frost-free period—20 to 50 days

Typical profile:
0 to 10 inches—dark brown cobbly loam
10 to 17 inches—dark brown very cobbly clay loam
17 to 30 inches—dark brown very cobbly clay
30 inches—fractured basalt

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 17 and 30 inches

Characteristics of the Blizzard Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 6,300 to 6,800 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—40 to 45 degrees F
Frost-free period—20 to 50 days

Typical profile:
0 to 1 inch—dark brown very cobbly silty clay loam
1 inch to 7 inches—dark brown silty clay
7 to 16 inches—dark brown cobbly clay
16 inches—fractured basalt

Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (1 to 4 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 1 inch and 16 inches

Contrasting Inclusions

• Soils that are similar to the Blizzard soil but have bedrock at a depth of 10 inches or less and have dominantly curlleaf mountainmahogany or western juniper in the potential plant community
• Soils that are similar to the Blizzard soil but are 35 percent rock fragments or more throughout

Major Use

Livestock grazing

Major Management Factors

Devoy soil—rock fragments on the surface, depth to bedrock, available water capacity, permeability, shrink-swell potential
Blizzard soil—available water capacity, depth to bedrock, depth to the claypan, rock fragments on the surface, shrink-swell potential, permeability, water erosion

Dominant Vegetation in Potential Plant Community

Devoy soil—Idaho fescue, Thurber needlegrass, bluebunch wheatgrass, mountain big sagebrush
Blizzard soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The surface layer of the Blizzard soil is saturated following snowmelt.
• The cobbles in the surface layer may restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The claypan and bedrock in the Blizzard soil restrict rooting depth.
• The bedrock in the Devoy soil restricts rooting depth.
• The low available water capacity limits forage production and seedling survival.
• The depth to bedrock limits the construction of water impoundments.
• The shallow depth to bedrock in the Blizzard soil limits the placement of fenceposts.
• Pedestaled plants and an erosion pavement on the Blizzard soil are the result of past erosion.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Blizzard soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the

existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrink-swell potential, and a cool growing season.

68C—Diaz very cobbly loam, 2 to 15 percent slopes

Composition

Diaz soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Diaz Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium over residuum; source—tuff, basalt
Elevation: 4,400 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—dark brown very cobbly loam
5 to 9 inches—brown loam
9 to 17 inches—brown and dark yellowish brown clay loam
17 to 23 inches—yellowish brown clay loam
23 inches—basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 17 inches

Contrasting Inclusions

• Rock outcrop
• Soils that are similar to the Diaz soil but have bedrock at a depth of less than 20 inches

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, water erosion, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Indian ricegrass, Thurber needlegrass, needleandthread, Wyoming big sagebrush

Livestock Grazing

General management considerations:
• The low precipitation limits forage production and seedling survival.
• The bedrock restricts rooting depth.
• The depth to bedrock limits construction of water impoundments.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness.

69B—Donica gravelly loam, 0 to 5 percent slopes

Composition

Donica soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Donica Soil

Position on landscape: Alluvial fans in lake basins
Parent material: Kind—gravelly alluvium; source—tuff, andesite, basalt
Elevation: 4,600 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 6 inches—very dark brown gravelly loam
6 to 24 inches—dark brown very gravelly sandy loam
24 to 34 inches—dark brown very gravelly loam
34 to 61 inches—dark brown very gravelly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Permeability: Moderately rapid
Available water capacity: About 3 inches
Hazard of erosion by water: Slight

Contrasting Inclusions

• Drews soils that are on adjacent lake terraces
• Salisbury soils that are on adjacent, higher lying lake terraces

Major Uses

Cropland, livestock grazing, homesites

Major Management Factors

Available water capacity, rock fragments throughout the soil, permeability

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The low available water capacity limits forage production and seedling survival.
- Seepage as a result of the rapid permeability of the substratum limits construction of water impoundments.
- The rock fragments throughout the soil restrict the placement of fenceposts.

Suitable management practices:
- If this unit is seeded, select plants that tolerate droughtiness.
- Seed on the contour to reduce the risk of erosion.

Cropland

General management considerations:
- Because of the limited precipitation and low available water capacity, continuous cropping is suitable only if the soil is irrigated. A suitable cropping system includes small grain and summer fallow.
- Because of the rapid water intake rate and moderately rapid permeability, this soil is best suited to sprinkler irrigation.
- Because the soil is droughty, frequent applications of irrigation water for short periods are needed.
- The rock fragments on the surface make seedbed preparation difficult.

Suitable management practices:
- Irrigate during the dry period in summer.
- To minimize runoff, erosion, and leaching of plant nutrients, adjust the applications of irrigation water to the available water capacity, the water intake rate, and the needs of the crop grown.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
- The low available water capacity may result in a severe rate of seedling mortality.
- Cultivation or application of herbicides helps to control competing vegetation.

Homesites

General management considerations:
- Because of the rapid permeability of the substratum, onsite sewage disposal systems may not be suitable because of the risk of ground water pollution.
- This unit is a good source of roadfill.
- Removal of gravel and cobbles from the surface may be needed for the establishment of lawns.
- Irrigation is needed for the establishment and maintenance of lawn grasses, shrubs, vines, shade trees, and ornamental trees.

69C—Donica gravelly loam, 5 to 15 percent slopes

Composition

Donica soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Donica Soil

Position on landscape: Alluvial fans in lake basins
Parent material: Kind—gravelly alluvium; source—tuff, andesite, basalt
Elevation: 4,600 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 6 inches—very dark brown gravelly loam
6 to 24 inches—dark brown very gravelly sandy loam
24 to 34 inches—dark brown very gravelly loam
34 to 61 inches—dark brown very gravelly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Permeability: Moderately rapid
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate

Contrasting Inclusions

- Drews soils that are on adjacent lake terraces
- Salisbury soils that are on adjacent, higher lying lake terraces
- Soils that have slopes of less than 5 percent or more than 15 percent

Major Uses

Livestock grazing, cropland, homesites

Major Management Factors

Slope, available water capacity, rock fragments throughout the soil, permeability, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The low available water capacity limits forage production and seedling survival.
- Rock fragments throughout the soil restrict the placement of fenceposts.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness.
- Seed on the contour or across the slope where practical.

Cropland

General management considerations:
- Because of the limited precipitation and low available water capacity, continuous cropping is suitable only if the soil is irrigated. A suitable cropping system includes small grain and summer fallow.
- Because of the rapid water intake rate, rapid permeability of the substratum, and steepness of slope, this soil is best suited to sprinkler irrigation.
- Because the soil is droughty, frequent applications of irrigation water for short periods are needed.
- The rock fragments on the surface make seedbed preparation difficult.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
- The low available water capacity may result in a severe rate of seedling mortality.
- Cultivation or application of herbicides helps to control competing vegetation.

Suitable management practices:
- Irrigate during the dry period in summer.
- To minimize erosion and leaching of plant nutrients, adjust the application of irrigation water to the available water capacity, the water intake rate, and the needs of the crop grown.

Homesites

General management considerations:
- Because of the rapid permeability of the substratum, onsite sewage disposal systems may not be suitable because of the risk of polluting ground water.
- This unit is a good source of roadfill.
- Design and construct buildings and access roads to compensate for the steepness of slope.
- Removal of gravel and cobbles from the surface may be needed for the establishment of lawns.
- Irrigation is needed for the establishment and maintenance of lawn grasses, shrubs, vines, shade trees, and ornamental trees.

70C—Drakesflat loam, 2 to 15 percent slopes

Composition

Drakesflat soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Drakesflat Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 5,500 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 6 inches—very dark brown loam
6 to 12 inches—very dark grayish brown cobbly loam
12 to 23 inches—dark brown clay loam
23 to 31 inches—dark brown clay loam
31 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Moderately deep (20 to 40 inches) to bedrock, shallow or moderately deep (15 to 30 inches) to secondary lime
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Carbonates: Slightly effervescent between depths of 23 and 31 inches

Contrasting Inclusions

- Fertaline soils that are on tablelands and have low sagebrush in the potential plant community
- Coglin soils that are on tablelands and have black sagebrush in the potential plant community
- Soils that are similar to the Drakesflat soil but have bedrock or a hardpan at a depth of less than 20 inches or more than 40 inches

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, available water capacity, water erosion, calcareous layer

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
- The bedrock and calcareous layer restrict rooting depth.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The low available water capacity limits forage production and seedling survival.
- The depth to bedrock limits construction of water impoundments.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

70E—Drakesflat loam, 15 to 30 percent slopes

Composition

Drakesflat soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Drakesflat Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 5,500 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 6 inches—very dark brown loam
6 to 12 inches—very dark grayish brown cobbly loam
12 to 23 inches—dark brown clay loam
23 to 31 inches—dark brown clay loam
31 inches—tuff that has coatings of silica and calcium carbonate in fractures

Depth class: Moderately deep (20 to 40 inches) to bedrock, shallow or moderately deep (15 to 30 inches) to secondary lime
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Severe
Carbonates: Slightly effervescent between depths of 23 and 31 inches

Contrasting Inclusions

- Fertaline soils that are on tablelands and have low sagebrush in the potential plant community
- Coglin soils that are on tablelands and have black sagebrush in the potential plant community
- Soils that are similar to the Drakesflat soil but have bedrock or a hardpan at a depth of less than 20 inches or more than 40 inches
- Soils that have slopes of less than 15 percent or more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, depth to bedrock, calcareous layer, available water capacity

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
- The bedrock and calcareous layer restrict rooting depth.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The low available water capacity limits forage production and seedling survival.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.
• Seed on the contour or across the slope where practical.

71C—Drakesflat-Coglin complex, 2 to 15 percent slopes

Composition

Drakesflat soil and similar inclusions—45 percent
Coglin soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Drakesflat Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 5,500 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 6 inches—very dark brown loam
6 to 12 inches—very dark grayish brown cobbly loam
12 to 23 inches—dark brown clay loam
23 to 31 inches—dark brown clay loam
31 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Moderately deep (20 to 40 inches) to bedrock, shallow or moderately deep (15 to 30 inches) to secondary lime
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Carbonates: Slightly effervescent between depths of 23 and 31 inches

Characteristics of the Coglin Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 5,500 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 2 inches—very dark grayish brown extremely stony loam
2 to 7 inches—dark brown clay
7 to 16 inches—dark yellowish brown silty clay loam
16 to 60 inches—dark yellowish brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock, very shallow (2 to 5 inches) to the claypan, shallow or moderately deep (10 to 30 inches) to secondary lime
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 2 and 7 inches
Carbonates: Strongly effervescent between depths of 16 and 60 inches

Contrasting Inclusions

• Fertaline soils that are on tablelands and have low sagebrush in the potential plant community
• Soils that are similar to the Drakesflat soil but have bedrock or a hardpan at a depth of less than 20 inches or more than 40 inches
• Soils that are similar to the Coglin soil but have bedrock or a hardpan at a depth of less than 40 inches

Major Use

Livestock grazing

Major Management Factors

Drakesflat soil—depth to bedrock, available water capacity, water erosion, calcareous layer
Coglin soil—stones on the surface, depth to the claypan, calcareous layer, water erosion, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Drakesflat soil—bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass
Coglin soil—black sagebrush, bottlebrush squirreltail, Sandberg bluegrass

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Seeding areas of the more favorable Drakesflat soil

in this unit is difficult because of the pattern in which they occur with areas of the less favorable extremely stony Coglin soil.
• The bedrock and calcareous layer in the Drakesflat soil restrict rooting depth.
• Crusting of the surface layer of the Coglin soil reduces infiltration and restricts seedling emergence and survival.
• The calcareous layer and claypan in the Coglin soil restrict rooting depth.
• The depth to bedrock in the Drakesflat soil limits construction of water impoundments.
• The surface layer of the Coglin soil is saturated following snowmelt.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.

Suitable management practices:
• Delay grazing until the Coglin soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

72F—Drakespeak very gravelly coarse sandy loam, 20 to 50 percent south slopes

Composition

Drakespeak soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Drakespeak Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 7,500 to 8,300 feet
Climatic factors:
Mean annual precipitation—30 to 38 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
0 to 6 inches—very dark brown very gravelly coarse sandy loam
6 to 21 inches—very dark grayish brown very gravelly coarse sandy loam
21 to 26 inches—dark brown very gravelly coarse sandy loam
26 to 37 inches—light olive brown very gravelly coarse sandy loam
37 to 47 inches—dark yellowish brown very gravelly coarse sandy loam
47 to 60 inches—dark brown very gravelly coarse sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Rock outcrop
• Soils that are similar to the Drakespeak soil but are in areas protected from wind and have mountain big sagebrush and common snowberry in the potential plant community
• Soils that are similar to the Drakespeak soil but have bedrock at a depth of 20 to 60 inches

Major Uses

Watershed, wildlife habitat, livestock grazing

Major Management Factors

Slope, water erosion, gravel and cobbles in the soil, wind erosion, available water capacity

Dominant Vegetation in Potential Plant Community

Low sagebrush, granite gilia, red fescue

Livestock Grazing

General management considerations:
• Cold soil temperatures limit plant growth.
• Grazing should be delayed until the soil is warm and the plants have achieved sufficient growth to withstand grazing pressure.
• The steepness of slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in summer when forage plants have achieved sufficient growth to withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a short, cool growing season.

73B—Drews loam, 0 to 5 percent slopes

Composition

Drews soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Drews Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—rhyolite, basalt, tuff
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 11 inches—very dark brown loam
11 to 16 inches—very dark grayish brown clay loam
16 to 36 inches—dark brown gravelly clay loam
36 to 60 inches—dark yellowish brown very gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 8 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

- Deter, Donica, and Drewsgap soils that are on adjacent lake terraces
- Salisbury soils that are on adjacent, slightly higher lying lake terraces
- Oxwall soils that are on adjacent, slightly higher lying lake terraces and have low sagebrush in the potential plant community
- Soils that have slopes of more than 5 percent

Major Uses

Cropland, livestock grazing, homesites

Major Management Factor

Water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- This unit is well suited to livestock grazing and range management.
- Seeding should be done on the contour to reduce the risk of erosion.

Cropland

General management considerations:
- Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated. A suitable cropping system includes small grain and summer fallow.
- Suitable irrigation methods include sprinkler and border systems.
- If border irrigation is used, leveling is needed for uniform application of water.
- To avoid exposing the subsoil, land smoothing that involves only shallow cuts is best suited.
- Irrigate during the dry period in summer.
- Irrigation water management is needed to minimize runoff and erosion.
- Using minimum tillage and returning crop residue to the soil reduce soil compaction, improve soil tilth, and increase the water intake rate.
- A wide variety of trees and shrubs can be used for windbreaks and environmental plantings.
- Cultivation or application of herbicides helps to control competing vegetation.

Homesites

General management considerations:
- This unit is well suited to use as homesites.
- Irrigation is needed for the establishment and maintenance of lawn grasses, shrubs, vines, shade trees, and ornamental trees.

73C—Drews loam, 5 to 15 percent slopes

Composition

Drews soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Drews Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—rhyolite, basalt, tuff
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 11 inches—very dark brown loam
11 to 16 inches—very dark grayish brown clay loam
16 to 36 inches—dark brown gravelly clay loam

36 to 60 inches—dark yellowish brown very gravelly loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 8 inches
Hazard of erosion: By water—moderate; by wind—slight or moderate

Contrasting fInclusions

• Deter, Donica, and Drewsgap soils that are on adjacent lake terraces
• Salisbury soils that are on adjacent, slightly higher lying lake terraces
• Oxwall soils that are on adjacent, slightly higher lying lake terraces and have low sagebrush in the potential plant community
• Soils that have slopes of less than 5 percent or more than 15 percent

Major Uses

Cropland, livestock grazing, homesites

Major Management Factors

Slope, water erosion, wind erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• This unit is well suited to livestock grazing and range management.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• Seed on the contour or across the slope where practical.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated.
• Because of the slope, this soil is best suited to sprinkler irrigation.
• Irrigate during the dry period in summer.
• Irrigation water management reduces runoff and erosion.
• Reduce the risk of erosion by maintaining crop residue on the soil surface, stripcropping, farming across the slope, and keeping the surface of the soil rough.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings.
• Cultivation or application of herbicides helps to control competing vegetation.

Homesites

General management considerations:
• Excavation increases the risk of water erosion.
• Irrigation is needed for the establishment and maintenance of lawn grasses, shrubs, vines, shade trees, and ornamental trees in summer.

Suitable management practices:
• Reduce the risk of erosion and minimize the cost of maintenance by stabilizing areas that have been disturbed.
• Build roads in the less sloping areas of the unit to minimize cuts and fills.
• Reduce the risk of erosion on steep cuts and fills by establishing a plant cover.
• In the steeper areas, reduce the risk of erosion by disturbing only the part of the site that is used for construction.

73E—Drews loam, 15 to 30 percent slopes

Composition

Drews soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Drews Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—rhyolite, basalt, tuff
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 11 inches—very dark brown loam
11 to 16 inches—very dark grayish brown clay loam
16 to 36 inches—dark brown gravelly clay loam
36 to 60 inches—dark yellowish brown very gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 8 inches

Hazard of erosion: By water—severe; by wind—slight or moderate

Contrasting Inclusions

- Deter and Donica soils that are on adjacent lake terraces
- Oxwall soils that are on adjacent, slightly higher lying lake terraces and have low sagebrush in the potential plant community
- Soils that have slopes of less than 15 percent or more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, wind erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Slope may restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- A wide variety of trees and shrubs can be used for windbreaks and environmental plantings.
- Cultivation or application of herbicides helps to control competing vegetation.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- Seed on the contour or across the slope where practical.

74C—Drews cobbly loam, 5 to 15 percent slopes

Composition

Drews soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Drews Soil

Position on landscape: Slump benches on lake terraces
Parent material: Kind—colluvium, alluvium; source—rhyolite, basalt, tuff
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 11 inches—very dark brown cobbly loam
11 to 16 inches—very dark grayish brown clay loam
16 to 36 inches—dark brown gravelly clay loam
36 to 60 inches—dark yellowish brown very gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 8 inches
Hazard of erosion by water: Moderate

Contrasting Inclusions

- Lasere soils that are on adjacent, slightly higher lying foot slopes and hills and have low sagebrush in the potential plant community
- Lakeview soils that are on adjacent, lower lying lake terraces
- Soils that have slopes of less than 5 percent or more than 15 percent

Major Uses

Cropland, livestock grazing

Major Management Factors

Slope, rock fragments on the surface, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- This unit is well suited to livestock grazing and range management.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- Seed on the contour or across the slope where practical.

Cropland

General management considerations:
- Because of the limited precipitation, continuous cropping is not practical unless the soil is irrigated. A

suitable cropping system includes small grain and summer fallow.
• Because of the slope, sprinkler irrigation is best suited to this soil.
• Coarse fragments on the surface make seedbed preparation difficult.
• Irrigation water management reduces runoff and erosion.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings.
• Cultivation or application of herbicides helps to control competing vegetation.

Suitable management practices:
• Irrigate during the dry period in summer.
• Reduce the risk of erosion by maintaining crop residue on the surface, stripcropping, farming across the slope, and keeping the soil surface rough.

75B—Drews-Oxwall complex, 0 to 5 percent slopes

Composition

Drews soil and similar inclusions—50 percent
Oxwall soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Drews Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—rhyolite, basalt, tuff
Elevation: 4,700 to 5,200 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 11 inches—very dark brown loam
11 to 16 inches—very dark grayish brown clay loam
16 to 36 inches—dark brown gravelly clay loam
36 to 60 inches—dark yellowish brown very gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 8 inches
Hazard of erosion: By water—slight; by wind—slight or moderate

Characteristics of the Oxwall Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—rhyolite, tuff, volcanic ash
Elevation: 4,700 to 5,200 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 2 inches—very dark gray gravelly loam
2 to 11 inches—very dark brown gravelly clay loam
11 to 16 inches—dark brown and dark yellowish brown gravelly clay
16 to 24 inches—indurated hardpan
24 to 60 inches—variegated, stratified very gravelly loam and very gravelly sandy loam
Depth class: Very shallow or shallow (5 to 12 inches) to the claypan; shallow (10 to 20 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 11 and 16 inches

Contrasting Inclusions

• Lasere soils that are on adjacent hills
• Deter, Donica, Drewsgap, and Salisbury soils that are on adjacent lake terraces
• Soils that have slopes of more than 5 percent

Major Uses

Livestock grazing, cropland

Major Management Factors

Drews soil—water erosion
Oxwall soil—depth to the claypan, depth to the hardpan, permeability, shrink-swell potential, available water capacity, water erosion

Dominant Vegetation in Potential Plant Community

Drews soil—Idaho fescue, antelope bitterbrush, bluebunch wheatgrass
Oxwall soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The claypan and hardpan in the Oxwall soil restrict rooting depth.
• The low available water capacity of the Oxwall soil limits forage production and seedling survival.

• The surface layer of the Oxwall soil is saturated following snowmelt.
• The shallow depth to the hardpan in the Oxwall soil limits placement of fenceposts.

Suitable management practices:
• Delay grazing until the surface layer is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Oxwall soil is seeded, select plants that tolerate droughtiness and shrinking and swelling.
• Seed on the contour to reduce erosion.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soils are irrigated. A suitable cropping system includes small grain and summer fallow.
• Suitable irrigation methods include sprinkler and border systems.
• If border irrigation is used, leveling is needed for uniform application of water.
• To avoid exposing the subsoil, land smoothing that involves only shallow cuts is best suited.
• The shallow depth to the hardpan in the Oxwall soil limits rooting depth.
• Irrigation water management is needed to prevent the buildup of a perched water table above the claypan in the Oxwall soil.
• Using minimum tillage and returning crop residue to the soil reduce compaction, improve tilth, and increase the water intake rate.
• When the Oxwall soil is dry, subsoiling or deep plowing to rip the hardpan can increase the effective rooting depth and improve internal drainage.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings on the Drews soil.
• Trees and shrubs for windbreaks and environmental plantings on the Oxwall soil should be tolerant of droughtiness.
• The seedling mortality rate on the Oxwall soil is severe because the high content of clay causes moisture stress.

Suitable management practices:
• Cultivate or apply herbicides to help control competing vegetation on the Oxwall soil.
• Irrigate during the dry period in summer.

76B—Drewsgap loam, 0 to 5 percent slopes

Composition

Drewsgap soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Drewsgap Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt, rhyolite
Elevation: 4,700 to 5,200 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 8 inches—very dark brown loam
8 to 14 inches—very dark grayish brown fine sandy loam
14 to 30 inches—dark brown sandy clay loam
30 to 34 inches—dark grayish brown sandy loam
34 to 49 inches—hardpan
49 to 61 inches—strong brown and dark brown very gravelly loam
Depth class: Moderately deep (20 to 40 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

• Deter and Drews soils that are on adjacent lake terraces
• Donica soils that are on alluvial fans on adjacent lake terraces
• Salisbury soils that are on higher lying lake terraces
• Soils that have slopes of more than 5 percent

Major Uses

Cropland, livestock grazing

Major Management Factors

Depth to the hardpan, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The hardpan restricts rooting depth.
- Seeding should be done on the contour to reduce erosion.

Cropland

General management considerations:
- Because of the limited precipitation, continuous cropping is not practical unless this soil is irrigated. A suitable cropping system includes small grain and summer fallow.
- Suitable irrigation methods include sprinkler and border systems.
- If border irrigation is used, leveling is needed for uniform application of water.
- To avoid exposing the hardpan, land smoothing that involves only shallow cuts is best suited.
- The hardpan limits rooting depth.
- Irrigation water management is needed to prevent the buildup of a perched water table above the hardpan.
- When the soil is dry, ripping the hardpan can increase the effective rooting depth and improve internal drainage.
- Using minimum tillage and returning crop residue to the soil reduce compaction and improve tilth.
- A wide variety of trees and shrubs can be used for windbreaks and environmental plantings.

Suitable management practices:
- Cultivate or apply herbicides to help control competing vegetation.
- Irrigate during the dry period in summer.

76C—Drewsgap loam, 5 to 15 percent slopes

Composition

Drewsgap soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Drewsgap Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt, rhyolite
Elevation: 4,700 to 5,200 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 8 inches—very dark brown loam
8 to 14 inches—very dark grayish brown fine sandy loam
14 to 30 inches—dark brown sandy clay loam
30 to 34 inches—dark grayish brown sandy loam
34 to 49 inches—hardpan
49 to 61 inches—strong brown and dark brown very gravelly loam
Depth class: Moderately deep (20 to 40 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion: By water—moderate; by wind—slight or moderate

Contrasting Inclusions

- Salisbury soils that are on higher lying lake terraces
- Deter and Drews soils that are on adjacent lake terraces
- Donica soils that are on alluvial fans on adjacent lake terraces
- Soils that have slopes of less than 5 percent or more than 15 percent

Major Uses

Cropland, livestock grazing

Major Management Factors

Depth to the hardpan, water erosion, wind erosion, slope

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The hardpan restricts rooting depth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- Seeding should be done on the contour or across the slope where practical.

Cropland

General management considerations:
- Because of the limited precipitation, continuous cropping is not practical unless this soil is irrigated. A suitable cropping system includes small grain and summer fallow.

• Because of the slope, this soil is best suited to sprinkler irrigation.
• The hardpan limits rooting depth.
• Irrigation water management is needed to prevent the buildup of a perched water table above the hardpan.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings.
• Cultivation or application of herbicides helps to control competing vegetation.
• Using minimum tillage and returning crop residue to the soil reduce compaction and improve tilth.

Suitable management practices:
• Irrigate during the dry period in summer.
• Regulate the application rate of irrigation water to control runoff and erosion.
• When the soil is dry, rip the hardpan to increase the effective rooting depth and improve internal drainage.
• Reduce the risk of erosion by farming across the slope or along the contour.

77E—Eglirim very stony loam, 2 to 30 percent slopes

Composition

Eglirim soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Eglirim Soil

Position on landscape: Colluvial fans
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 4,200 to 4,700 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 16 inches—very dark brown very stony loam
16 to 37 inches—dark yellowish brown extremely stony clay
37 to 60 inches—dark yellowish brown extremely stony loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate or severe
Shrink-swell potential: High between depths of 16 and 37 inches

Contrasting Inclusions

• Nuss and Royst soils that are on adjacent hills
• Rock outcrop
• Soils that have bedrock at a depth of 20 inches or less and have more than 35 percent rock fragments in the lower layers
• Soils that have slopes of more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Stones, available water capacity, shrink-swell potential, permeability, water erosion

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Idaho fescue, antelope bitterbrush

Livestock Grazing

General management considerations:
• Livestock tend to graze in the less stony areas.
• The very stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The soil expands when wet and contracts when dry, which makes special design of fences necessary.
• The low available water capacity limits forage production and seedling survival.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this soil is seeded, select plants that tolerate droughtiness and shrinking and swelling.

78F—Eglirim association, 30 to 50 percent slopes

Composition

Eglirim soil, north-facing, and similar inclusions—45 percent
Eglirim soil, south-facing, and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Eglirim Soils

Position on landscape: North- and south-facing slopes of colluvial fans
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 4,200 to 4,700 feet

Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days

Typical profile:
0 to 16 inches—very dark brown very stony loam
16 to 37 inches—dark yellowish brown extremely stony clay
37 to 60 inches—dark yellowish brown extremely stony loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 16 and 37 inches

Contrasting Inclusions

• Nuss and Royst soils that are on adjacent, higher lying hills
• Rock outcrop
• Soils that have bedrock at a depth of 20 inches or less and have more than 35 percent rock fragments in the lower layers
• Soils that have slopes of less than 30 percent or more than 50 percent

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, stones, available water capacity, shrink-swell potential, permeability

Dominant Vegetation in Potential Plant Community

Eglirim soil, north-facing—bluebunch wheatgrass, Idaho fescue, Wyoming big sagebrush, Sandberg bluegrass, Thurber needlegrass
Eglirim soil, south-facing—bluebunch wheatgrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
• Livestock tend to graze in the less stony areas.
• Livestock tend to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
• The very stony surface layer and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The soils expand when wet and contract when dry, which makes special design of fences necessary.
• The growing season on the north-facing slopes begins later in spring and moisture is available later in summer on these slopes than on the south-facing slopes.
• The areas on south-facing slopes warm up early in spring; therefore, the forage plants achieve sufficient growth for grazing earlier in the growing season.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize erosion to maintain forage production..
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.

79C—Erakatak cobbly loam, 2 to 15 percent slopes

Composition

Erakatak soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Erakatak Soil

Position on landscape: Tablelands
Parent material: Kind—residuum, colluvium; source—tuff, basalt
Elevation: 5,200 to 6,400 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 8 inches—dark brown cobbly loam
8 to 18 inches—dark brown very cobbly clay loam
18 to 30 inches—dark yellowish brown very cobbly clay
30 inches—basalt

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 18 and 30 inches

Contrasting Inclusions

• Rock outcrop

• Newlands soils that are on mountain foot slopes
• Ninemile, Carryback, and Freznik soils that are on tablelands and have low sagebrush in the potential plant community
• Soils that are similar to the Erakatak soil but have bedrock at a depth of 10 to 20 inches or more than 40 inches

Major Uses

Livestock grazing, watershed, wildlife habitat

Major Management Factors

Rock fragments throughout the soil, permeability, depth to bedrock, water erosion, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Idaho fescue, Thurber needlegrass, mountain big sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The depth to bedrock limits construction of water impoundments.
• The rock fragments throughout the soil restrict the placement of fenceposts.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

80E—Erakatak-Carryback complex, 15 to 30 percent slopes

Composition

Erakatak soil and similar inclusions—50 percent
Carryback soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Erakatak Soil

Position on landscape: Hillsides, tablelands
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,400 to 6,200 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 8 inches—dark brown cobbly loam
8 to 18 inches—dark yellowish brown very cobbly clay
18 to 30 inches—dark yellowish brown very gravelly clay loam
30 inches—basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 18 and 30 inches

Characteristics of the Carryback Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,400 to 6,200 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—dark brown very cobbly loam
2 to 8 inches—very dark grayish brown silty clay loam
8 to 15 inches—brown clay
15 to 22 inches—brown silty clay loam
22 to 27 inches—brown silt loam
27 to 33 inches—brown loam
33 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (4 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 8 and 15 inches
Carbonates: Between depths of 22 and 27 inches—slightly effervescent; below this depth—strongly effervescent

Contrasting Inclusions

• Rock outcrop
• Newlands soils that are on mountain foot slopes and have mountain big sagebrush in the potential plant community

• Ninemile and Freznik soils that are on tablelands
• Soils that are similar to the Carryback soil but have bedrock at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Erakatak soil—permeability, depth to bedrock, rock fragments throughout the soil, water erosion, shrink-swell potential
Carryback soil—rock fragments on the surface, permeability, depth to the claypan, depth to bedrock, shrink-swell potential, calcareous layer, water erosion

Dominant Vegetation in Potential Plant Community

Erakatak soil—Idaho fescue, Thurber needlegrass, mountain big sagebrush, bluebunch wheatgrass
Carryback soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Pedestaled plants and an erosion pavement on the Carryback soil are the result of past erosion.
• The surface layer of the Carryback soil is saturated following snowmelt.
• The depth to bedrock limits construction of water impoundments.
• The bedrock in the Erakatak soil restricts rooting depth.
• The claypan, calcareous layer, and bedrock in the Carryback soil restrict rooting depth.
• The very cobbly surface layer can restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The rock fragments throughout the Erakatak soil restrict the placement of fenceposts.
• Because of the high corrosivity of the Carryback soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Carryback soil is firm and the preferred forage plants can withstand grazing.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

81E—Felcher very cobbly clay loam, 5 to 30 percent slopes

Composition

Felcher soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Felcher Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 5,500 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 4 inches—brown very cobbly clay loam
4 to 24 inches—dark grayish brown very cobbly loam
24 inches—basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate or severe

Contrasting Inclusions

• Jesse Camp soils that are on lake terraces
• Soils that are similar to the Felcher soil but have bedrock at a depth of 20 inches or less
• Soils that have slopes of less than 5 percent or more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, slope, water erosion, available water capacity, rock fragments

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Wyoming big sagebrush, Thurber needlegrass, Indian ricegrass, bottlebrush squirreltail

Livestock Grazing

General management considerations:
- The bedrock and rock fragments restrict rooting depth.
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The depth to bedrock and slope limit construction of water impoundments.
- The rock fragments throughout the soil limit placement of fenceposts.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the soil surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness.

82F—Felcher very cobbly clay loam, 30 to 50 percent south slopes

Composition

Felcher soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Felcher Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—8 to 12 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 4 inches—brown very cobbly clay loam
4 to 24 inches—dark grayish brown very cobbly loam
24 inches—basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Riddleranch soils that are on north-facing slopes
- Soils that are similar to the Felcher soil but have bedrock at a depth of 20 inches or less
- Soils that have slopes of less than 30 percent

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, depth to bedrock, available water capacity, rock fragments

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, antelope bitterbrush

Livestock Grazing

General management considerations:
- The bedrock and rock fragments restrict rooting depth.
- The low precipitation and low available water capacity limit forage production and seedling survival.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- The rock fragments throughout the soil limit placement of fenceposts.
- Slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness.

83G—Felcher-Rock outcrop complex, 30 to 70 percent south slopes

Composition

Felcher soil and similar inclusions—60 percent
Rock outcrop—25 percent
Contrasting inclusions—15 percent

Characteristics of the Felcher Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,000 to 5,800 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 4 inches—pale brown very stony clay loam

4 to 24 inches—dark grayish brown very cobbly loam
24 inches—basalt

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Severe or very severe

Characteristics of the Rock Outcrop

Position on landscape: Escarpments
Kind of rock: Basalt

Contrasting Inclusions

• Westbutte soils that are on north-facing slopes at higher elevations and have mountain big sagebrush in the potential plant community
• Floke soils that are on tablelands and have low sagebrush in the potential plant community
• Riddleranch and Fitzwater soils on north-facing mountainsides
• Ratto and Locane soils on tablelands

Major Use

Livestock grazing

Major Management Factors

Slope, rock fragments on the surface, water erosion, depth to bedrock, available water capacity, Rock outcrop

Dominant Vegetation in Potential Plant Community

Felcher soil—bluebunch wheatgrass, antelope bitterbrush

Livestock Grazing

General management considerations:
• Livestock tend to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
• The bedrock and rock fragments restrict rooting depth.
• The low available water capacity limits forage production and seedling survival.
• The very stony surface layer, areas of Rock outcrop, and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The stones on the surface and areas of Rock outcrop limit placement of fenceposts.
• The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness.

84F—Felcher-Westbutte association, 30 to 50 percent slopes

Composition

Felcher soil and similar inclusions—45 percent
Westbutte soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Felcher Soil

Position on landscape: South-facing mountainsides
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 4,700 to 5,800 feet
Climatic factors:
Mean annual precipitation—12 to 14 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 4 inches—brown very stony clay loam
4 to 24 inches—dark grayish brown very cobbly loam
24 inches—basalt

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Characteristics of the Westbutte Soil

Position on landscape: North-facing mountainsides
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 4,700 to 5,800 feet
Climatic factors:
Mean annual precipitation—12 to 14 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 7 inches—very dark grayish brown extremely stony loam
7 to 16 inches—very dark grayish brown very stony loam
16 to 24 inches—dark brown very stony loam

24 to 33 inches—dark brown very cobbly loam
33 inches—tuff

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Rock outcrop
- Lambring and Pearlwise soils that are on north-facing mountainsides
- Ninemile soils that are on tablelands and have low sagebrush in the potential plant community
- Ratto soils that are on adjacent tablelands
- Riddleranch soils that are on south-facing mountainsides
- Soils that have slopes of less than 30 percent

Major Use

Livestock grazing

Major Management Factors

Felcher soil—slope, water erosion, available water capacity, rock fragments on the surface, depth to bedrock

Westbutte soil—slope, rock fragments on the surface, water erosion, available water capacity, depth to bedrock

Dominant Vegetation in Potential Plant Community

Felcher soil—bluebunch wheatgrass, antelope bitterbrush

Westbutte soil—Idaho fescue, bluebunch wheatgrass, mountain big sagebrush, basin wildrye

Livestock Grazing

General management considerations:

- Cold soil temperatures and a short growing season limit the period of plant growth on the Westbutte soil.
- The content of rock fragments limits placement of fenceposts.
- The depth to bedrock and content of rock fragments restrict rooting depth.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- Livestock herd and graze in the less stony areas of the unit.
- The extremely stony or very stony surface layer and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.

Suitable management practices:

- Delay grazing on the Westbutte soil until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If the Westbutte soil is seeded, select plants that tolerate droughtiness and a cool growing season.
- If the Felcher soil is seeded, select plants that tolerate droughtiness.

85C—Fertaline gravelly loam, 2 to 15 percent slopes

Composition

Fertaline soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Fertaline Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium and residuum; source—basalt, tuff
Elevation: 5,300 to 5,500 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 11 inches—very dark grayish brown gravelly loam
11 to 16 inches—dark yellowish brown gravelly clay
16 to 21 inches—dark yellowish brown gravelly clay loam
21 inches—indurated, extremely gravelly hardpan

Depth class: Moderately deep (20 to 30 inches) to the hardpan; very deep (more than 60 inches) to bedrock, very shallow or shallow (5 to 11 inches) to the claypan
Drainage class: Well drained
Permeability: Upper 11 inches—moderate; below this depth—very slow
Available water capacity: About 4 inches

Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 11 and 21 inches

Contrasting Inclusions

- Floke soils that are on tablelands
- Drakesflat soils that are on tablelands and have Wyoming big sagebrush in the potential plant community
- Coglin soils that are on tablelands and have black sagebrush in the potential plant community

Major Use

Livestock grazing

Major Management Factors

Available water capacity, depth to the hardpan, depth to the claypan, permeability, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, low sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
- The claypan and hardpan restrict rooting depth.
- The surface layer is saturated following snowmelt.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The hardpan limits construction of water impoundments.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

86C—Fertaline-Coglin complex, 2 to 15 percent slopes

Composition

Fertaline soil and similar inclusions—45 percent
Coglin soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Fertaline Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium and residuum; source—basalt, tuff
Elevation: 5,000 to 5,500 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 11 inches—very dark grayish brown gravelly loam
11 to 16 inches—brown gravelly clay
16 to 21 inches—dark yellowish brown gravelly clay loam
21 inches—indurated, extremely gravelly hardpan
Depth class: Moderately deep (20 to 30 inches) to the hardpan; very deep (more than 60 inches) to bedrock, very shallow or shallow (5 to 11 inches) to the claypan
Drainage class: Well drained
Permeability: Upper 11 inches—moderate; below this depth—very slow
Available water capacity: About 4 inches
Shrink-swell potential: High between depths of 11 and 21 inches
Hazard of erosion by water: Moderate

Characteristics of the Coglin Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 5,500 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—dark brown extremely stony loam
2 to 7 inches—dark brown clay
7 to 16 inches—dark yellowish brown silty clay loam

16 to 60 inches—dark yellowish brown silty clay loam

Depth class: Very deep (more than 60 inches) to bedrock, very shallow (2 to 5 inches) to the claypan, shallow or moderately deep (10 to 30 inches) to secondary lime
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 2 and 7 inches
Carbonates: Strongly effervescent between depths of 16 and 60 inches

Contrasting Inclusions

• Floke soils on tablelands
• Drakesflat soils that are on tablelands and have Wyoming big sagebrush in the potential plant community
• Soils that have slopes of less than 2 percent or more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Fertaline soil—available water capacity, depth to the hardpan, depth to the claypan, permeability, shrink-swell potential, water erosion
Coglin soil—stones on the surface, calcareous layer, water erosion, depth to the claypan, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Fertaline soil—bluebunch wheatgrass, low sagebrush, Sandberg bluegrass
Coglin soil—black sagebrush, bottlebrush squirreltail, Sandberg bluegrass

Livestock Grazing

General management considerations:
• The claypan and calcareous layer in the Coglin soil restrict rooting depth.
• The claypan and hardpan in the Fertaline soil restrict rooting depth.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Seeding areas of the more favorable Fertaline soil in this unit is difficult because of the pattern in which they occur with areas of the less favorable extremely stony Coglin soil.
• The extremely stony surface layer of the Coglin soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The surface layer is saturated following snowmelt.
• Crusting of the surface of the Coglin soil reduces infiltration and restricts seedling emergence and survival.
• Unless the hardpan in the Fertaline soil is ripped, it restricts construction of water impoundments.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soils are firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

87B—Fitzwater loam, 0 to 5 percent slopes

Composition

Fitzwater soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Fitzwater Soil

Position on landscape: Mountaintops
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,500 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 14 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 10 inches—very dark grayish brown loam
10 to 19 inches—dark brown extremely cobbly clay loam
19 to 60 inches—dark brown extremely cobbly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid

Available water capacity: About 3 inches
Hazard of erosion by water: Slight

Contrasting Inclusions

• Anawalt soils that are on tablelands and have low sagebrush in the potential plant community
• Newlands soils that are on foot slopes and mountainsides
• Soils that have bedrock or a pan at a depth of 40 inches or less

Major Use

Livestock grazing

Major Management Factors

Cobbles and gravel in the soil, available water capacity

Dominant Vegetation in Potential Plant Community

Idaho fescue, Thurber needlegrass, mountain big sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The low available water capacity limits forage production and seedling survival.
• Development of water impoundments is limited by the rock fragments throughout the soil.
• The high content of rock fragments in the lower layers restricts rooting depth and the placement of fenceposts.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

88E—Fitzwater extremely stony loam, 2 to 30 percent slopes

Composition

Fitzwater soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Fitzwater Soil

Position on landscape: Mountaintops
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,800 to 7,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 10 inches—very dark grayish brown extremely stony loam
10 to 19 inches—dark brown extremely cobbly clay loam
19 to 60 inches—dark brown extremely cobbly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate or severe

Contrasting Inclusions

• Newlands soils that are on foot slopes and north-facing mountainsides
• Fitzwater soils that have low sagebrush in the potential plant community
• Rock outcrop

Major Use

Livestock grazing

Major Management Factors

Stones on the surface, cobbles and gravel in the soil, slope, available water capacity, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, Thurber needlegrass, mountain big sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Development of water impoundments is restricted because of the steepness of slope and the rock fragments throughout the soil.
• The high content of rock fragments on the surface and in the soil restricts rooting depth and the placement of fenceposts.
• Livestock herd and graze in the less stony areas of the unit.
• The extremely stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The low available water capacity limits forage production and seedling survival.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

89F—Fitzwater extremely stony loam, 30 to 50 percent south slopes

Composition

Fitzwater soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Fitzwater Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,800 to 7,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 10 inches—very dark grayish brown extremely stony loam
10 to 19 inches—dark brown extremely cobbly clay loam
19 to 60 inches—dark brown extremely cobbly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 3 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Fitzwater soils that have low sagebrush in the potential plant community
• Newlands soils that are on foot slopes and north-facing mountainsides
• Rock outcrop

Major Use

Livestock grazing (fig. 12)

Figure 12.—Area of Fitzwater extremely stony loam, 30 to 50 percent south slopes, in good to excellent range condition. The dominant vegetation is bluebunch wheatgrass.

Major Management Factors

Slope, stones on the surface, cobbles and gravel in the soil, water erosion, available water capacity

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, mountain big sagebrush

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The low available water capacity limits forage production and seedling survival.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• The high content of rock fragments on the surface and in the soil restricts rooting depth and the placement of fenceposts.
• Livestock herd and graze in the less stony areas of this unit.
• The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• The extremely stony surface layer and the

steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

90F—Fitzwater complex, 30 to 50 percent south slopes

Composition

Fitzwater soil, thin surface, and similar inclusions—50 percent
Fitzwater soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Fitzwater Soils

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,800 to 7,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile of the Fitzwater soil, thin surface:
0 to 3 inches—very dark grayish brown extremely stony loam
3 to 19 inches—dark brown extremely cobbly clay loam
19 to 60 inches—dark brown extremely cobbly loam
Typical profile of the Fitzwater soil:
0 to 10 inches—very dark brown extremely stony loam
10 to 19 inches—dark brown extremely cobbly clay loam
19 to 60 inches—dark brown extremely cobbly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Harcany soils that are on higher, south-facing mountainsides
• Newlands soils that are on foot slopes and north-facing mountainsides
• Rock outcrop

Major Use

Livestock grazing

Major Management Factors

Slope, stones on the surface and in the soil, water erosion, available water capacity

Dominant Vegetation in Potential Plant Community

Fitzwater soil, thin surface—Idaho fescue, low sagebrush, bluebunch wheatgrass
Fitzwater soil—bluebunch wheatgrass, mountain big sagebrush

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The low available water capacity limits forage production and seedling survival.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of this unit.
• Some areas of this unit have a thin surface layer because of past erosion. These areas support dominantly low sagebrush.
• The high content of rock fragments on the surface and in the soils restricts rooting depth and the placement of fenceposts.
• The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• The extremely stony surface layer and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the

existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

91F—Fitzwater-Westbutte association, 30 to 50 percent slopes

Composition

Fitzwater soil and similar inclusions—60 percent
Westbutte soil and similar inclusions—25 percent
Contrasting inclusions—15 percent

Characteristics of the Fitzwater Soil

Position on landscape: South-facing mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 10 inches—very dark grayish brown extremely stony loam
10 to 19 inches—dark brown extremely cobbly clay loam
19 to 60 inches—dark brown extremely cobbly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 3 inches
Hazard of erosion by water: Severe

Characteristics of the Westbutte Soil

Position on landscape: North-facing mountainsides
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark grayish brown extremely stony loam
7 to 16 inches—very dark grayish brown very stony loam
16 to 24 inches—dark brown very stony loam
24 to 33 inches—dark brown very cobbly loam
33 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Rock outcrop
• Felcher and Riddleranch soils on south-facing mountainsides
• Freznik soils that are on tablelands and have low sagebrush in the potential plant community
• Lambring and Pearlwise soils on north-facing mountainsides

Major Use

Livestock grazing

Major Management Factors

Fitzwater soil—available water capacity, stones on the surface and in the soil, slope, water erosion
Westbutte soil—available water capacity, stones on the surface, slope, water erosion, depth to bedrock

Dominant Vegetation in Potential Plant Community

Fitzwater soil—bluebunch wheatgrass, mountain big sagebrush
Westbutte soil—Idaho fescue, bluebunch wheatgrass, mountain big sagebrush, basin wildrye

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of this unit.
• The low available water capacity limits forage production and seedling survival primarily on the Fitzwater soil.
• The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• The extremely stony surface layer and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The high content of rock fragments on the surface of

the soils and in the soils restricts rooting depth and the placement of fenceposts.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

92C—Floke complex, 2 to 15 percent slopes

Composition

Floke soil and similar inclusions—50 percent
Floke soil, thin surface, and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Floke Soils

Position on landscape: Tablelands
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 4,900 to 6,000 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile of the Floke soil:
0 to 8 inches—very dark grayish brown and dark grayish brown very stony loam
8 to 12 inches—brown clay
12 to 15 inches—brown clay loam
15 to 20 inches—indurated hardpan
20 inches—basalt
Typical profile of the Floke soil, thin surface:
0 to 3 inches—dark grayish brown extremely stony loam
3 to 8 inches—dark brown clay
8 to 13 inches—brown clay
13 to 19 inches—brown clay loam
19 to 21 inches—indurated hardpan
21 inches—basalt
Depth class: Floke soil—moderately deep (20 to 30 inches) to bedrock, shallow (14 to 20 inches) to the hardpan, very shallow (5 to 10 inches) to the claypan; Floke soil, thin surface—moderately deep (20 to 30 inches) to bedrock, shallow (14 to 20 inches) to the hardpan, very shallow (2 to 5 inches) to the claypan
Hazard of erosion by water: Floke soil—moderate; Floke soil, thin surface—moderate or severe
Shrink-swell potential: Floke soil—high between depths of 8 and 12 inches; Floke soil, thin surface—high between depths of 3 and 13 inches
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches

Contrasting Inclusions

- Rock outcrop
- Strips of Rubble land that extend downslope
- Ratto soils that are on tablelands and have Wyoming big sagebrush in the potential plant community
- Anawalt and Freznik soils that are on tablelands
- Soils that are similar to the Floke soils but have bedrock or a hardpan at a depth of 10 inches or less or at a depth of 20 to 40 inches
- Soils that have slopes of less than 2 percent or more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Stones on the surface, depth to the hardpan, depth to the claypan, permeability, available water capacity, water erosion

Dominant Vegetation in Potential Plant Community

Floke soil—bluebunch wheatgrass, low sagebrush, Sandberg bluegrass
Floke soil, thin surface—Sandberg bluegrass, low sagebrush

Livestock Grazing

General management considerations:
- The claypan and hardpan restrict rooting depth.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The surface layer is saturated following snowmelt.
- Some areas of this unit have a thin surface layer because of past erosion. These areas support dominantly low sagebrush.
- The extremely stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The depth to bedrock limits the construction of water impoundments.
- The depth to bedrock limits placement of fenceposts and makes special design of fences necessary.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

93C—Floke-Ratto complex, 2 to 15 percent slopes

Composition

Floke soil and similar inclusions—45 percent
Ratto soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Floke Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 4,800 to 6,000 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 8 inches—very dark grayish brown and dark grayish brown very stony loam
8 to 12 inches—brown clay
12 to 15 inches—brown clay loam
15 to 20 inches—indurated hardpan
20 inches—basalt
Depth class: Moderately deep (20 to 30 inches) to bedrock, shallow (14 to 20 inches) to the hardpan, very shallow (5 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 8 and 12 inches

Characteristics of the Ratto Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 4,800 to 6,000 feet
Climatic factors (mean annual):
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown very cobbly loam
3 to 9 inches—dark brown gravelly clay loam
9 to 13 inches—brown clay loam
13 to 15 inches—brown gravelly clay loam
15 to 19 inches—indurated, very gravelly hardpan
19 to 60 inches—grayish brown gravelly loamy sand
Depth class: Shallow (12 to 20 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow above the hardpan; very rapid below the hardpan
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 15 inches
Carbonates: Strongly effervescent between depths of 13 and 15 inches; violently effervescent below this depth

Contrasting Inclusions

- Rock outcrop
- Coglin soils that are on tablelands and have black sagebrush in the potential plant community
- Strips of Rubble land that extend downslope in areas of the Floke soil
- Floke soils that have a thinner surface layer and support dominantly Sandberg bluegrass
- Freznik soils that support dominantly Sandberg bluegrass
- Anawalt soils that are on tablelands
- Soils that have slopes of less than 2 percent or more than 15 percent
- Soils that are similar to the Floke soil but have bedrock or a hardpan at a depth of 10 inches or less

Major Use

Livestock grazing

Major Management Factors

Floke soil—stones on the surface, depth to the claypan, depth to the hardpan, permeability, available water capacity, water erosion
Ratto soil—depth to the hardpan, permeability, available water capacity, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Floke soil—bluebunch wheatgrass, low sagebrush, Sandberg bluegrass
Ratto soil—bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The claypan in the Floke soil restricts rooting depth.
- The hardpan in the Ratto soil restricts rooting depth.
- The surface layer of the Floke soil is saturated following snowmelt.
- Pedestaled plants and an erosion pavement on the Floke soil are the result of past erosion.
- The depth to the hardpan limits construction of water impoundments.
- The depth to the hardpan limits placement of fenceposts and makes special design of fences necessary.
- The very stony surface layer of the Floke soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Floke soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

94A—Fluvaquents, 0 to 2 percent slopes

Composition

Fluvaquents and similar inclusions—90 percent
Contrasting inclusions—10 percent

Characteristics of the Fluvaquents

Position on landscape: Shorelines adjacent to Goose Lake
Parent material: Kind—lacustrine sediment; source—tuff, basalt, rhyolite, volcanic ash
Elevation: 4,400 to 4,700 feet
Climatic factors:
Mean annual precipitation—14 to 16 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Reference profile:
0 to 2 inches—very dark grayish brown silty clay loam
2 to 20 inches—dark brown, mottled silt loam
20 to 32 inches—pale brown very cobbly clay loam
32 to 60 inches—dark brown very gravelly coarse sand
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained and somewhat poorly drained
Permeability: Slow and moderate
Available water capacity: About 8 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: November through May—0 to 36 inches; rest of year—more than 36 inches
Frequency of flooding: Frequent for brief periods from November through April
Salinity: Very slightly saline to strongly saline; salinity is highest adjacent to the lake
Sodicity: Slightly sodic and moderately sodic
Carbonates: Slightly effervescent to violently effervescent

Contrasting Inclusions

- Tandy soils that are on adjacent alluvial flats in Goose Lake Valley
- Narrow dunelike strips that are at the upper edge of the unit and consist of sandy material over extremely gravelly sand
- Stream channels that cut and fill annually

Major Uses

Wildlife habitat, livestock grazing

Major Management Factors

Wetness, salinity, sodicity, permeability

Dominant Vegetation in Potential Plant Community

Nuttall alkaligrass, inland saltgrass

Livestock Grazing

General management considerations:
- This unit provides food and cover for wetland wildlife.
- Grazing should be deferred during the period of nesting for waterfowl.

• Water on the surface and the high water table restrict rooting depth and survival of plants.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• Excess sodium in the soils results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface reduce the water intake rate and restrict seedling emergence and survival.
• Stream corridors are subject to cutting and filling during periods of flooding.

Suitable management practices:
• Delay grazing until the soils are adequately drained and are firm enough to withstand trampling by livestock.
• If this unit is seeded, select plants that tolerate wetness, salinity, and sodicity and that provide cover for nesting waterfowl.

95B—Fordney gravelly loamy sand, 0 to 5 percent slopes

Composition

Fordney soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Fordney Soil

Position on landscape: Terraces
Parent material: Kind—alluvium, eolian sand; source—tuff, basalt, volcanic ash
Elevation: 4,400 to 5,000 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 7 inches—very dark grayish brown gravelly loamy sand
7 to 46 inches—dark brown loamy sand
46 to 60 inches—brown sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Excessively drained
Permeability: Moderately rapid
Available water capacity: About 5 inches
Hazard of erosion: By water—slight; by wind—moderate

Contrasting Inclusions

• Harriman soils that are on adjacent lake terraces and have dominantly bluebunch wheatgrass, basin wildrye, and mountain big sagebrush in the potential plant community
• Mesman soils that are on slightly lower lying lake terraces and have dominantly needleandthread and basin big sagebrush in the potential plant community
• McConnel soils that are on slightly lower lying lake terraces and have dominantly Thurber needlegrass and Sandberg bluegrass in the potential plant community
• Soils that have slopes of more than 5 percent

Major Uses

Livestock grazing, cropland

Major Management Factors

Permeability, wind erosion, available water capacity

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, Thurber needlegrass

Livestock Grazing

General management considerations:
• The low available water capacity limits forage production and seedling survival.
• This unit is subject to wind erosion if the vegetation is removed or degraded.
• The moderately rapid permeability and potential for seepage limit construction of water impoundments.
• Range seeding controls blowing and drifting sand.

Suitable management practices:
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
• If this unit is seeded, select plants that tolerate droughtiness.

Cropland

General management considerations:
• Irrigation is needed for crops.
• Because of the moderately rapid permeability and rapid water intake rate, this soil is best suited to sprinkler irrigation.
• Because of the low available water capacity, light and frequent applications of irrigation water are needed.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
• The seedling mortality rate is moderate because of the low available water capacity.

Suitable management practices:
• Irrigate during the dry period in summer.
• Adjust the application of irrigation water to the available water capacity, the water intake rate, and the needs of the crop grown to avoid overirrigating and leaching of plant nutrients.
• Reduce the risk of wind erosion by planting crops in narrow strips at right angles to the prevailing wind, maintaining crop residue on the surface, and using minimum tillage.
• To ensure the establishment and survival of seedlings, use continuous cultivation, mulch, or herbicides to control competing vegetation.

95C—Fordney gravelly loamy sand, 5 to 15 percent slopes

Composition

Fordney soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Fordney Soil

Position on landscape: Terraces
Parent material: Kind—alluvium, eolian sand; source—tuff, basalt, volcanic ash
Elevation: 4,400 to 5,000 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 7 inches—very dark grayish brown gravelly loamy sand
7 to 46 inches—dark brown loamy sand
46 to 60 inches—brown sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Excessively drained
Permeability: Moderately rapid
Available water capacity: About 5 inches
Hazard of erosion: By water—slight; by wind—moderate

Contrasting Inclusions

• Harriman soils that are on lake terraces and have dominantly bluebunch wheatgrass, basin wildrye, and mountain big sagebrush in the potential plant community
• Mesman soils that are on slightly lower lying lake terraces and have dominantly needleandthread and basin big sagebrush in the potential plant community
• McConnel soils that are on slightly lower lying lake terraces and have dominantly Thurber needlegrass and Sandberg bluegrass in the potential plant community
• Soils that have slopes of less than 5 percent or more than 15 percent

Major Uses

Livestock grazing, cropland

Major Management Factors

Permeability, wind erosion, slope, available water capacity

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, Thurber needlegrass

Livestock Grazing

General management considerations:
• The low available water capacity limits forage production and seedling survival.
• This unit is subject to wind erosion if the vegetation is removed or degraded.
• The moderately rapid permeability and potential for seepage limit construction of water impoundments.
• Range seeding controls blowing and drifting sand.

Suitable management practices:
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
• If this unit is seeded, select plants that tolerate droughtiness.

Cropland

General management considerations:
• Irrigation is needed for crops.
• Because of the slope and the rapid water intake rate, this soil is best suited to sprinkler irrigation.
• Because of the droughtiness and low available water capacity, light and frequent applications of irrigation water are needed.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
• The seedling mortality rate is moderate because of the low available water capacity.

Suitable management practices:
• Irrigate during the dry period in summer.
• To reduce water erosion, adjust the application of irrigation water to the water intake rate.

• Adjust the application of irrigation water to the available water capacity, the water intake rate, and the needs of the crop grown to avoid overirrigating and leaching of plant nutrients and to reduce runoff.
• Maintain crop residue on the surface to reduce water erosion.
• Reduce the risk of wind erosion by planting crops in narrow strips at right angles to the prevailing wind, maintaining crop residue on the surface, and using minimum tillage.
• To ensure the establishment and survival of seedlings, use continuous cultivation, mulch, or herbicides to control competing vegetation.

96C—Freznik very stony loam, thin surface, 2 to 15 percent slopes

Composition

Freznik soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Freznik Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium over residuum; source—tuff, basalt
Elevation: 5,600 to 6,400 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown very stony loam
3 to 25 inches—dark yellowish brown clay
25 to 32 inches—yellowish brown clay loam
32 inches—slightly fractured basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 5 inches) to the claypan
Drainage class: Well drained
Permeability: Upper 3 inches—moderate; below this depth—very slow
Available water capacity: About 5 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 3 and 25 inches

Contrasting Inclusions

• Rock outcrop
• Strips of Rubble land that extend downslope
• Deseed soils that are on tablelands and have Wyoming big sagebrush in the potential plant community
• Carryback soils that are on tablelands and have dominantly bluebunch wheatgrass in the potential plant community
• Floke soils that are on tablelands
• Soils that have slopes of more than 15 percent
• Soils that have a cobbly or stony surface layer

Major Use

Livestock grazing

Major Management Factors

Stones on the surface, depth to the claypan, permeability, depth to bedrock, shrink-swell potential, available water capacity

Dominant Vegetation in Potential Plant Community

Sandberg bluegrass, low sagebrush

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The claypan and bedrock restrict rooting depth.
• The surface layer is saturated following snowmelt.
• The depth to bedrock limits construction of water impoundments.
• The very stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots.
• Special design of fences is needed because of the subsoil that expands when wet and contracts when dry and because of the rock fragments on the surface.
• The low available water capacity limits forage production and seedling survival.
• Livestock herd and graze in the less stony areas of the unit.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate

droughtiness, shrinking and swelling, and a cool growing season.

97A—Goose Lake silt loam, 0 to 1 percent slopes

Composition

Goose Lake soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Goose Lake Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment, alluvium; source—tuff, rhyolite, basalt
Elevation: 4,500 to 4,725 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 6 inches—black silt loam
6 to 10 inches—very dark gray silt loam
10 to 42 inches—very dark gray silty clay
42 to 62 inches—dark gray clay loam
Depth class: Very deep (more than 60 inches) to bedrock, shallow (13 to 20 inches) to the clayey layer
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 9 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: February through August—6 inches above the surface to 48 inches below the surface; rest of year—more than 48 inches
Frequency of flooding: Rare
Shrink-swell potential: High between depths of 10 and 42 inches

Contrasting Inclusions

• Thunderegg soils that are on terraces, some of which are slightly higher lying
• Lakeview soils that are on slightly higher lying terraces and have dominantly basin wildrye and basin big sagebrush in the potential plant community
• Stockdrive soils that are on slightly higher lying terraces and have dominantly basin wildrye, inland saltgrass, and black greasewood in the potential plant community

Major Uses

Cropland, hayland, livestock grazing, wildlife habitat

Major Management Factors

Wetness, shrink-swell potential, permeability, clayey layer

Dominant Vegetation in Potential Plant Community

Tufted hairgrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife in spring.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction and puddling of the surface layer.
• A high water table early in the growing season restricts the rooting depth of non-water-tolerant plants.
• The clayey layer restricts rooting depth and water movement.
• The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
• Delay grazing until the soil is adequately drained and is firm enough to withstand trampling by livestock.
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• If this unit is seeded, select plants that tolerate wetness and shrinking and swelling and that provide cover for nesting waterfowl.

Cropland and Hayland

General management considerations:
• Wetness limits the choice of hay and pasture plants and other crops.
• The rooting depth is limited by the clayey layer.
• The seasonal high water table provides some supplemental moisture for plants in summer.
• Irrigation is needed for most crops.
• Suitable irrigation methods include sprinkler, furrow, and border systems.
• If furrow or border irrigation systems are used, land leveling may be needed to ensure uniform application of water.

- To avoid exposing the clayey layer, land smoothing that involves only shallow cuts is best suited.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of wetness.
- Because this soil is poorly drained, the seedling mortality rate is moderate.
- Spring planting may be delayed because of wetness.

Suitable management practices:
- Use open ditches to remove surface water in spring.
- Irrigate during the dry period late in summer or in fall.
- Because the permeability is slow, regulate the application of irrigation water to avoid ponding of the surface and the buildup of a perched water table.
- Maintain soil tilth and reduce compaction of the soil by returning crop residue to the soil and keeping tillage at a minimum.

98A—Goose Lake silt loam, sodic, 0 to 1 percent slopes

Composition

Goose Lake soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Goose Lake Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—tuff, rhyolite, basalt, volcanic ash
Elevation: 4,500 to 4,725 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 6 inches—black silt loam
6 to 10 inches—very dark gray silt loam
10 to 42 inches—very dark gray silty clay
42 to 62 inches—dark gray clay loam
Depth class: Very deep (more than 60 inches) to bedrock, shallow (13 to 20 inches) to the clayey layer
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 7 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: February through August—6 inches above the surface to 48 inches below the surface; rest of year—more than 48 inches
Frequency of flooding: Rare
Shrink-swell potential: High between depths of 10 and 42 inches
Salinity: Slightly saline in the upper 10 inches
Sodicity: Slightly sodic in the upper 10 inches
Contrasting features:
- Thunderegg soils that are on terraces, some of which are slightly higher lying, and have dominantly tufted hairgrass and Nebraska sedge in the potential plant community
- Lakeview soils that are on slightly higher lying terraces and have dominantly basin wildrye and basin big sagebrush in the potential plant community
- Stockdrive soils that are on slightly higher lying terraces and have dominantly basin wildrye, inland saltgrass, and black greasewood in the potential plant community

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Wetness, shrink-swell potential, permeability, sodicity, salinity, clayey layer

Dominant Vegetation in Potential Plant Community

Nuttall alkaligrass, inland saltgrass

Livestock Grazing

General management considerations:
- This unit provides food and cover for wetland wildlife.
- Grazing should be deferred during the period of nesting for waterfowl.
- Grazing when the soil is wet results in compaction and puddling of the surface.
- Salts reduce the amount of water available to plants and restrict seedling survival.
- A high water table early in the growing season restricts the rooting depth of non-water-tolerant plants.
- The clayey layer restricts rooting depth and water movement.
- The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
- Delay grazing until the soil is adequately drained and is firm enough to withstand trampling by livestock.
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- If this unit is seeded, select plants that tolerate

wetness, sodicity, salinity, and shrinking and swelling and that provide cover for nesting waterfowl.

Hayland

General management considerations:
- Wetness, salinity, and sodicity limit the choice of hay and pasture plants.
- The rooting depth is limited by the clayey layer.
- The seasonal high water table provides supplemental moisture for plants in summer.
- Removal of salts and sodium is difficult unless the soil is drained.
- Irrigation may be needed to meet the needs of the crops grown and to leach salts below the root zone.
- Suitable irrigation methods include sprinkler, furrow, and border systems.
- If furrow or border irrigation is used, land leveling may be needed for uniform application of irrigation water.
- To avoid exposing the clayey layer, land smoothing that involves only shallow cuts is best suited.
- The soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Irrigation and drainage are needed for intensive management.
- Because of the content of salts, trees and shrubs suitable for windbreaks and environmental plantings are limited and the seedling mortality is severe.
- Spring planting may be delayed because of wetness.

Suitable management practices:
- Use open ditches to remove surface water in spring.
- Reduce the content of salts and sodium by applying proper amounts of soil amendments and by leaching.
- Irrigate during the dry period late in summer or early in fall.
- Because permeability is slow, regulate the application of irrigation water to avoid ponding of the surface and the buildup of a perched water table.
- Maintain soil tilth and reduce soil compaction by returning crop residue to the soil and keeping tillage at a minimum.
- Select plants that can tolerate wetness.

99A—Goose Lake silty clay loam, wet, 0 to 1 percent slopes

Composition

Goose Lake soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Goose Lake Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—tuff, rhyolite, basalt
Elevation: 4,500 to 4,725 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 6 inches—black silty clay loam
6 to 10 inches—very dark gray silt loam
10 to 42 inches—very dark gray silty clay
42 to 62 inches—dark gray clay loam
Depth class: Very deep (more than 60 inches) to bedrock, shallow (13 to 20 inches) to the clayey layer
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 9 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: February through August—12 inches above the surface to 36 inches below the surface; rest of year—more than 36 inches
Frequency of flooding: Rare
Shrink-swell potential: High between depths of 10 and 42 inches

Contrasting Inclusions

- Thunderegg soils that are on terraces, some of which are slightly higher lying, and have dominantly tufted hairgrass and Nebraska sedge in the potential plant community.
- Lakeview soils that are on slightly higher lying terraces and have dominantly basin wildrye and basin big sagebrush in the potential plant community.
- Stockdrive soils that are on slightly higher lying terraces and have dominantly basin wildrye, inland

saltgrass, and black greasewood in the potential plant community

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Wetness, shrink-swell potential, permeability, clayey layer

Dominant Vegetation in Potential Plant Community

Spikerush, dock, Baltic rush

Livestock Grazing

General management considerations:
- This unit provides food and cover for wetland wildlife.
- Grazing should be deferred during the period of nesting for waterfowl.
- Grazing when the soil is wet results in compaction and puddling of the surface.
- A high water table early in the growing season restricts the rooting depth of non-water-tolerant plants.
- The clayey layer restricts the rooting depth and water movement.
- The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
- Delay grazing until the soil is adequately drained and is firm enough to withstand trampling by livestock.
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- If this unit is seeded, select plants that tolerate wetness and shrinking and swelling and that provide cover for nesting waterfowl.

Hayland

General management considerations:
- Wetness limits the choice of hay and pasture plants.
- The rooting depth is limited by the clayey layer.
- The seasonal high water table provides some supplemental moisture for plants in summer.
- Irrigation may be needed late in summer or in fall.
- Suitable irrigation methods include sprinkler, furrow, and border systems.
- If furrow or border irrigation is used, land leveling may be needed for uniform application of water.
- To avoid exposing the clayey layer, land leveling that involves only shallow cuts is best suited.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Trees and shrubs for windbreaks or environmental plantings should be tolerant of wetness.
- Because this soil is poorly drained, the seedling mortality rate is moderate.

Suitable management practices:
- Irrigate during the dry period late in summer and in fall.
- Use open ditches to remove surface water in spring.
- Because permeability is slow, regulate the application of irrigation water to avoid ponding of the surface and the buildup of a perched water table.
- Maintain tilth and reduce compaction by returning crop residue to the soil.

100C—Hager complex, 2 to 15 percent slopes

Composition

Hager soil and similar inclusions—45 percent
Hager soil, thin surface, and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Hager Soils

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 4,500 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile of the Hager soil:
0 to 8 inches—very dark grayish brown and dark brown cobbly loam
8 to 24 inches—brown and dark yellowish brown silty clay loam
24 to 37 inches—dark yellowish brown loam
37 to 42 inches—indurated hardpan
42 inches—tuff
Typical profile of the Hager soil, thin surface:
0 to 3 inches—dark brown extremely stony loam
3 to 12 inches—dark yellowish brown and brown silty clay loam
12 to 37 inches—dark yellowish brown loam
37 to 42 inches—indurated hardpan
42 inches—tuff
Carbonates: Hager soil—slightly effervescent between depths of 24 and 37 inches; Hager soil, thin

surface—violently effervescent between depths of 12 and 42 inches

Depth class: Moderately deep (20 to 40 inches) to the hardpan; deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

- Drakesflat soils that are on tablelands near the higher elevations and that have dominantly bluebunch wheatgrass and Sandberg bluegrass in the potential plant community
- Felcher soils that are on adjacent steep escarpments and have dominantly bluebunch wheatgrass and antelope bitterbrush in the potential plant community
- Coglin soils that are near the higher elevations
- Old Camp soils that are near the lower elevations and have dominantly Indian ricegrass and Thurber needlegrass in the potential plant community
- Soils that are similar to the Hager soils but have a hardpan at a depth of 20 inches or less
- Soils that have slopes of less than 2 percent

Major Use

Livestock grazing

Major Management Factors

Hager soil—available water capacity, depth to the hardpan, water erosion, calcareous layer
Hager, thin surface—stones on the surface, water erosion, available water capacity, depth to the hardpan, calcareous layer

Dominant Vegetation in Potential Plant Community

Hager soil—Thurber needlegrass, Wyoming big sagebrush, Indian ricegrass, bottlebrush squirreltail, spiny hopsage
Hager soil, thin surface—black sagebrush, bottlebrush squirreltail, Sandberg bluegrass

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- Some areas of this unit have a thin surface layer because of past erosion. These areas support dominantly black sagebrush.
- The extremely stony surface layer of the Hager soil, thin surface, restricts rooting depth and seedling emergence.
- Seeding areas of the more favorable Hager soil in this unit is difficult because of the pattern in which they occur with areas of the less favorable extremely stony Hager soil, thin surface.
- The extremely stony surface layer of the Hager soil, thin surface, restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.

Suitable management practices:
- Minimize erosion of the surface layer to maintain forage production.
- Minimize the risk of water erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
- If this unit is seeded, select plants that tolerate droughtiness.

101C—Hallihan gravelly fine sandy loam, 0 to 15 percent slopes

Composition

Hallihan soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Hallihan Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
2 inches to 0—white fir and lodgepole pine needles
0 to 2 inches—black gravelly fine sandy loam
2 to 13 inches—dark brown and dark yellowish brown gravelly fine sandy loam
13 to 21 inches—dark yellowish brown very gravelly fine sandy loam
21 to 43 inches—pale brown very gravelly sandy loam
43 to 60 inches—pale brown extremely gravelly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained

Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

• Twelvemile soils that are on adjacent, south-facing mountainsides
• Soils that are similar to the Hallihan soil but have bedrock at a depth of 40 to 60 inches

Major Use

Woodland

Major Management Factors

Cold temperatures in summer, available water capacity, rock fragments

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine

Woodland

Estimated growth at culmination of mean annual increment: 57 cubic feet per acre per year for white fir at age 70

General management considerations:
• Accumulations of snow can bend or break small trees.
• Wet, unsurfaced roads and skid trails are firm.
• Dry, unsurfaced roads and skid trails are dusty.
• Cuts and fills are stable.
• The rock fragments limit the planting of trees.
• Because of the droughtiness and the cold temperatures in summer, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.
• To minimize soil displacement and compaction, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.

102E—Hallihan gravelly fine sandy loam, 15 to 40 percent north slopes

Composition

Hallihan soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Hallihan Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
2 inches to 0—white fir and lodgepole pine needles
0 to 2 inches—black gravelly fine sandy loam
2 to 13 inches—dark brown and dark yellowish brown gravelly fine sandy loam
13 to 21 inches—dark yellowish brown very gravelly fine sandy loam
21 to 43 inches—pale brown very gravelly sandy loam
43 to 60 inches—pale brown extremely gravelly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Chocktoot, Hammersley, and Kittleson soils that are on adjacent mountainsides
• Twelvemile soils that are on adjacent, south-facing mountainsides
• Longjohn soils that are on adjacent, higher lying mountainsides
• Soils that are similar to the Hallihan soil but have bedrock at a depth of 40 to 60 inches

Major Use

Woodland

Major Management Factors

Cold temperatures in summer, slope, available water capacity, rock fragments, water erosion

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine

Woodland

Estimated growth at culmination of mean annual increment: 57 cubic feet per acre per year for white fir at age 70

General management considerations:
- Accumulations of snow can bend or break small trees.
- Wet, unsurfaced roads and skid trails are firm.
- Dry, unsurfaced roads and skid trails are dusty.
- Cuts and fills ravel when dry.
- The rock fragments make tree planting difficult.
- To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
- Because of the droughtiness and the cold temperatures in summer, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
- To minimize soil compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
- To reduce compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragment in the surface layer.
- Minimize mechanical piling of slash. Heavy equipment causes soil disturbance and compaction and exposes the soil. Maintain slash on the surface to reduce sheet and rill erosion.

102G—Hallihan gravelly fine sandy loam, 40 to 60 percent north slopes

Composition

Hallihan soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Hallihan Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
2 inches to 0—white fir and lodgepole pine needles
0 to 2 inches—black gravelly fine sandy loam
2 to 13 inches—dark brown and dark yellowish brown gravelly fine sandy loam
13 to 21 inches—dark yellowish brown very gravelly fine sandy loam
21 to 43 inches—pale brown very gravelly sandy loam
43 to 60 inches—pale brown extremely gravelly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Chocktoot and Kittleson soils that are on adjacent mountainsides
- Twelvemile soils that are on adjacent, south-facing mountainsides
- Longjohn soils that are on adjacent, higher lying mountainsides
- Soils that are similar to the Hallihan soil but have bedrock at a depth of 40 to 60 inches

Major Use

Woodland

Major Management Factors

Cold temperatures in summer, slope, water erosion, available water capacity, rock fragments

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine

Woodland

Estimated growth at culmination of mean annual increment: 57 cubic feet per acre per year for white fir at age 70

General management considerations:
- Accumulations of snow can bend or break small trees.

• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
• Wet, unsurfaced roads are firm.
• Dry, unsurfaced roads are dusty.
• Cuts and fills ravel when dry.
• Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
• The rock fragments make tree planting difficult.
• Because of the droughtiness and the cold temperatures in summer, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• To minimize soil displacement, cable yarding systems should be used.
• To minimize compaction and erosion, avoid logging in spring when the soils are wet.
• Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
• Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
• Leave slash material on the soil to minimize sheet and rill erosion.

103E—Hammersley-Kittleson complex, 15 to 40 percent north slopes

Composition

Hammersley soil and similar inclusions—50 percent
Kittleson soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Hammersley Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
3 inches to 0—white fir needles
0 to 15 inches—very dark grayish brown loam
15 to 24 inches—very dark grayish brown clay loam
24 to 35 inches—dark brown clay
35 to 50 inches—dark yellowish brown cobbly clay
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 24 and 50 inches

Characteristics of the Kittleson Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
3 inches to 0—white fir needles
0 to 44 inches—dark brown sandy loam
44 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Chocktoot and Hallihan soils that are on adjacent mountainsides
• Soils that have south aspects or slopes of more than 40 percent

Major Use

Woodland

Major Management Factors

Hammersley soil—cold temperatures in summer, slope, water erosion, permeability
Kittleson soil—cold temperatures in summer, slope, water erosion, depth to bedrock

Dominant Vegetation in Potential Plant Community

Hammersley and Kittleson soils—white fir, ponderosa pine

Woodland

Estimated growth at culmination of mean annual increment: Hammersley and Kittleson soils—57 cubic feet per acre per year for white fir at age 70

General management considerations:
- Accumulations of snow can bend or break small trees.
- The clay layer in the Hammersley soil restricts permeability.
- Wet, unsurfaced roads and skid trails on the Hammersley soil are slippery and sticky, and those on the Kittleson soil are soft.
- Dry, unsurfaced roads and skid trails on the Kittleson soil are dusty.
- Cuts and fills on the Hammersley soil slough when wet, and those on the Kittleson soil are stable.
- To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
- Because of the cold temperatures in summer, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
- To minimize soil compaction, erosion, and displacement, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring.
- To minimize compaction, adjust yarding operations to the content of soil moisture and content of organic matter in the surface layer.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the surface.
- Reduce the risk of erosion and displacement of the Hammersley soil by limiting vehicle access to periods when the soil is dry or frozen.

103G—Hammersley-Kittleson complex, 40 to 70 percent north slopes

Composition

Hammersley soil and similar inclusions—50 percent
Kittleson soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Hammersley Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
3 inches to 0—white fir needles
0 to 15 inches—very dark grayish brown loam
15 to 24 inches—very dark grayish brown clay loam
24 to 35 inches—dark brown clay
35 to 50 inches—dark yellowish brown cobbly clay
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: Severe or very severe
Shrink-swell potential: High between depths of 24 and 50 inches

Characteristics of the Kittleson Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December

through April; more than 48 inches—January through March

Typical profile:

3 inches to 0—white fir needles
0 to 44 inches—dark brown sandy loam
44 inches—highly weathered tuff

Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe or very severe

Contrasting Inclusions

- Chocktoot and Hallihan soils that are on adjacent mountainsides
- Soils that are more than 35 percent rock fragments throughout
- Soils that are stony in the upper 15 inches
- Soils that have slopes of less than 40 percent

Major Use

Woodland

Major Management Factors

Hammersley soil—cold temperatures in summer, slope, water erosion, permeability
Kittleson soil—cold temperatures in summer, slope, water erosion, depth to bedrock

Dominant Vegetation in Potential Plant Community

Hammersley and Kittleson soils—white fir, ponderosa pine

Woodland

Estimated growth at culmination of mean annual increment: Hammersley and Kittleson soils—57 cubic feet per acre per year for white fir at age 70

General management considerations:

- Accumulations of snow can bend or break small trees.
- Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
- The clay layer in the Hammersley soil restricts permeability.
- Wet, unsurfaced roads on the Hammersley soil are sticky and on the Kittleson soil are soft.
- The bedrock in the Hammersley soil has fair quality for use as base and grade material in road construction.
- Cuts and fills on the Hammersley soil slough when wet, and those on the Kittleson soil are stable.
- To maintain the quantity and quality of the water in riparian areas, a buffer zone should be maintained around these areas and disturbance should be minimized. Trees should not be felled into or skidded through riparian areas.
- Because of the cold temperatures in summer, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:

- To minimize soil displacement, use cable yarding systems.
- To minimize compaction and erosion, avoid logging in spring when the soils are wet.
- Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, and accumulating slash on the surface.
- Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
- Leave slash material on the soil to minimize sheet and rill erosion.
- To reduce the risk of soil erosion and displacement on the Hammersley soil, limit vehicle access to periods when the soil is dry or frozen.

104E—Harcany very gravelly loam, 15 to 30 percent slopes

Composition

Harcany soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Harcany Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—basalt
Elevation: 6,000 to 8,000 feet

Climatic factors:

Mean annual precipitation—14 to 16 inches
Mean annual air temperature—40 to 45 degrees F
Frost-free period—20 to 50 days

Typical profile:

0 to 24 inches—very dark brown very gravelly loam
24 to 40 inches—dark brown extremely cobbly loam
40 to 60 inches—dark brown extremely stony loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 4 inches

Hazard of erosion by water: Severe

Contrasting Inclusions

- Fitzwater soils that are on south-facing slopes
- Soils that have bedrock at a depth of 40 to 60 inches
- Soils that have slopes of less than 15 percent or more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Available water capacity, rock fragments, water erosion, slope

Dominant Vegetation in Potential Plant Community

Idaho fescue, Thurber needlegrass, mountain big sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a very short growing season limit the period of plant growth.
- The low available water capacity limits forage production and seedling survival.
- The rock fragments throughout the soil limit the placement of fenceposts.

Suitable management practices:
- Delay grazing until late in spring or early in summer when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate a cool, very short growing season.

105E—Harcany complex, 5 to 30 percent slopes

Composition

Harcany soil and similar inclusions—50 percent
Harcany soil, thin surface, and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Harcany Soils

Position on landscape: Mountains
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 6,000 to 7,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—40 to 45 degrees F
Frost-free period—20 to 50 days
Typical profile of the Harcany soil:
0 to 24 inches—very dark brown very gravelly loam
24 to 40 inches—dark brown extremely cobbly loam
40 to 60 inches—dark brown extremely stony loam
Typical profile of the Harcany soil, thin surface:
0 to 14 inches—very dark brown very gravelly loam
14 to 40 inches—dark brown extremely cobbly loam
40 to 60 inches—dark brown extremely stony loam
Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 to 4 inches
Hazard of erosion by water: Moderate or severe

Contrasting Inclusions

- Rock outcrop
- Fitzwater and Newlands soils that are at the lower elevations
- Soils that have bedrock at a depth of 40 to 60 inches
- Soils that have slopes of more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Available water capacity, rock fragments, water erosion

Dominant Vegetation in Potential Plant Community

Harcany soil—Idaho fescue, Thurber needlegrass, mountain big sagebrush, bluebunch wheatgrass
Harcany soil, thin surface—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a very short growing season limit the period of plant growth.
- The rock fragments throughout the soil limit the placement of fenceposts.
- The steepness of slope and rock fragments limit the construction of water impoundments.
- Some areas of this unit have a thin surface layer

because of past erosion. These areas support dominantly low sagebrush.
• The low available water capacity limits forage production and seedling survival.

Suitable management practices:
• Delay grazing until late in spring or early in summer when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a cool, very short growing season.

106F—Harcany complex, 30 to 50 percent north slopes

Composition

Harcany soil and similar inclusions—50 percent
Harcany soil, thin surface, and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Harcany Soils

Position on landscape: Mountains
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 6,000 to 7,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—40 to 45 degrees F
Frost-free period—20 to 50 days
Typical profile of the Harcany soil:
0 to 24 inches—very dark brown very gravelly loam
24 to 40 inches—dark brown extremely cobbly loam
40 to 60 inches—dark brown extremely stony loam
Typical profile of the Harcany soil, thin surface:
0 to 14 inches—very dark brown very gravelly loam
14 to 40 inches—dark brown extremely cobbly loam
40 to 60 inches—dark brown extremely stony loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 to 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Fitzwater soils that are on adjacent, south-facing slopes or are at the lower elevations
• Rock outcrop
• Soils that are similar to the Harcany soils but have bedrock at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Slope, rock fragments, water erosion, available water capacity

Dominant Vegetation in Potential Plant Community

Harcany soil—Idaho fescue, mountain big sagebrush, bluebunch wheatgrass, basin wildrye
Harcany soil, thin surface—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a very short growing season limit the period of plant growth.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
• Some areas of this unit have a thin surface layer because of past erosion. These areas support dominantly low sagebrush.
• Livestock tend to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
• Slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The rock fragments throughout the soils limit the placement of fenceposts.
• The low available water capacity limits forage production and seedling survival.

Suitable management practices:
• Delay grazing until late in spring or early in summer when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a cool, very short growing season.

107E—Harcany complex, high precipitation, 5 to 30 percent slopes

Composition

Harcany soil and similar inclusions—50 percent
Harcany soil, thin surface, and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Harcany Soils

Position on landscape: Mountains
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 7,000 to 8,000 feet
Climatic factors:
Mean annual precipitation—16 to 18 inches
Mean annual air temperature—40 to 45 degrees F
Frost-free period—20 to 50 days
Typical profile of the Harcany soil:
0 to 24 inches—very dark brown very gravelly loam
24 to 40 inches—dark brown extremely cobbly loam
40 to 60 inches—dark brown extremely stony loam
Typical profile of the Harcany soil, thin surface:
0 to 14 inches—very dark grayish brown very gravelly loam
14 to 40 inches—very dark yellowish brown very gravelly loam
40 to 60 inches—very dark yellowish brown extremely stony loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 to 4 inches
Hazard of erosion by water: Moderate or severe

Contrasting Inclusions

- Harcany soils that are at lower elevations and do not have rough fescue in the potential plant community
- Rock outcrop
- Small spring areas and snow pockets that support dominantly basin wildrye, Cusick bluegrass, mountain big sagebrush, mountain snowberry, Idaho fescue, bluebunch wheatgrass, and antelope bitterbrush
- Soils that are similar to the Harcany soils but have bedrock at a depth of 40 to 60 inches
- Soils that have slopes of more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Rock fragments, water erosion

Dominant Vegetation in Potential Plant Community

Harcany soil—rough fescue, mountain big sagebrush, Idaho fescue
Harcany soil, thin surface—rough fescue, Idaho fescue, low sagebrush

Livestock Grazing

General management considerations:
- Cold soil temperatures and a very short growing season limit the period of plant growth.
- Some areas of this unit have a thin surface layer because of past erosion. These areas support dominantly low sagebrush.
- The steepness of slope and rock fragments limit the construction of water impoundments.
- Rock fragments throughout the profile limit the placement of fenceposts.

Suitable management practices:
- Delay grazing until summer when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate a short, cool growing season.

108G—Harcany-Rock outcrop complex, 30 to 70 percent north slopes

Composition

Harcany soil and similar inclusions—35 percent
Harcany soil, thin surface, and similar inclusions—30 percent
Rock outcrop—20 percent
Contrasting inclusions—15 percent

Characteristics of the Harcany Soils

Position on landscape: Escarpments
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 6,000 to 7,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—40 to 45 degrees F
Frost-free period—20 to 50 days
Typical profile of the Harcany soil:

0 to 24 inches—very dark brown very gravelly loam
24 to 40 inches—dark brown extremely cobbly loam
40 to 60 inches—dark brown extremely stony loam

Typical profile of the Harcany soil, thin surface:
0 to 14 inches—very dark brown very gravelly loam
14 to 40 inches—dark brown extremely cobbly loam
40 to 60 inches—dark brown extremely stony loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 to 4 inches
Hazard of erosion by water: Severe or very severe

Characteristics of the Rock Outcrop

Position on landscape: Escarpments
Kind of rock: Basalt, tuff

Contrasting Inclusions

• Fitzwater soils that are on south-facing slopes at lower elevations
• Soils that are similar to the Harcany soils but have bedrock at a depth of 40 to 60 inches
• Soils that have slopes of less than 30 percent or more than 70 percent
• Rubble land

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, available water capacity, Rock outcrop

Dominant Vegetation in Potential Plant Community

Harcany soil—Idaho fescue, mountain big sagebrush, bluebunch wheatgrass, basin wildrye
Harcany soil, thin surface—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a very short growing season limit the period of plant growth.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• The steepness of slope and areas of Rock outcrop restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Some areas of this unit have a thin surface because of past erosion. These areas support dominantly low sagebrush.
• The rock fragments throughout the soil and the areas of Rock outcrop restrict the placement of fenceposts.

Suitable management practices:
• Delay grazing until late in spring or early in summer when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a cool, very short growing season.

109B—Harriman loam, 0 to 5 percent slopes

Composition

Harriman soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Harriman Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—rhyolite, basalt, tuff
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days

Typical profile:
0 to 2 inches—very dark grayish brown loam
2 to 10 inches—very dark brown loam
10 to 40 inches—dark brown clay loam
40 to 64 inches—dark brown sandy clay loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 9 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

• Deter soils that are on adjacent lake terraces

• Mesman soils that are on adjacent, lower lying lake terraces and have dominantly basin big sagebrush and black greasewood in the potential plant community
• McConnel soils that are on adjacent, lower lying lake terraces and fans and have dominantly basin big sagebrush and Wyoming big sagebrush in the potential plant community
• Lasere soils that are on adjacent hills and have dominantly low sagebrush in the potential plant community.
• Soils that have slopes of more than 5 percent
• Soils that are similar to the Harriman soil but have a hardpan or bedrock at a depth of 40 to 60 inches or more

Major Uses

Cropland, livestock grazing, homesites

Major Management Factor

Water erosion

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, basin wildrye, antelope bitterbrush, Idaho fescue

Livestock Grazing

General management considerations:
• The low precipitation limits forage production and seedling survival.

Suitable management practices:
• If this unit is seeded, select plants that tolerate droughtiness.
• Seed on the contour to reduce the risk of erosion.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated.
• Suitable irrigation methods include sprinkler and border systems.
• If border irrigation is used, leveling is needed for uniform application of water.
• To avoid exposing the clay loam, land smoothing that includes only shallow cuts is best suited.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings on this soil.

Suitable management practices:
• Irrigate during the dry period in summer.
• Manage irrigation water to minimize runoff and erosion.
• Use minimum tillage and return crop residue to the soil to minimize soil compaction, improve soil tilth, and increase the water intake rate.
• Cultivate or apply herbicides to help control competing vegetation.

Homesites

General management considerations:
• This unit is well suited to homesites.
• Irrigation is needed for the establishment and maintenance of lawn grasses, shrubs, vines, shade trees, and ornamental trees in summer.

109C—Harriman loam, 5 to 15 percent slopes

Composition

Harriman soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Harriman Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—basalt, tuff, rhyolite, volcanic ash
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 2 inches—very dark grayish brown loam
2 to 10 inches—very dark brown loam
10 to 40 inches—dark brown clay loam
40 to 64 inches—dark brown sandy clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 9 inches
Hazard of erosion: By water—moderate; by wind—slight or moderate

Contrasting Inclusions

• Deter soils that are on adjacent lake terraces
• McConnel soils that are on adjacent, lower lying lake terraces and fans and have dominantly basin big sagebrush and Wyoming big sagebrush in the potential plant community
• Lasere soils that are on adjacent hills and have dominantly low sagebrush in the potential plant community
• Soils that have slopes of less than 5 percent or more than 15 percent

• Soils that are similar to the Harriman soil but have a hardpan or bedrock at a depth of 40 to 60 inches

Major Uses

Livestock grazing, cropland

Major Management Factors

Slope, wind erosion, water erosion

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, basin wildrye, antelope bitterbrush, Idaho fescue

Livestock Grazing

General management considerations:
• The low precipitation limits forage production and seedling survival.

Suitable management practices:
• Seed on the contour or across the slope where practical.
• If this unit is seeded, select plants that tolerate droughtiness.
• Minimize the risk of erosion by seeding, preserving the existing plant cover, accumulating litter on the surface, and maintaining adequate plant cover.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated.
• Because of the slope, this soil is best suited to sprinkler irrigation.
• Irrigate during the dry period in summer.
• Irrigation water management controls runoff and reduces erosion.
• Reduce the risk of erosion by farming across the slope, stripcropping, maintaining crop residue on the surface, and keeping the soil surface rough.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings on this soil.
• Cultivation or application of herbicides helps to control competing vegetation.

110C—Hart very gravelly loam, 2 to 15 percent slopes

Composition

Hart soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Hart Soil

Position on landscape: Relict fan piedmonts on tablelands
Parent material: Kind—alluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 9 inches—dark brown very gravelly loam
9 to 19 inches—brown clay
19 to 25 inches—dark brown very gravelly silty clay loam
25 to 30 inches—dark brown very gravelly loam
30 to 43 inches—dark brown extremely gravelly loam
43 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Deep (40 to 60 inches) to bedrock, very shallow or shallow (7 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 5 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 19 inches
Carbonates: Between depths of 19 and 25 inches—violently effervescent; below this depth—strongly effervescent

Contrasting Inclusions

• Newlands soils that are on mountainsides and foot slopes and have dominantly mountain big sagebrush in the potential plant community
• Hart soils that are on fans and have a surface layer that is less than 7 inches thick
• Ninemile soils that are on tablelands
• Soils that are similar to the Hart soil but have a hardpan or bedrock at a depth of 20 to 40 inches

Major Use

Livestock grazing

Major Management Factors

Shrink-swell potential, depth to the claypan, calcareous layer, permeability, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The claypan and calcareous layer restrict rooting depth.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The surface layer is saturated following snowmelt.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
- If this unit is seeded, select plants that tolerate shrinking and swelling and a cool growing season.

111C—Hart complex, 2 to 15 percent slopes

Composition

Hart soil and similar inclusions—45 percent
Hart soil, thin surface, and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Hart Soils

Position on landscape: Relict fan piedmonts on tablelands
Parent material: Kind—alluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile of the Hart soil:
0 to 9 inches—dark brown very gravelly loam
9 to 19 inches—brown clay
19 to 25 inches—dark brown very gravelly silty clay loam
25 to 30 inches—dark brown very gravelly loam
30 to 43 inches—dark brown extremely gravelly loam
43 inches—tuff that has coatings of calcium and silica in fractures
Typical profile of the Hart soil, thin surface:
0 to 4 inches—dark brown extremely cobbly loam
4 to 15 inches—brown clay
15 to 25 inches—dark brown very gravelly silty clay loam
25 to 30 inches—dark brown very gravelly loam
30 to 43 inches—dark brown extremely gravelly loam
43 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Hart soil—deep (40 to 60 inches) to bedrock, very shallow or shallow (7 to 10 inches) to the claypan; Hart soil, thin surface—deep (40 to 60 inches) to bedrock, very shallow (4 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 5 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: Hart soil—high between depths of 9 and 19 inches; Hart soil, thin surface—high between depth of 4 and 15 inches
Carbonates: Hart soil—violently effervescent between depths of 19 and 25 inches, strongly effervescent below this depth; Hart soil, thin surface—violently effervescent between depths of 15 and 25 inches, strongly effervescent below this depth

Contrasting Inclusions

- Newlands soils that are on mountainsides and foot slopes and have dominantly mountain big sagebrush in the potential plant community
- Ninemile soils that are on tablelands
- Soils that are similar to the Hart soils but have a hardpan or bedrock at a depth of 20 to 40 inches

Major Use

Livestock grazing

Major Management Factors

Cobbles on the surface, depth to the claypan, calcareous layer, permeability, shrink-swell potential, water erosion

Dominant Vegetation In Potential Plant Community

Hart soil—Idaho fescue, low sagebrush, bluebunch wheatgrass
Hart soil, thin surface—black sagebrush, bottlebrush squirreltail, Sandberg bluegrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The claypan and calcareous layer restrict rooting depth.
• The surface layer is saturated following snowmelt.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

112C—Helphenstein-Turpin-Kewake complex, 0 to 15 percent slopes

Composition

Helphenstein soil and similar inclusions—40 percent
Turpin soil and similar inclusions—30 percent
Kewake soil and similar inclusions—20 percent
Contrasting inclusions—10 percent

Characteristics of the Helphenstein Soil

Position on landscape: Lake terraces that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,600 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 7 inches—very dark grayish brown fine sandy loam
7 to 36 inches—brown loam
36 to 50 inches—dark brown silt loam
50 to 55 inches—brown silt loam
55 to 65 inches—light gray and brown very fine sandy loam and silt loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat poorly drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: February through April—24 to 48 inches; rest of year—more than 48 inches
Salinity: Slightly saline
Sodicity: Strongly sodic
Carbonates: Strongly effervescent to violently effervescent in the upper part

Characteristics of the Turpin Soil

Position on landscape: Lake terraces that have slopes of 0 to 5 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,600 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—very dark grayish brown sandy clay loam
5 to 20 inches—very dark grayish brown sandy clay loam
20 to 29 inches—dark grayish brown sandy clay loam
29 to 60 inches—dark grayish brown loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion: By water—slight; by wind—slight or moderate
Salinity: Upper 20 inches—slightly saline; below this depth—moderately saline
Sodicity: Strongly sodic throughout
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Kewake Soil

Position on landscape: Sand dunes in lake basins that have slopes of 2 to 15 percent
Parent material: Eolian sand
Elevation: 4,200 to 4,600 feet

Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 10 inches—dark grayish brown fine sand
10 to 60 inches—dark brown fine sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Excessively drained
Permeability: Rapid
Available water capacity: About 3 inches
Hazard of erosion: By water—slight or moderate; by wind—very severe
Salinity: Slightly saline
Sodicity: Moderately sodic or strongly sodic
Carbonates: Violently effervescent throughout

Contrasting Inclusions

• Ozamis and Reese soils that are on adjacent lake terraces and have dominantly alkali sacaton in the potential plant community
• McConnel soils that are on very gravelly, higher lying lake terraces and alluvial fans

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Helphenstein soil—salinity, sodicity, wind erosion, available water capacity, permeability
Turpin soil—salinity, sodicity, available water capacity, permeability
Kewake soil—wind erosion, salinity, sodicity, available water capacity, permeability

Dominant Vegetation in Potential Plant Community

Helphenstein soil—black greasewood, inland saltgrass, basin wildrye
Turpin soil—shadscale, black greasewood, basin wildrye
Kewake soil—Indian ricegrass, black greasewood, fourwing saltbush, needleandthread, basin wildrye, basin big sagebrush

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• The sodic surface layer severely limits range recovery and seedling survival.
• Excess sodium in the soils results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface of the Helphenstein and Turpin soils reduce infiltration and restrict seedling emergence and survival.
• Water movement is rapid through the Kewake soil and slow through the Helphenstein and Turpin soils.
• Water erosion is a concern on the Turpin soil because of the steepness of slope, the slow permeability, and the poor structure of the surface layer.
• Because of the sandy texture of the surface, the soils in this unit are subject to wind erosion if the vegetation is removed or degraded and the surface is exposed.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.
• If the vegetation is removed, range seeding is needed to control blowing and drifting sand.
• Trees and shrubs suitable for windbreaks and environmental plantings on the Helphenstein soil are limited, and the seedling mortality rate is severe because of the concentration of salts.
• The Turpin and Kewake soils generally are not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.

Suitable management practices:
• Delay grazing in spring until the Helphenstein soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
• If the Helphenstein and Kewake soils are seeded, select plants that tolerate droughtiness, slight salinity, and moderate or strong sodicity.
• If the Turpin soil is seeded, select plants that tolerate droughtiness and strong sodicity.

113A—Icene-Lofftus-Pit complex, 0 to 1 percent slopes

Composition

Icene soil and similar inclusions—35 percent
Lofftus soil and similar inclusions—30 percent
Pit soil and similar inclusions—25 percent
Contrasting inclusions—10 percent

Characteristics of the Icene Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—very dark grayish brown fine sandy loam
5 to 10 inches—dark brown silt loam
10 to 28 inches—dark brown loam
28 to 65 inches—dark brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to dense, consolidated lacustrine sediment
Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: February through April—24 to 72 inches; rest of year—more than 72 inches
Salinity: Upper 10 inches—slightly saline or moderately saline; below this depth—strongly saline
Sodicity: Upper 10 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Lofftus Soil

Position on landscape: Lake terraces
Parent material: Kind—ash mantle over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 30 inches—dark grayish brown silt loam
30 to 50 inches—dark grayish brown hardpan
50 to 60 inches—stratified lacustrine sediment
Depth class: Moderately deep (20 to 40 inches) to the hardpan; very deep (more than 60) to bedrock
Drainage class: Somewhat poorly drained
Permeability: Above the hardpan—moderate; through the hardpan—very slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—slight or moderate
Depth to perched water table: March through June—12 to 36 inches; rest of year—more than 36 inches
Salinity: Moderately saline
Sodicity: Moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Pit Soil

Position on landscape: Alluvial flats in basins
Parent material: Kind—alluvium over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 6 inches—very dark grayish brown silt loam
6 to 25 inches—black clay
25 to 40 inches—very dark grayish brown clay
40 to 60 inches—very dark grayish brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock, very shallow (6 to 10 inches) to the clay layer
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: December through May—6 inches above the surface to 36 inches below the surface; rest of year—more than 36 inches
Frequency of flooding: Rare
Shrink-swell potential: High between depths of 6 and 40 inches
Carbonates: Upper 36 inches—noneffervescent; below this depth—strongly effervescent

Contrasting Inclusions

- Mesman soils that are on adjacent, slightly higher lying lake terraces
- Playas
- Boravall soils that are on alluvial flats in lake basins

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Icene soil—sodicity, salinity, available water capacity, depth to dense, consolidated lacustrine sediment, permeability, wind erosion
Lofftus soil—depth to the hardpan, salinity, sodicity, available water capacity, wetness, wind erosion

Pit soil—wetness, shrink-swell potential, permeability

Dominant Vegetation in Potential Plant Community

Icene soil—shadscale, black greasewood, basin wildrye
Lofftus soil—basin wildrye, black greasewood
Pit soil—alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:
- The low precipitation limits forage production and seedling survival.
- Excess sodium in the Icene and Lofftus soils results in nutrient imbalances and a caustic root environment.
- Salts in the Icene and Lofftus soils reduce the amount of water available to plants and restrict seedling survival.
- Dense, consolidated lacustrine sediment in the Icene soil restricts rooting depth.
- Dispersion and crusting of the surface of the Lofftus and Icene soils reduce infiltration and restrict seedling emergence.
- The Icene and Lofftus soils are subject to wind erosion if the vegetation is removed or degraded and the surface is exposed.
- The cemented hardpan in the Lofftus soil restricts rooting depth.
- The Lofftus soil is very sticky when wet or moist.
- A high water table early in the growing season in the Lofftus and Pit soils restricts rooting depth.
- The Pit soil provides food and cover for wetland wildlife.
- Grazing should be deferred during the period of nesting for waterfowl.
- Grazing when the surface of the Pit soil is wet results in compaction and poor tilth.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.
- Range seeding controls wind erosion on the Icene and Lofftus soils.

Suitable management practices:
- Delay grazing until the soils are firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
- Reduce the risk of wind erosion on the Icene and Lofftus soils by preserving the existing plant cover and accumulating litter on the surface.
- If the Icene soil is seeded, select plants that tolerate slight or moderate salinity, strong sodicity, and droughtiness.
- If the Lofftus soil is seeded, select plants that tolerate seasonal wetness, strong salinity, strong sodicity, and droughtiness in summer.
- If the Pit soil is seeded, select plants that tolerate seasonal wetness, shrinking and swelling, and frost heaving and that provide cover for nesting waterfowl.

Hayland

General management considerations:
- Wetness of the Lofftus and Pit soils limits the choice of hay and pasture plants and the period of access for haying operations.
- The concentration of salts and sodium in the Icene and Lofftus soils limits the selection of hay and pasture plants.
- The Icene and Lofftus soils tie up large amounts of phosphorus, which limits the amount that is available to plants.
- Because the Lofftus and Pit soils are very sticky when wet, machinery becomes embedded.
- Haying operations on the Lofftus and Pit soils should take place only after the soils have been adequately drained.
- Ripping the hardpan in the Lofftus soil improves soil drainage and increases the effective rooting depth.
- Ripping the dense, consolidated lacustrine sediment in the Icene soil increases the effective rooting depth.
- The Icene and Pit soils generally are not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.
- Because of the concentration of salts, trees and shrubs suitable for windbreaks and environmental plantings on the Lofftus soil are limited and the seedling mortality rate is severe.

114B—Icene-Mesman-Reese complex, 0 to 5 percent slopes

Composition

Icene soil and similar inclusions—35 percent
Mesman soil and similar inclusions—25 percent
Reese soil and similar inclusions—25 percent
Contrasting inclusions—15 percent

Characteristics of the Icene Soil

Position on landscape: Lake terraces that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—very dark grayish brown fine sandy loam
5 to 10 inches—dark brown silt loam
10 to 28 inches—dark brown loam
28 to 65 inches—dark brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to dense, consolidated lacustrine sediment
Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: February through April—24 to 72 inches; rest of year—more than 72 inches
Salinity: Upper 10 inches—slightly saline or moderately saline; below this depth—strongly saline
Sodicity: Upper 10 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Mesman Soil

Position on landscape: Lake terraces that have slopes of 0 to 5 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—dark brown fine sandy loam
9 to 20 inches—brown sandy clay loam
20 to 25 inches—brown silt loam
25 to 35 inches—brown very fine sandy loam
35 to 60 inches—brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to consolidated, compacted sediment
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion: By water—slight; by wind—moderate
Salinity: Upper 9 inches—slightly saline; below this depth—strongly saline
Sodicity: Upper 9 inches—moderately sodic; below this depth—slightly sodic or moderately sodic

Characteristics of the Reese Soil

Position on landscape: Alluvial flats in lake basins that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark brown very fine sandy loam
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: March through July—12 to 36 inches; rest of year—more than 36 inches
Salinity: Upper 10 inches—strongly saline; below this depth—moderately saline or slightly saline
Sodicity: Upper 33 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

- Helphenstein soils that are on adjacent lake terraces
- Als soils that are on adjacent dunes

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Icene soil—salinity, available water capacity, sodicity,

wind erosion, permeability, depth to dense, consolidated lacustrine sediment
Mesman soil—available water capacity, salinity, sodicity, wind erosion, permeability, depth to dense, consolidated lacustrine sediment
Reese soil—wetness, available water capacity, salinity, sodicity, wind erosion, permeability, frost action

Dominant Vegetation in Potential Plant Community

Icene soil—shadscale, black greasewood, basin wildrye
Mesman soil—basin big sagebrush, spiny hopsage, black greasewood, Indian ricegrass, basin wildrye
Reese soil—alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Excess sodium in the soils results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface reduce infiltration and restrict seedling emergence and survival.
• Grazing on the Reese soil when the surface is wet results in compaction and puddling.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• The Reese soil provides food and cover for wetland wildlife early in spring.
• A high water table early in the growing season restricts rooting depth.
• Dense, consolidated lacustrine sediment in the Mesman and Icene soils restricts rooting depth.
• If the vegetation is removed or degraded and the surface is exposed, wind erosion is a problem.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.
• Range seeding controls wind erosion in areas where the vegetation has been removed.
• Plants on the Reese soil are subject to damage because of a high potential for frost action.
• The Icene soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings.
• Because of the concentration of salts, trees and shrubs suitable for windbreaks and environmental plantings on the Mesman and Reese soils are limited and the seedling mortality rate is severe.

Suitable management practices:
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate salinity, sodicity, and droughtiness in summer.
• Allow the Reese soil to drain adequately before grazing to prevent damage to the soil and plants.

115A—Icene-Playas complex, 0 to 1 percent slopes

Composition

Icene soil and similar inclusions—55 percent
Playas—30 percent
Contrasting inclusions—15 percent

Characteristics of the Icene Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—very dark grayish brown fine sandy loam
5 to 10 inches—dark brown silt loam
10 to 28 inches—dark brown loam
28 to 65 inches—dark brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to dense, consolidated lacustrine sediment
Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: February through April—24 to 72 inches; rest of year—more than 72 inches
Salinity: Upper 10 inches—slightly saline or moderately saline; below this depth—strongly saline
Sodicity: Upper 10 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Playas

Position on landscape: Basin floors
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Reference profile:
0 to 6 inches—silty clay loam
6 to 60 inches—stratified silty clay and silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Very slow
Hazard of erosion by wind: None to severe, depending on the time of year
Depth to seasonal water table: February through September—12 inches above the surface to 12 inches below the surface; rest of year—more than 12 inches
Shrink-swell potential: High
Salinity: Moderately saline or strongly saline
Sodicity: Strongly sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

- Helphenstein soils that are on adjacent lake terraces
- Reese soils that are on adjacent, slightly lower lying lake terraces
- Als soils that are on adjacent dunes
- Mesman soils that are on adjacent, slightly higher lying lake terraces

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Icene soil—sodicity, salinity, available water capacity, wind erosion, permeability, depth to dense, consolidated lacustrine sediment
Playas—sodicity, salinity, available water capacity, permeability, seasonal wetness, shrink-swell potential, wind erosion

Dominant Vegetation in Potential Plant Community

Icene soil—shadscale, black greasewood, basin wildrye

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- Variable yearly ponding in the areas of Playas results in an unstable plant community.
- The areas of Playas provide habitat for wetland wildlife in spring and early in summer.
- Excess sodium results in nutrient imbalances and a caustic root environment.
- Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
- Salts reduce the amount of water available to plants and restrict seedling survival.
- Dense, consolidated lacustrine sediment in the Icene soil restricts rooting depth.
- If the vegetation on the Icene soil is removed or degraded, wind erosion is a problem.
- Because of the lack of vegetation, the areas of Playas are subject to wind erosion late in summer or early in fall.
- Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.
- This unit generally is not suited to growing trees and shrubs for windbreaks and environmental plantings.
- If the vegetation is removed, range seeding controls wind erosion.

Suitable management practices:
- Delay grazing in spring until the soil is firm and the preferred forage plants can withstand grazing pressure.
- If the Icene soil is seeded, select plants that tolerate strong sodicity, moderate salinity, and droughtiness in summer.
- Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.

116G—Itca very cobbly loam, 30 to 70 percent north slopes

Composition

Itca soil and similar inclusions—90 percent
Contrasting inclusions—10 percent

Characteristics of the Itca Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 4,500 to 5,400 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 5 inches—dark brown very cobbly loam
5 to 12 inches—dark brown very cobbly clay loam
12 to 16 inches—brown extremely cobbly clay
16 inches—basalt
Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe or very severe

Contrasting Inclusions

- Soils that have south-facing slopes
- Rock outcrop

Major Use

Livestock grazing

Major Management Factors

Stones and cobbles throughout the soil, depth to the claypan, depth to bedrock, permeability, slope, water erosion, available water capacity, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
- The surface layer is saturated following snowmelt.
- The low available water capacity limits forage production and seedling survival.
- The bedrock and rock fragments restrict rooting depth.
- The shallow depth to bedrock and content of rock fragments limit the placement of fenceposts.
- Steepness of slope and rock fragments on the surface restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- If this soil is disturbed, slopes are likely to be unstable.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this soil is seeded, select plants that tolerate droughtiness, shrink-swell potential, and a cool growing season.

117F—Itca-Bullump complex, 30 to 50 percent north slopes

Composition

Itca soil and similar inclusions—45 percent
Bullump soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Itca Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 5,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 5 inches—dark brown very cobbly loam
5 to 12 inches—dark brown very cobbly clay loam
12 to 16 inches—brown extremely cobbly clay
16 inches—basalt
Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained

Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe

Characteristics of the Bullump Soil

Position on landscape: Mountainsides, hillsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff, rhyolite
Elevation: 5,300 to 5,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 11 inches—very dark grayish brown extremely gravelly loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly clay loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Soils that have south-facing slopes
- Rock outcrop
- Very shallow soils that have dominantly curlleaf mountainmahogany in the potential plant community
- Soils that have slopes of less than 30 percent
- Booth soils that are in less sloping areas
- Soils that are similar to the Bullump soil but have few rock fragments throughout the soil

Major Use

Livestock grazing

Major Management Factors

Itca soil—slope, water erosion, stones and cobbles throughout the soil, depth to the claypan, permeability, depth to bedrock, available water capacity, shrink-swell potential
Bullump soil—slope, water erosion

Dominant Vegetation in Potential Plant Community

Itca soil—Idaho fescue, low sagebrush, bluebunch wheatgrass
Bullump soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on south-facing slopes.
- The surface layer of the Itca soil is saturated following snowmelt.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- The steepness of slope and rock fragments on the surface restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The low available water capacity of the Itca soil limits forage production and seedling survival.
- The content of rock fragments and the shallow depth to bedrock in the Itca soil limit placement of fenceposts.
- Pedestaled plants and an erosion pavement on the Itca soil are the result of past erosion.
- If the Itca soil is disturbed, slopes are likely to be unstable.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Itca soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is needed, select plants that tolerate droughtiness and a cool growing season.

118B—Jesse Camp silt loam, 2 to 5 percent slopes

Composition

Jesse Camp soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Jesse Camp Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,000 to 5,300 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days

Typical profile:
0 to 34 inches—dark brown silt loam
34 to 50 inches—dark yellowish brown silt loam
50 to 60 inches—dark yellowish brown very gravelly sandy loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion: By water—slight; by wind—moderate
Carbonates: Between depths of 34 and 50 inches—strongly effervescent
Salinity: Between depths of 4 and 60 inches—slightly saline or moderately saline

Contrasting Inclusions

• Spangenburg soils that are on slightly lower lying lake terraces

Major Use

Livestock grazing

Major Management Factor

Wind erosion

Dominant Vegetation in Potential Plant Community

Basin wildrye, basin big sagebrush

Livestock Grazing

General management considerations:
• The low precipitation limits forage production and reduces seedling survival.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This soil is suited to grazing in winter.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.

119C—Kewake-Helphenstein complex, 0 to 15 percent slopes

Composition

Kewake soil and similar inclusions—55 percent
Helphenstein soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Kewake Soil

Position on landscape: Sand dunes in lake basins that have slopes of 1 to 15 percent
Parent material: Eolian sand
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days

Typical profile:
0 to 10 inches—dark grayish brown fine sand
10 to 60 inches—dark brown fine sand

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Excessively drained
Permeability: Rapid
Available water capacity: About 3 inches
Hazard of erosion: By water—slight or moderate; by wind—very severe
Salinity: Slightly saline
Sodicity: Moderately sodic or strongly sodic
Carbonates: Violently effervescent throughout

Characteristics of the Helphenstein Soil

Position on landscape: Lake terraces that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days

Typical profile:
0 to 7 inches—very dark grayish brown fine sandy loam
7 to 36 inches—brown loam
36 to 50 inches—dark brown silt loam
50 to 55 inches—brown silt loam
55 to 65 inches—light gray and brown very fine sandy loam and silt loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat poorly drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: February through April—24 to 48 inches; rest of year—more than 48 inches
Salinity: Slightly saline

Sodicity: Strongly sodic
Carbonates: Strongly effervescent or violently effervescent in the upper part

Contrasting Inclusions

• Icene and Turpin soils that are on adjacent lake terraces and have dominantly shadscale in the potential plant community
• Reese soils that are on adjacent, slightly lower lying lake terraces and have dominantly alkali sacaton in the potential plant community
• Crump soils that are on adjacent, lower lying lake terraces and support dominantly sedges and cattails
• Ozamis soils that are on adjacent lake terraces and have dominantly alkali sacaton in the potential plant community

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Kewake and Helphenstein soils—wind erosion, available water capacity, salinity, sodicity, permeability

Dominant Vegetation in Potential Plant Community

Kewake soil—Indian ricegrass, basin big sagebrush, black greasewood, fourwing saltbush, needleandthread, basin wildrye
Helphenstein soil—black greasewood, inland saltgrass, basin wildrye

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• Excess sodium in the soils results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface of the Helphenstein soil reduce infiltration and restrict seedling emergence and survival.
• Because the surface layer is sandy, the soils in this unit are subject to wind erosion if the vegetation is removed or degraded and the surface is exposed.
• Water movement is rapid through the Kewake soil and slow through the Helphenstein soil.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Range seeding controls blowing and drifting sand.
• This unit is suited to grazing in winter.
• The Kewake soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.
• Trees and shrubs suitable for windbreaks and environmental plantings on the Helphenstein soil are limited, and the seedling mortality rate is severe because of the concentration of salts.

Suitable management practices:
• Delay grazing in spring until the Helphenstein soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
• If this unit is seeded, select plants that tolerate droughtiness, slight salinity, and moderate or strong sodicity.

120C—Kewake-Icene complex, 0 to 15 percent slopes

Composition

Kewake soil and similar inclusions—55 percent
Icene soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Kewake Soil

Position on landscape: Sand dunes in lake basins that have slopes of 1 to 15 percent
Parent material: Eolian sand
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 10 inches—dark grayish brown fine sand
10 to 60 inches—dark brown fine sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Excessively drained
Permeability: Rapid
Available water capacity: About 3 inches
Hazard of erosion: By water—slight or moderate; by wind—very severe
Salinity: Slightly saline
Sodicity: Moderately sodic or strongly sodic
Carbonates: Violently effervescent throughout

Characteristics of the Icene Soil

Position on landscape: Lake terraces that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—very dark grayish brown fine sandy loam
5 to 10 inches—dark brown silt loam
10 to 28 inches—dark brown loam
28 to 65 inches—dark brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to dense, consolidated lacustrine sediment
Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: February through April—24 to 72 inches; rest of year—more than 72 inches
Salinity: Upper 10 inches—slightly saline or moderately saline; below this depth—strongly saline
Sodicity: Upper 10 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

- Turpin soils that are on adjacent lake terraces
- Ozamis and Reese soils that are on adjacent, lower lying lake terraces and have dominantly alkali sacaton and inland saltgrass in the potential plant community
- Helphenstein soils that are on adjacent, slightly lower lying lake terraces and do not have shadscale in the potential plant community

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Kewake soil—sodicity, salinity, available water capacity, wind erosion
Icene soil—sodicity, salinity, available water capacity, wind erosion, depth to dense, consolidated lacustrine sediment

Dominant Vegetation in Potential Plant Community

Kewake soil—Indian ricegrass, black greasewood, fourwing saltbush, needleandthread, basin wildrye, basin big sagebrush
Icene soil—shadscale, black greasewood, basin wildrye

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- Salts reduce the amount of water available to plants and restrict seedling survival.
- Excess sodium in the soils results in nutrient imbalances and a caustic root environment.
- The sodic surface layer of the Kewake soil severely limits seedling survival.
- Dispersion and crusting of the surface of the Icene soil reduce infiltration and restrict seedling emergence and survival.
- Dense, consolidated lacustrine sediment in the Icene soil restricts rooting depth.
- Water movement is rapid through the Kewake soil and slow through the Icene soil.
- Because the surface layer is sandy, the soils in this unit are subject to wind erosion if the vegetation is removed or degraded and the surface is exposed.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.
- Range seeding controls blowing and drifting sand.
- These soils generally are not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.

Suitable management practices:
- Delay grazing in spring until the Icene soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of wind erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
- If the Kewake soil is seeded, select plants that tolerate droughtiness, moderate or strong sodicity, and slight salinity.
- If the Icene soil is seeded, select plants that tolerate droughtiness in summer, strong sodicity, and slight or moderate salinity.

121C—Kewake-Ozamis-Reese complex, 0 to 15 percent slopes

Composition

Kewake soil and similar inclusions—35 percent
Ozamis soil and similar inclusions—30 percent
Reese soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the Kewake Soil

Position on landscape: Sand dunes in lake basins that have slopes of 1 to 15 percent
Parent material: Eolian sand
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 10 inches—dark grayish brown fine sand
10 to 60 inches—dark brown fine sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Excessively drained
Permeability: Rapid
Available water capacity: About 3 inches
Hazard of erosion: By water—slight or moderate; by wind—very severe
Salinity: Slightly saline
Sodicity: Moderately sodic or strongly sodic
Carbonates: Violently effervescent throughout

Characteristics of the Ozamis Soil

Position on landscape: Alluvial flats in lake basins that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—black silty clay
9 to 12 inches—black clay loam
12 to 19 inches—black silty clay
19 to 60 inches—dark grayish brown loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: March through June—12 to 48 inches; rest of year—more than 48 inches
Frequency of flooding: Rare
Salinity: Upper 9 inches—moderately saline; below this depth—slightly saline

Characteristics of the Reese Soil

Position on landscape: Alluvial flats in lake basins that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark brown very fine sandy loam
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: March through July—12 to 36 inches; rest of year—more than 36 inches
Frequency of flooding: Rare
Salinity: Upper 10 inches—strongly saline; below this depth—moderately saline or slightly saline
Sodicity: Upper 33 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

- Alvodest soils that are on alluvial flats in basins
- Playas
- Turpin soils that are on adjacent, slightly higher lying lake terraces
- Crump and Helphenstein soils that are on adjacent, slightly lower lying lake terraces

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Kewake soil—available water capacity, salinity, sodicity, wind erosion, permeability
Ozamis soil—salinity, available water capacity, wetness, frost action, clayey surface layer
Reese soil—salinity, sodicity, wetness, available water capacity, frost action, permeability, wind erosion

Dominant Vegetation in Potential Plant Community

Kewake soil—Indian ricegrass, basin big sagebrush, black greasewood, fourwing saltbush, needleandthread, basin wildrye
Ozamis and Reese soils—alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The Ozamis and Reese soils provide food and cover for wetland wildlife early in spring.
- Salts reduce the amount of water available to plants and restrict seedling survival.
- Excess sodium in the Kewake and Reese soils results in nutrient imbalances and a caustic root environment.
- Dispersion and crusting of the surface of the Reese soil reduce infiltration and restrict seedling emergence and survival.
- Grazing when the Ozamis and Reese soils are wet results in compaction and poor tilth of the surface layer.
- A high water table in the Ozamis and Reese soils early in the growing season restricts rooting depth.
- The surface layer of the Ozamis soil expands when wet and contracts when dry, which can rip and tear plant roots.
- Water movement is rapid through the Kewake soil and moderately slow through the Ozamis and Reese soils.
- Because the surface layer is sandy, the Kewake and Reese soils are subject to wind erosion if the vegetation is removed or degraded and the surface is exposed.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.
- Range seeding controls wind erosion on the Kewake and Reese soils.
- The Kewake soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.
- Trees and shrubs suitable for windbreaks and environmental plantings on the Ozamis and Reese soils are limited, and the seedling mortality rate is severe because of the concentration of salts.

Suitable management practices:
- Minimize the risk of wind erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
- Allow the Ozamis and Reese soils to adequately drain before grazing to prevent damage to the soils and plants.
- If the Kewake soil is seeded, select plants that tolerate droughtiness, slight salinity, and moderate or strong sodicity.
- If the Ozamis soil is seeded, select plants that tolerate moderate salinity, wetness, and frost heaving.
- If the Reese soil is seeded, select plants that tolerate strong salinity, strong sodicity, wetness, droughtiness in summer, and frost heaving.

122E—Kittleson sandy loam, 15 to 40 percent north slopes

Composition

Kittleson soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Kittleson Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
3 inches to 0—white fir needles
0 to 44 inches—dark brown sandy loam
44 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Chocktoot, Hallihan, and Hammersley soils that are on adjacent mountainsides
- Polander soils that are on adjacent, south-facing mountainsides
- Soils that are similar to the Kittleson soils but have bedrock at a depth of 60 inches or more
- Soils that have slopes of more than 40 percent

Major Use

Woodland

Major Management Factors

Cold temperatures in summer, slope, water erosion, depth to bedrock

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine

Woodland

Estimated growth at culmination of mean annual increment: 57 cubic feet per acre per year for white fir at age 70

General management considerations:
- Accumulations of snow can bend or break small trees.
- Wet, unsurfaced roads and skid trails are soft.
- Dry, unsurfaced roads and skid trails are dusty.
- Cuts and fills are stable.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- To maintain the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
- Because of the cold temperatures in summer, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
- To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.
- To minimize compaction, adjust yarding operations to the content of moisture and organic matter in the surface layer.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
- Reduce the risk of soil erosion and displacement by limiting vehicle access to periods when the soil is dry or frozen.

123E—Kittleson-Hallihan complex, 15 to 40 percent north slopes

Composition

Kittleson soil and similar inclusions—50 percent
Hallihan soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Kittleson Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March
Typical profile:
3 inches to 0—white fir needles
0 to 44 inches—dark brown sandy loam
44 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Characteristics of the Hallihan Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 6,300 to 7,200 feet
Climatic factors:
Mean annual precipitation—30 to 34 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—December through April; more than 48 inches—January through March

Typical profile:
2 inches to 0—white fir and lodgepole pine needles
0 to 2 inches—black gravelly fine sandy loam
2 to 13 inches—dark brown and dark yellowish brown gravelly fine sandy loam
13 to 21 inches—dark yellowish brown very gravelly fine sandy loam
21 to 43 inches—pale brown very gravelly sandy loam
43 to 60 inches—pale brown extremely gravelly sandy loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Chocktoot and Hammersley soils that are on adjacent mountainsides
- Soils that have southerly aspects or have slopes of more than 40 percent

Major Use

Woodland

Major Management Factors

Kittleson soil—cold temperatures in summer, slope, water erosion, depth to bedrock
Hallihan soil—cold temperatures in summer, slope, water erosion, rock fragments, available water capacity

Dominant Vegetation in Potential Plant Community

Kittleson and Hallihan soils—white fir, ponderosa pine

Woodland

Estimated growth at culmination of mean annual increment: Kittleson and Hallihan soils—57 cubic feet per acre per year for white fir at age 70

General management considerations:
- Accumulations of snow can bend or break small trees.
- Wet, unsurfaced roads and skid trails on the Kittleson soil are soft, and those on the Hallihan soil are firm.
- Dry, unsurfaced roads and skid trails are dusty.
- Cuts and fills on the Kittleson soil are stable, and those on the Hallihan soil ravel when dry.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- The bedrock in the Hallihan soil is of fair quality for use as base and grade material for road construction.
- The rock fragments in the Hallihan soil limit planting.
- To maintain the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
- Because of the cold temperatures in summer, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
- To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring.
- To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
- Reduce the risk of soil erosion and displacement by limiting vehicle access to periods when the Kittleson soil is dry or frozen.

124A—Lakeview loam, 0 to 2 percent slopes

Composition

Lakeview soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Lakeview Soil

Position on landscape: Flood plains and alluvial fans in Goose Lake Valley
Parent material: Kind—alluvium; source—tuff, rhyolite, basalt, volcanic ash
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days

Typical profile:
0 to 4 inches—black loam
4 to 14 inches—black silty clay loam

14 to 20 inches—very dark brown sandy clay loam
20 to 32 inches—very dark grayish brown sandy clay loam
32 to 60 inches—dark grayish brown sandy clay loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Moderately well drained
Permeability: Moderately slow
Available water capacity: About 8 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: March through September—30 to 60 inches; rest of year—more than 60 inches
Frequency of flooding: Occasional for brief periods from March through May

Contrasting Inclusions

• Ozamis soils that are on alluvial flats and have dominantly tufted hairgrass, Baltic rush, and Nebraska sedge in the potential plant community
• Drews soils that are on adjacent, higher lying lake terraces and have dominantly Idaho fescue and mountain big sagebrush in the potential plant community

Major Uses

Cropland, livestock grazing, wildlife habitat

Major Management Factor

Flooding

Dominant Vegetation in Potential Plant Community

Basin wildrye

Livestock Grazing

General management considerations:
• This unit provides food and cover for wildlife.
• A seasonal high water table increases the amount of moisture in the soil.
• Stream channels are subject to cutting and filling during periods of flooding.
• If the vegetation is removed or degraded, this soil is subject to erosion during flooding in spring.
• Grazing should be managed to maintain or increase the abundance of plants that help to stabilize streambanks, reduce erosion, and moderate water temperatures.
• Streambank erosion can be reduced and the quality and quantity of water improved by fencing riparian areas.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• Maintain adequate plant cover in fall to protect the soil from erosion during flooding in spring.

Cropland

General management considerations:
• Most climatically adapted crops can be grown.
• Irrigation is needed for maximum production.
• Suitable irrigation methods include sprinkler, furrow, and border systems.
• If furrow or border systems are used, land leveling or smoothing may be needed for uniform application of irrigation water.
• This soil is easily compacted when wet.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings.

Suitable management practices:
• Irrigate during the dry period in summer.
• Minimize compaction of the soil by returning crop residue to the soil and keeping tillage at a minimum.
• Maintain crop residue or stubble on the soil surface to protect the soil from erosion during flooding in spring.

125A—Lakeview silty clay loam, 0 to 2 percent slopes

Composition

Lakeview soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Lakeview Soil

Position on landscape: Flood plains and alluvial fans in Goose Lake Valley
Parent material: Kind—alluvium; source—tuff, rhyolite, basalt, volcanic ash
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 14 inches—black silty clay loam
14 to 20 inches—dark brown sandy clay loam
20 to 32 inches—very dark grayish brown sandy clay loam
32 to 60 inches—dark grayish brown sandy clay loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Moderately well drained
Permeability: Moderately slow
Available water capacity: About 8 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: March through September—30 to 60 inches; rest of year—more than 60 inches
Frequency of flooding: Occasional for brief periods from March through May

Contrasting Inclusions

• Ozamis soils that are on alluvial flats and have dominantly tufted hairgrass, Baltic rush, and Nebraska sedge in the potential plant community
• Drews soils that are on adjacent, higher lying lake terraces and have dominantly Idaho fescue and mountain big sagebrush in the potential plant community

Major Uses

Cropland, livestock grazing, wildlife habitat

Major Management Factors

Flooding, silty surface layer

Dominant Vegetation in Potential Plant Community

Basin wildrye

Livestock Grazing

General management considerations:
• This unit provides food and cover for wildlife.
• A seasonal high water table increases the amount of moisture in the soil.
• Stream channels are subject to cutting and filling during periods of flooding.
• If the vegetation is removed or degraded, this soil is subject to erosion during flooding in spring.
• Grazing should be managed to maintain or increase the abundance of plants that help to stabilize streambanks, reduce erosion, and moderate water temperatures.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• Maintain adequate plant cover in fall to protect the soil from erosion during flooding in spring.
• Fence riparian areas to reduce streambank erosion and improve the quality and quantity of the water.

Cropland

General management considerations:
• Most climatically adapted crops can be grown.
• Irrigation is needed for maximum production.
• Suitable irrigation methods include sprinkler, furrow, and border systems.
• Land leveling or smoothing may be needed for uniform application of irrigation water applied by furrow or border systems.
• The silty clay loam surface layer restricts the operation of equipment to periods late in spring and in summer.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings.

Suitable management practices:
• Irrigate during the dry period in summer.
• Maintain crop residue or stubble on the surface to protect the soil from erosion during flooding in spring.
• Reduce crusting and compaction of the surface by keeping tillage at a minimum and returning crop residue to the soil.

126A—Lakeview silty clay loam, sodic, 0 to 2 percent slopes

Composition

Lakeview soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Lakeview Soil

Position on landscape: Flood plains in Goose Lake Valley
Parent material: Kind—alluvium; source—tuff, rhyolite, basalt, volcanic ash
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 14 inches—black silty clay loam
14 to 20 inches—dark brown sandy clay loam
20 to 32 inches—very dark grayish brown sandy clay loam
32 to 60 inches—dark grayish brown sandy clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Moderately well drained

Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: March through September—30 to 60 inches; rest of year—more than 60 inches
Frequency of flooding: Occasional for brief periods from March through May
Salinity: Slightly saline throughout
Sodicity: Upper 14 inches—slightly sodic; below this depth—moderately sodic

Contrasting Inclusions

• Lakeview soils that are not saline or sodic
• Ozamis soils that are on alluvial flats and have dominantly tufted hairgrass, Baltic rush, and Nebraska sedge in the potential plant community
• Drews soils that are on adjacent, higher lying lake terraces and have dominantly Idaho fescue and mountain big sagebrush in the potential plant community

Major Uses

Cropland, livestock grazing, wildlife habitat

Major Management Factors

Flooding, silty surface layer, sodicity

Dominant Vegetation in Potential Plant Community

Basin wildrye, inland saltgrass, black greasewood

Livestock Grazing

General management considerations:
• This unit provides food and cover for wildlife.
• Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
• Crusting of the soil surface reduces infiltration and restricts seedling emergence and survival.
• Salts reduce the amount of water available for plant growth.
• Stream channels are subject to cutting and filling during periods of flooding.
• If the vegetation is removed or degraded, this soil is subject to erosion during flooding in spring.
• Grazing should be managed to maintain or increase the abundance of plants that help to stabilize streambanks, reduce erosion, and moderate water temperatures.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If this soil is seeded, select plants that tolerate sodicity.
• Maintain adequate plant cover in fall to protect the soil from erosion during flooding in spring.
• Fence riparian areas to reduce streambank erosion and improve the quality and quantity of the water.

Cropland

General management considerations:
• The concentration of salts and sodium limits the production of some hay and pasture plants and other crops.
• Irrigation is needed for maximum production.
• Suitable irrigation methods include sprinkler, furrow, and border systems.
• Land leveling is needed for uniform application of irrigation water applied by furrow or border systems.
• Because of the silty clay loam surface layer, the operation of equipment should be restricted to periods late in spring and in summer.
• Removing salts without applying proper amounts of soil amendments causes dispersion and crusting of the soil surface.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of the sodicity of the soil.

Suitable management practices:
• Irrigate during the dry period in summer.
• Reduce the content of sodium by applying proper amounts of soil amendments and leaching the soil with good-quality irrigation water.
• Reduce crusting and compaction of the surface by keeping tillage at a minimum and returning crop residue to the soil.
• Apply irrigation water at a rate that does not exceed the permeability rate to prevent a buildup of the water table and a concentration of salts and sodium.

127A—Lakeview silty clay loam, low precipitation, 0 to 2 percent slopes

Composition

Lakeview soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Lakeview Soil

Position on landscape: Alluvial fans in Chewaucan Valley
Parent material: Kind—alluvium; source—tuff, rhyolite, and basalt mixed with volcanic ash
Elevation: 4,400 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days

Typical profile:
0 to 14 inches—black silty clay loam
14 to 20 inches—very dark brown sandy clay loam
20 to 32 inches—very dark grayish brown sandy clay loam
32 to 60 inches—dark grayish brown sandy clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Moderately well drained
Permeability: Moderately slow
Available water capacity: About 8 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: December through May—12 to 48 inches; rest of year—more than 48 inches
Frequency of flooding: Rare

Contrasting Inclusions

• Ozamis soils that are on alluvial flats and have dominantly alkali sacaton, alkali bluegrass, and inland saltgrass in the potential plant community
• Crump soils that are on alluvial flats and have dominantly rushes, sedges, and cattails in the potential plant community
• Mesman soils that are on adjacent, higher lying lake terraces and have dominantly needleandthread and Indian ricegrass in the potential plant community

Major Uses

Cropland, livestock grazing, wildlife habitat

Major Management Factor

Droughtiness

Dominant Vegetation in Potential Plant Community

Basin wildrye, creeping wildrye

Livestock Grazing

General management considerations:
• This unit provides food and cover for wildlife.
• The low precipitation limits forage production and seedling survival.
• A seasonal high water table increases the amount of moisture in the soil.
• Grazing should be managed to maintain or increase the abundance of plants that help to stabilize streambanks, reduce erosion, and moderate water temperatures.
• This unit is suited to grazing in winter.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• Fence riparian areas to reduce streambank erosion and improve the quality and quantity of the water.

Cropland

General management considerations:
• Most climatically adapted crops can be grown if irrigation water is available.
• Suitable irrigation methods include sprinkler, furrow, and border systems.
• Land leveling or smoothing may be needed for uniform application of irrigation water applied by furrow or border systems.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings.

Suitable management practices:
• Irrigate during the dry period in summer.
• Reduce compaction of the soil and crusting of the surface layer by returning crop residue to the soil and keeping tillage at a minimum.

128A—Lakeview-Stockdrive complex, 0 to 2 percent slopes

Composition

Lakeview soil and similar inclusions—50 percent
Stockdrive soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Lakeview Soil

Position on landscape: Flood plains that have slopes of 0 to 2 percent
Parent material: Kind—alluvium; source—tuff, rhyolite, and basalt mixed with volcanic ash
Elevation: 4,700 to 4,760 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 14 inches—black silty clay loam
14 to 20 inches—dark brown sandy clay loam
20 to 32 inches—very dark grayish brown sandy clay loam
32 to 60 inches—dark grayish brown sandy clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Moderately well drained
Permeability: Moderately slow
Available water capacity: About 8 inches
12***Hazard of erosion by water:*** Slight
Depth to seasonal high water table: March through

September—30 to 60 inches; rest of year—more than 60 inches
Frequency of flooding: Occasional for brief periods from March through May

Characteristics of the Stockdrive Soil

Position on landscape: Lake terraces in areas that are slightly higher than the Lakeview soils and have slopes of 0 to 1 percent
Parent material: Kind—eolian material over lacustrine sediment; source—tuff, basalt, rhyolite, volcanic ash
Elevation: 4,700 to 4,760 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 3 inches—brown fine sandy loam
3 to 6 inches—dark brown loam
6 to 12 inches—dark brown silty clay loam
12 to 29 inches—dark yellowish brown fine sandy loam
29 to 32 inches—dark yellowish brown very gravelly sand
32 to 34 inches—dark grayish brown extremely gravelly sand
34 to 38 inches—brown very gravelly sand
38 to 44 inches—dark brown sand
44 to 56 inches—dark brown silty clay loam
56 to 66 inches—dark yellowish brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep or deep (25 to 45 inches) to stratified sand and gravel
Drainage class: Somewhat poorly drained
Permeability: Upper part—slow; middle part—rapid; lower part—moderately slow
Available water capacity: About 2 inches
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to perched water table: March through May—6 inches above the surface to 48 inches below the surface; rest of the year—more than 48 inches
Salinity: Moderately saline or strongly saline
Sodicity: Strongly sodic
Carbonates: Upper 32 inches—violently effervescent

Contrasting Inclusions

• Drews soils that are on slightly higher lying lake terraces and have dominantly Idaho fescue, mountain big sagebrush, and antelope bitterbrush in the potential plant community
• Goose Lake and Thunderegg soils that are on slightly lower lying lake terraces and have dominantly tufted hairgrass and Nebraska sedge in the potential plant community

Major Uses

Cropland, hayland, livestock grazing, wildlife habitat

Major Management Factors

Lakeview soil—flooding
Stockdrive soil—sodicity, salinity, available water capacity, wetness, permeability, wind erosion

Dominant Vegetation in Potential Plant Community

Lakeview soil—basin wildrye
Stockdrive soil—basin wildrye, inland saltgrass, black greasewood

Livestock Grazing

General management considerations:
• This unit provides food and cover for wildlife.
• Grazing should be deferred during the period of nesting for waterfowl.
• A seasonal high water table increases the amount of moisture in the Lakeview soil.
• Stream channels in areas of the Lakeview soil are subject to cutting and filling during periods of flooding.
• If the vegetation is removed or degraded, the Lakeview soil is subject to erosion during flooding in spring.
• Grazing on the Lakeview soil should be managed to maintain or increase the abundance of plants that help to stabilize streambanks, reduce erosion, and moderate water temperatures.
• Salts in the Stockdrive soil reduce the amount of water available to plants and restrict seedling survival.
• Excess sodium in the Stockdrive soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface of the Stockdrive soil reduce the water intake rate, which causes ponding, and restrict seedling emergence and survival.
• The low available water capacity of the Stockdrive soil limits forage production and seedling survival.
• The Stockdrive soil is subject to wind erosion if the vegetation is removed or degraded.
• Range seeding controls blowing and drifting sand on the Stockdrive soil.

Suitable management practices:
• Allow the soils to drain adequately before grazing to prevent damage to the soils and plants.
• Maintain adequate plant cover on the Lakeview soil in fall to protect the soil from erosion during flooding in spring.

• Minimize the risk of wind erosion on the Stockdrive soil by maintaining existing plant cover, seeding, and accumulating litter on the soil surface.
• If the Stockdrive soil is seeded, select plants that tolerate wetness, salinity, and sodicity.
• Fence riparian areas of the Lakeview soil to reduce streambank erosion and improve the quality and quantity of the water.

Cropland

General management considerations:
• Most climatically adapted crops can be grown on the Lakeview soil, but salts and sodium limit the selection and production of hay and pasture plants and other crops on the Stockdrive soil.
• Irrigation is needed for maximum production on the Lakeview soil and for leaching of salts in the Stockdrive soil.
• Suitable irrigation methods include sprinkler, furrow, and border systems.
• Land leveling may be needed for uniform application of irrigation water applied by furrow and border systems.
• A high water table and water on the surface in spring restrict access by equipment and limit plant survival.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings on the Lakeview soil.
• Trees and shrubs suitable for windbreaks and environmental plantings on the Stockdrive soil are limited, and the seedling mortality rate is severe because of the concentration of salts.
• Irrigation is needed on the Stockdrive soil to prevent a rise in the level of the water table and the subsequent upward movement of salts and sodium in the soil.
• The content of sodium in the Stockdrive soil can be reduced by applying proper amounts of soil amendments. Salts can be leached by applying good-quality irrigation water.
• Because of the high corrosivity of the Stockdrive soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Irrigate during the dry period in summer.
• Maintain crop residue or stubble on the surface of the Lakeview soil to protect the soil from erosion during flooding in spring.
• Minimize the risk of wind erosion on the Stockdrive soil by keeping the surface rough and maintaining residue on the surface.
• Reduce crusting and compaction of the surface by keeping tillage at a minimum and returning crop residue to the soils.

129E—Lambring-Rock outcrop complex, 5 to 30 percent slopes

Composition

Lambring soil, thin surface, and similar inclusions—45 percent
Lambring soil and similar inclusions—25 percent
Rock outcrop—15 percent
Contrasting inclusions—15 percent

Characteristics of the Lambring Soils

Position on landscape: Hillsides, mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile of the Lambring soil, thin surface:
0 to 5 inches—very dark brown very gravelly loam
5 to 20 inches— dark brown very cobbly loam
20 to 25 inches—dark brown extremely cobbly loam
25 to 45 inches—yellowish brown extremely cobbly sandy loam
45 inches—basalt
Typical profile of the Lambring soil:
0 to 10 inches—very dark brown very gravelly loam
10 to 20 inches—dark brown very cobbly loam
20 to 34 inches—dark brown extremely cobbly loam
34 to 52 inches—yellowish brown extremely cobbly sandy loam
52 inches—basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Available water capacity: About 4 inches
Permeability: Moderate
Hazard of erosion by water: Moderate or severe

Characteristics of the Rock Outcrop

Position on landscape: Hillsides, mountainsides
Kind of rock: Basalt, tuff

Contrasting Inclusions

• Westbutte soils
• Fitzwater soils that are on south-facing slopes and

have Wyoming big sagebrush in the potential plant community
• Soils that have slopes of less than 5 percent or more than 30 percent
• Rubble land

Major Use

Livestock grazing

Major Management Factors

Lambring soils—rock fragments throughout the soils, water erosion, Rock outcrop

Dominant Vegetation in Potential Plant Community

Lambring soil, thin surface—Idaho fescue, low sagebrush, bluebunch wheatgrass
Lambring soil—Idaho fescue, Thurber needlegrass, mountain big sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Livestock herd and graze in the less stony areas of the unit.
• Seeding is difficult because of the pattern in which the soils occur with areas of Rock outcrop.
• The rock fragments and areas of Rock outcrop restrict the placement of fenceposts.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a cool growing season.

130G—Lambring-Rock outcrop complex, 30 to 70 percent north slopes

Composition

Lambring soil and similar inclusions—45 percent
Lambring soil, thin surface, and similar inclusions—25 percent
Rock outcrop—15 percent
Contrasting inclusions—15 percent

Characteristics of the Lambring Soils

Position on landscape: Escarpments, hillsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile of the Lambring soil:
0 to 10 inches—very dark brown very gravelly loam
10 to 20 inches—dark brown very cobbly loam
20 to 34 inches—dark brown extremely cobbly loam
34 to 52 inches—yellowish brown extremely cobbly sandy loam
52 inches—basalt
Typical profile of the Lambring soil, thin surface:
0 to 5 inches—very dark brown very gravelly loam
5 to 20 inches—dark brown very cobbly loam
20 to 25 inches—dark brown extremely cobbly loam
25 to 45 inches—yellowish brown extremely cobbly sandy loam
45 inches—basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 4 inches
Hazard of erosion by water: Severe or very severe

Characteristics of the Rock Outcrop

Position on landscape: Escarpments
Kind of rock: Basalt, tuff

Contrasting Inclusions

• Westbutte soils that are on north-facing mountainsides
• Riddleranch soils that are on south-facing mountainsides and have Wyoming big sagebrush in the potential plant community
• Rubble land

Major Use

Livestock grazing

Major Management Factors

Lambring soils—slope, water erosion, rock fragments throughout the soils, Rock outcrop

Dominant Vegetation in Potential Plant Community

Lambring soil—Idaho fescue, mountain big sagebrush, bluebunch wheatgrass, basin wildrye

Lambring soil, thin surface—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on south-facing slopes.
• The rock fragments and areas of Rock outcrop restrict the placement of fenceposts.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of the unit.
• Slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a cool growing season.

131A—Langslet silt loam, 0 to 2 percent slopes

Composition

Langslet soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Langslet Soil

Position on landscape: Low lake terraces
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,100 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 8 inches—dark grayish brown silt loam
8 to 47 inches—dark grayish brown silty clay
47 to 60 inches—olive silty clay
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat poorly drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: January through May—6 inches above the surface to 24 inches below the surface; rest of year—more than 24 inches
Shrink-swell potential: High between depths of 8 and 60 inches

Contrasting Inclusions

• Mudpot soils that are on adjacent, slightly lower lying lake terraces and support dominantly spikerush, dock, povertyweed, and mat muhly
• Swalesilver soils that are on adjacent lake terraces and have dominantly silver sagebrush in the potential plant community
• Soils that have slopes of more than 2 percent

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Wetness, frost action, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Creeping wildrye, bottlebrush squirreltail

Livestock Grazing

General management considerations:
• This soil provides food and cover for wetland wildlife.
• Variable yearly ponding results in an unstable plant community.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• The clayey layer restricts permeability, which causes ponding, and restricts seedling emergence and survival.
• The soil expands when wet and contracts when dry, which can rip and tear plant roots and makes special design of fences necessary.
• The low precipitation limits forage production and seedling survival.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• A seasonal high water table and ponding during the growing season restrict the rooting depth of non-water tolerant plants.
• Because of the high corrosivity to uncoated steel,

protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Because of a high potential for frost action, seedlings on this unit are subject to winterkill and other damage.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness in summer.
• The seedling mortality rate is severe because the high content of clay causes moisture stress late in summer and in fall.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If this unit is seeded, select plants that tolerate wetness, shrinking and swelling, and a cool growing season and that provide cover for nesting waterfowl.
• Cultivate or apply herbicides to control competing vegetation.

132C—Lasere loam, 2 to 15 percent slopes

Composition

Lasere soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Lasere Soil

Position on landscape: Wave-cut benches on hills and mountains
Parent material: Kind—lake sediment; source—basalt, tuff
Elevation: 4,800 to 5,300 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 3 inches—grayish brown loam
3 to 10 inches—dark grayish brown loam
10 to 15 inches—brown silty clay
15 to 23 inches—light yellowish brown silty clay loam
23 to 25 inches—pale yellow weathered tuff
25 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (5 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 10 and 23 inches

Contrasting Inclusions

• Booth soils that are on the upper part of slopes
• Nuss soils that are on the upper part of slopes and have curlleaf mountainmahogany and ponderosa pine in the potential plant community
• Rock outcrop
• Soils that have slopes of more than 15 percent
• Soils that are similar to the Lasere soil but have a very cobbly surface layer
• Soils that are similar to the Lasere soil but have bedrock at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Water erosion, depth to the claypan, depth to bedrock, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The claypan and bedrock restrict rooting depth.
• The surface layer is saturated following snowmelt.
• Pedestaled plants are the result of past erosion.
• The depth to bedrock limits construction of water impoundments.
• The low available water capacity limits forage production and seedling survival.
• The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and damage structures and makes special design of fences necessary.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
• The seedling mortality rate is severe because the high content of clay causes moisture stress.

Suitable management practices:
• Delay grazing until the surface layer is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling.
• Cultivate or apply herbicides to control competing vegetation.

133E—Lasere very stony loam, 5 to 30 percent slopes

Composition

Lasere soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Lasere Soil

Position on landscape: Wave-cut benches on hills and mountains
Parent material: Kind—colluvium, lacustrine sediment; source—basalt, tuff
Elevation: 4,800 to 5,300 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 3 inches—grayish brown very stony loam
3 to 10 inches—dark grayish brown very stony loam
10 to 15 inches—brown silty clay
15 to 23 inches—light yellowish brown silty clay loam
23 to 25 inches—pale yellow weathered tuff
25 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (5 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate or severe
Shrink-swell potential: High between depths of 10 and 23 inches

Contrasting Inclusions

• Booth soils that are on the upper part of slopes
• Nuss soils that are on the upper part of slopes and have curlleaf mountainmahogany and ponderosa pine in the potential plant community
• Rock outcrop
• Soils that have slopes of less than 5 percent or more than 30 percent
• Soils that are similar to the Lasere soil but have bedrock at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, depth to bedrock, stones on the surface, permeability, available water capacity, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The claypan and bedrock restrict rooting depth.
• The surface layer is saturated following snowmelt.
• The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and damage structures and makes special design of fences necessary.
• The very stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The depth to bedrock and the slope limit construction of water impoundments.
• Livestock herd and graze in the less stony areas of the unit.
• The low available water capacity limits forage production and seedling survival.

Suitable management practices:
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.

134F—Lasere very stony loam, 30 to 50 percent south slopes

Composition

Lasere soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Lasere Soil

Position on landscape: Hillsides
Parent material: Kind—colluvium, lacustrine sediment, residuum; source—basalt, tuff
Elevation: 4,800 to 5,300 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days

Typical profile:
0 to 3 inches—grayish brown very stony loam
3 to 10 inches—dark grayish brown very stony loam
10 to 15 inches—brown silty clay
15 to 23 inches—light yellowish brown silty clay loam
23 to 25 inches—pale yellow weathered tuff
25 inches—tuff

Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (5 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 10 and 23 inches

Contrasting Inclusions

- Nuss soils that are on the upper part of slopes and have curlleaf mountainmahogany and ponderosa pine in the potential plant community
- Rock outcrop
- Booth soils that are on the upper part of slopes
- Soils that have slopes of less than 30 percent
- Soils that are similar to the Lasere soil but have bedrock at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Water erosion, slope, depth to the claypan, depth to bedrock, shrink-swell potential, available water capacity, stones on the surface, permeability

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, low sagebrush, Idaho fescue, Sandberg bluegrass, Thurber needlegrass

Livestock Grazing

General management considerations:
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- Livestock herd and graze in the less stony areas of the unit.
- The claypan and bedrock restrict rooting depth.
- The surface layer is saturated following snowmelt.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- The very stony surface layer and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.
- Slopes may be unstable if this soil is disturbed.
- The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.

Suitable management practices:
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.

135C—Lasere complex, 2 to 15 percent slopes

Composition

Lasere soil and similar inclusions—50 percent
Lasere soil, thick surface, and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Lasere Soils

Position on landscape: Wave-cut benches on hills and mountains
Parent material: Kind—colluvium, lacustrine sediment; source—basalt, tuff
Elevation: 4,800 to 5,300 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days

Typical profile of the Lasere soil:
0 to 3 inches—grayish brown loam
3 to 10 inches—dark grayish brown loam
10 to 15 inches—brown silty clay
15 to 23 inches—light yellowish brown silty clay loam
23 to 25 inches—pale yellow weathered tuff
25 inches—tuff

Typical profile of the Lasere soil, thick surface:
0 to 3 inches—grayish brown loam
3 to 15 inches—dark grayish brown loam
15 to 20 inches—brown silty clay

20 to 28 inches—light yellowish brown silty clay loam
28 to 30 inches—pale yellow weathered tuff
30 inches—tuff

Depth class: Lasere soil—moderately deep (20 to 40 inches) to bedrock, very shallow (5 to 10 inches) to the claypan; Lasere soil, thick surface—moderately deep (20 to 40 inches) to bedrock, shallow (10 to 15 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High in the subsoil

Contrasting Inclusions

• Booth soils that are on the upper part of slopes
• Nuss soils that are on the upper part of slopes and have curlleaf mountainmahogany and ponderosa pine in the potential plant community
• Rock outcrop
• Soils that have slopes of more than 15 percent
• Soils that are similar to the Lasere soils but have a very cobbly surface layer
• Soils that are similar to the Lasere soils but have bedrock at a depth of 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, depth to bedrock, water erosion, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Lasere soil—Idaho fescue, low sagebrush, bluebunch wheatgrass
Lasere soil, thick surface—Idaho fescue, antelope bitterbrush, bluebunch wheatgrass, mountain big sagebrush

Livestock Grazing

General management considerations:
• The claypan and bedrock restrict rooting depth.
• The surface layer is saturated following snowmelt.
• The soil expands when wet and contracts when dry, which can rip and tear plant roots and damage structures and makes special design of fences necessary.
• The depth to bedrock limits construction of water impoundments.

Suitable management practices:
• Delay grazing until the soils are firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling.

136E—Lasere-Lorella complex, 5 to 30 percent slopes

Composition

Lasere soil and similar inclusions—50 percent
Lorella soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Lasere Soil

Position on landscape: Wave-cut benches, hillsides
Parent material: Kind—colluvium, lacustrine sediment; source—basalt, tuff
Elevation: 4,800 to 5,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 3 inches—grayish brown very stony loam
3 to 10 inches—dark grayish brown very stony loam
10 to 15 inches—brown silty clay
15 to 23 inches—light yellowish brown silty clay loam
23 to 25 inches—pale yellow weathered tuff
25 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (5 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 10 and 23 inches

Characteristics of the Lorella Soil

Position on landscape: Rock benches, hillsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 4,800 to 5,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:

0 to 4 inches—dark brown very stony loam
4 to 19 inches—dark brown very cobbly clay loam
19 inches—tuff

Depth class: Shallow (10 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 11 and 19 inches

Contrasting Inclusions

• Bullump soils that are on north-facing hillsides
• Nuss soils that are on higher lying rock benches
• Booth soils that are on higher lying benches and hillsides
• Rock outcrop
• Soils that have an extremely cobbly loam surface layer
• Soils that are similar to the Lasere soil but have bedrock at a depth of 10 to 20 inches
• Soils that are similar to the Lorella soil but have bedrock at a depth of 20 to 40 inches

Major Use

Livestock grazing

Major Management Factors

Lasere soil—stones on the surface, depth to the claypan, depth to bedrock, shrink-swell potential, water erosion, permeability, available water capacity

Lorella soil—stones on the surface, depth to bedrock, available water capacity, shrink-swell potential, water erosion, permeability

Dominant Vegetation in Potential Plant Community

Lasere soil—bluebunch wheatgrass, low sagebrush, Idaho fescue

Lorella soil—bluebunch wheatgrass, antelope bitterbrush, Idaho fescue

Livestock Grazing

General management considerations:

• Livestock herd and graze in the less stony areas of the unit.
• The claypan and bedrock in the Lasere soil restrict rooting depth.
• The bedrock in the Lorella soil restricts rooting depth.
• The depth to bedrock and steepness of slope limit the construction of water impoundments.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The surface layer is saturated following snowmelt.
• The very stony surface layer restricts operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The soils expand when wet and contract when dry, which can rip and tear plant roots and damage structures and makes special design of fences necessary.
• The shallow depth of the Lorella soil limits placement of fenceposts.

Suitable management practices:

• Delay grazing until the soils are firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.

137G—Lasere-Lorella-Bullump association, 30 to 70 percent slopes

Composition

Lasere soil and similar inclusions—35 percent
Lorella soil and similar inclusions—30 percent
Bullump soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the Lasere Soil

Position on landscape: South-facing hillsides that have slopes of 30 to 50 percent
Parent material: Kind—colluvium, lacustrine sediment; source—basalt, tuff
Elevation: 4,800 to 5,500 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 3 inches—grayish brown very stony loam
3 to 10 inches—dark grayish brown very stony loam
10 to 15 inches—brown silty clay
15 to 23 inches—light yellowish brown silty clay loam
23 to 25 inches—pale yellow weathered tuff
25 inches—tuff

Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (5 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow

Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 10 and 23 inches

Characteristics of the Lorella Soil

Position on landscape: South-facing hillsides that have slopes of 30 to 70 percent
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 4,800 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 4 inches—dark brown very stony loam
4 to 19 inches—dark brown very cobbly clay loam
19 inches—tuff
Depth class: Shallow (10 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe or very severe
Shrink-swell potential: High between depths of 11 and 19 inches

Characteristics of the Bullump Soil

Position on landscape: North-facing mountainsides and hillsides that have slopes of 30 to 70 percent
Parent material: Kind—colluvium, residuum; source—rhyolite, tuff, basalt
Elevation: 6,000 to 7,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 11 inches—very dark grayish brown extremely gravelly loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly clay loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe or very severe

Contrasting Inclusions

- Booth and Nuss soils that are on north-facing hillsides and on south-facing slopes in the higher lying areas
- Rock outcrop
- Soils that have slopes of less than 30 percent or more than 70 percent
- Soils that are similar to the Bullump soil but have bedrock at a depth of less than 60 inches

Major Use

Livestock grazing

Major Management Factors

Lasere soil—water erosion, slope, stones on the surface, depth to the claypan, depth to bedrock, available water capacity, shrink-swell potential, permeability
Lorella soil—water erosion, slope, stones on the surface, depth to bedrock, available water capacity, shrink-swell potential, permeability
Bullump soil—water erosion, slope

Dominant Vegetation in Potential Plant Community

Lasere soil—bluebunch wheatgrass, low sagebrush, Idaho fescue, Sandberg bluegrass, Thurber needlegrass
Lorella soil—bluebunch wheatgrass, mountain big sagebrush
Bullump soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
- The claypan and bedrock in the Lasere soil restrict rooting depth.
- Livestock herd and graze in the less stony areas of the unit.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- The very stony surface layer of the Lasere and Lorella soils and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The subsoil of the Lasere and Lorella soils expands when wet and contracts when dry, which makes special design of fences necessary.
- The low available water capacity of the Lasere and Lorella soils limits forage production and seedling survival.

• Slopes may be unstable if the Lasere and Lorella soils are disturbed.
• The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• The bedrock in the Lorella soil restricts rooting depth.
• The shallow depth of the Lorella soil and the rock fragments in the Lorella and Bullump soils limit placement of fenceposts and make special design of fences necessary.
• Cold soil temperatures and a short growing season limit plant growth on the Bullump soil. Grazing should be delayed until late in spring when forage plants have achieved sufficient growth.

Suitable management practices:
• Delay grazing on the Lasere and Lorella soils until the soils are firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Lorella and Lasere soils are seeded, select plants that tolerate droughtiness and shrinking and swelling.
• If the Bullump soil is seeded, select plants that tolerate a cool growing season.

138C—Lobert loam, 2 to 15 percent slopes

Composition

Lobert soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Lobert Soil

Position on landscape: High lake terraces
Parent material: Kind—lacustrine material; source—tuff, basalt
Elevation: 5,200 to 6,000 feet
Climatic factors:
Mean annual precipitation—16 to 20 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 60 inches—dark brown loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 10 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

• Booth soils that are on adjacent benches, foot slopes, and hills and have low sagebrush in the potential plant community
• Winterim soils that are on adjacent hills
• Salisbury soils that are on adjacent, lower lying lake terraces
• Soils that have slopes of less than 2 percent or more than 15 percent
• Soils that are similar to the Lobert soil but have bedrock at a depth of 40 to 60 inches

Major Use

Woodland

Major Management Factor

Water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Ross sedge

Woodland

Estimated growth at culmination of mean annual increment: 69 cubic feet per acre per year for ponderosa pine at age 40
Estimated yield (Scribner rule): 225 board feet per acre per year for ponderosa pine at age 150

General management considerations:
• Wet, unsurfaced roads and skid trails are soft.
• Because this soil is warm and droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• To minimize compaction, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring.
• To prevent rutting, restrict vehicle access to periods when the soil is dry or frozen.
• Reduce competing vegetation by mechanical treatment, chemical treatment, or livestock grazing.

139B—Locane cobbly clay loam, 2 to 8 percent slopes

Composition

Locane soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Locane Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,450 to 5,650 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—dark grayish brown cobbly clay loam
2 to 10 inches—brown clay loam
10 to 18 inches—dark yellowish brown very cobbly clay
18 inches—basalt
Depth class: Shallow (10 to 20 inches) to bedrock, shallow (10 to 15 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Shrink-swell potential: High between depths of 10 and 18 inches

Contrasting Inclusions

- Small areas of Playas that are on adjacent tablelands
- Swalesilver soils that are in depressions and have silver sagebrush in the potential plant community
- Rock outcrop
- Anawalt soils that are on tablelands and have low sagebrush in the potential plant community
- Soils that have slopes of more than 8 percent

Major Use

Livestock grazing

Major Management Factors

Available water capacity, depth to bedrock, depth to the claypan, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The bedrock and claypan restrict rooting depth.
- The low available water capacity limits forage production and seedling survival.
- The depth to bedrock limits construction of water impoundments.
- The shallow depth and rock fragments in the soil limit placement of fenceposts and make special design of fences necessary.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.
- Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

140C—Locane-Anawalt complex, 2 to 15 percent slopes

Composition

Locane soil and similar inclusions—45 percent
Anawalt soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Locane Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,100 to 6,200 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—dark grayish brown cobbly clay loam
2 to 10 inches—brown clay loam
10 to 18 inches—dark yellowish brown very cobbly clay
18 inches—basalt
Depth class: Shallow (10 to 20 inches) to bedrock, shallow (10 to 15 inches) to the claypan

Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 10 and 18 inches

Characteristics of the Anawalt Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,100 to 6,200 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown loam
4 to 9 inches—very dark grayish brown loam
9 to 17 inches—dark brown clay
17 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (12 to 20 inches) to bedrock, very shallow (3 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 17 inches

Contrasting Inclusions

- Rock outcrop
- Swalesilver soils that are in depressions and have silver sagebrush in the potential plant community
- Soils that have slopes of more than 15 percent
- Soils that are similar to the Locane and Anawalt soils but have bedrock at a depth of 20 to 40 inches

Major Use

Livestock grazing

Major Management Factors

Locane soil—depth to bedrock, available water capacity, depth to the claypan, shrink-swell potential, permeability
Anawalt soil—depth to bedrock, depth to the claypan, shrink-swell potential, available water capacity, permeability, water erosion

Dominant Vegetation in Potential Plant Community

Locane soil—bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass
Anawalt soil—bluebunch wheatgrass, Sandberg bluegrass, low sagebrush

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The claypan and bedrock restrict rooting depth, especially in the Anawalt soil.
- Development of water impoundments is restricted by the shallow depth to bedrock.
- The surface layer of the Anawalt soil is saturated following snowmelt.
- Pedestaled plants and an erosion pavement on the Anawalt soil are the result of past erosion.
- The low available water capacity limits forage production and seedling survival.
- The shallow depth and rock fragments in the Locane soil limit placement of fenceposts and make special design of fences necessary.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Anawalt soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.
- Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

140E—Locane-Anawalt complex, 15 to 30 percent slopes

Composition

Locane soil and similar inclusions—50 percent
Anawalt soil and similar inclusions—40 percent
Contrasting inclusions—10 percent

Characteristics of the Locane Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,800 to 6,100 feet

Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—dark grayish brown cobbly clay loam
2 to 10 inches—brown clay loam
10 to 18 inches—dark yellowish brown very cobbly clay
18 inches—basalt
Depth class: Shallow (10 to 20 inches) to bedrock, shallow (10 to 15 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 10 and 18 inches

Characteristics of the Anawalt Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,800 to 6,100 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown loam
4 to 9 inches—very dark grayish brown loam
9 to 17 inches—dark brown clay
17 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (12 to 20 inches) to bedrock, very shallow (3 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion: By water—severe
Shrink-swell potential: High between depths of 9 and 17 inches

Contrasting Inclusions

- Rock outcrop
- Soils that have slopes of less than 15 percent or more than 30 percent
- Soils that are similar to the Locane soil but do not have a claypan

Major Use

Livestock grazing

Major Management Factors

Available water capacity, depth to bedrock, depth to the claypan, shrink-swell potential, permeability, water erosion

Dominant Vegetation in Potential Plant Community

Locane soil—bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass
Anawalt soil—bluebunch wheatgrass, low sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The bedrock and claypan restrict rooting depth, especially on the Anawalt soil.
- The low available water capacity limits forage production and seedling survival.
- The surface layer of the Anawalt soil is saturated following snowmelt.
- Pedestaled plants and an erosion pavement on the Anawalt soil are the result of past erosion.
- The shallow depth and rock fragments in the Locane soil limit placement of fenceposts and make special design of fences necessary.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing in spring until the forage plants have achieved sufficient growth.
- Delay grazing until the Anawalt soil is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

141A—Lofftus-Mesman complex, 0 to 2 percent slopes

Composition

Lofftus soil and similar inclusions—45 percent
Mesman soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Lofftus Soil

Position on landscape: Lake terraces that have slopes of 0 to 1 percent
Parent material: Kind—ash mantle over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 30 inches—dark grayish brown silt loam
30 to 50 inches—dark grayish brown hardpan
50 to 60 inches—stratified lacustrine sediment
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to the hardpan
Drainage class: Somewhat poorly drained
Permeability: Moderate above the hardpan and very slow through it
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—slight or moderate
Depth to perched water table: March through June—12 to 36 inches; rest of year—more than 36 inches
Salinity: Moderately saline
Sodicity: Moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Mesman Soil

Position on landscape: Lake terraces that have slopes of 0 to 2 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—dark brown fine sandy loam
9 to 20 inches—brown sandy clay loam
20 to 25 inches—brown silt loam
25 to 35 inches—brown very fine sandy loam
35 to 60 inches—brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to dense, consolidated lacustrine sediment
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion: By water—slight; by wind—moderate
Salinity: Upper 9 inches—slightly saline; below this depth—strongly saline
Sodicity: Slightly sodic or moderately sodic throughout

Contrasting Inclusions

• Icene soils that are on adjacent lake terraces and have dominantly shadscale and black greasewood in the potential plant community
• Orovada soils that are on alluvial fans and have dominantly basin wildrye and basin big sagebrush in the potential plant community
• Pit soils that are on adjacent basin terraces

Major Uses

Livestock grazing, wildlife habitat, hayland

Major Management Factors

Lofftus soil—salinity, sodicity, depth to the hardpan, available water capacity, wetness, wind erosion
Mesman soil—salinity, sodicity, available water capacity, permeability, depth to dense, consolidated lacustrine sediment, wind erosion

Dominant Vegetation in Potential Plant Community

Lofftus soil—basin wildrye, black greasewood, inland saltgrass
Mesman soil—basin big sagebrush, Indian ricegrass, black greasewood, basin wildrye, spiny hopsage

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• The cemented hardpan in the Lofftus soil restricts rooting depth.
• Excess sodium results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
• The Lofftus soil is very sticky when moist or wet.
• A seasonal high water table in the Lofftus soil early in the growing season restricts rooting depth.
• Dense, consolidated lacustrine sediment in the Mesman soil restricts rooting depth.
• If the vegetation is removed or degraded and the surface is exposed, the soils in this unit are subject to wind erosion.
• If the vegetation is removed, range seeding is needed to control wind erosion.
• This unit is suited to grazing in winter.

Suitable management practices:
- Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- Delay grazing until the Lofftus soil is adequately drained and is firm.
- If the Lofftus soil is seeded, select plants that tolerate droughtiness in summer, salinity, sodicity, and seasonal wetness.
- If the Mesman soil is seeded, select plants that tolerate droughtiness in summer, salinity, and sodicity.

Hayland

General management considerations:
- Wetness of the Lofftus soil restricts access for haying operations.
- Because the Lofftus soil is very sticky when wet, machinery becomes embedded.
- The concentration of salts and sodium limits the production of some hay and pasture plants.
- The soils in this unit tie up large amounts of phosphorus, which limits the amount that is available to plants.
- Wetness of the Lofftus soil limits the choice of hay and pasture plants.
- Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
- Haying operations are restricted to periods when the Lofftus soil is adequately drained.
- Ripping the hardpan in the Lofftus soil improves drainage and increases the effective rooting depth.
- Ripping the dense, consolidated lacustrine sediment in the Mesman soil increases the effective rooting depth.
- Trees and shrubs suitable for windbreaks and environmental plantings on this unit are limited, and the seedling mortality rate is severe because of the concentration of salts.

142A—Lofftus-Reese complex, 0 to 1 percent slopes

Composition

Lofftus soil and similar inclusions—45 percent
Reese soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Lofftus Soil

Position on landscape: Lake terraces
Parent material: Kind—ash mantle over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 30 inches—dark grayish brown silt loam
30 to 50 inches—dark grayish brown hardpan
50 to 60 inches—stratified lacustrine sediment
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to the hardpan
Drainage class: Somewhat poorly drained
Permeability: Moderate above the hardpan and very slow through it
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—slight or moderate
Depth to perched water table: March through June—12 to 36 inches; rest of year—more than 36 inches
Salinity: Moderately saline
Sodicity: Moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Reese Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark brown very fine sandy loam
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: March through July—12 to 36 inches; rest of year—more than 36 inches

Salinity: Upper 10 inches—strongly saline; below this depth—moderately saline or slightly saline
Sodicity: Upper 20 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

- Helphenstein soils that are on adjacent lake terraces
- Icene and Mesman soils that are on adjacent, higher lying lake terraces
- Playas

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Lofftus soil—depth to the hardpan, available water capacity, sodicity, salinity, wetness, wind erosion
Reese soil—available water capacity, sodicity, salinity, wetness, permeability, frost action, wind erosion

Dominant Vegetation in Potential Plant Community

Lofftus soil—basin wildrye, black greasewood, inland saltgrass
Reese soil—alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:

- The low precipitation and low available water capacity of the surface layer limit forage production and seedling survival.
- Range recovery is slow because of the sodicity and salinity.
- Excess sodium in the soils results in nutrient imbalances and a caustic root environment.
- Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
- The Lofftus soil is very sticky when moist or wet.
- Wind erosion is a concern if the vegetation is removed or degraded and the soil surface is exposed.
- The cemented hardpan in the Lofftus soil restricts rooting depth.
- The high water table early in the growing season restricts rooting depth.
- The Reese soil provides food and cover for wetland wildlife early in spring.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.
- If the vegetation is removed, range seeding is needed to control wind erosion.
- Because of a high potential for frost action, plants on the Reese soil are subject to winterkill and other damage.
- Trees and shrubs suitable for windbreaks and environmental plantings are limited, and the seedling mortality rate is severe because of the concentration of salts.

Suitable management practices:

- Delay grazing until the soils are adequately drained and are firm enough to withstand trampling by livestock.
- Rip the hardpan in the Lofftus soil to improve drainage and increase the effective rooting depth.
- Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate moderate or strong salinity and sodicity, droughtiness in summer, and seasonal wetness.

143F—Longjohn gravelly coarse sandy loam, 15 to 50 percent north slopes

Composition

Longjohn soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Longjohn Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 6,800 to 8,400 feet
Climatic factors:
Mean annual precipitation—30 to 38 inches
Mean annual air temperature—41 to 45 degrees F
Frost-free period—20 to 50 days
Period of snowpack: More than 12 inches—November through May; more than 48 inches—January through March
Typical profile:
1 inch to 0—pine needles
0 to 1 inch—black gravelly coarse sandy loam
1 inch to 5 inches—dark brown gravelly coarse sandy loam
5 to 13 inches—dark brown very gravelly coarse sandy loam
13 to 24 inches—dark yellowish brown very gravelly coarse sandy loam

24 to 60 inches—brown extremely cobbly coarse sandy loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Chocktoot, Drakespeak, and Twelvemile soils that are on adjacent mountainsides at lower elevations

Major Uses

Woodland, watershed

Major Management Factors

Available water capacity, rock fragments, cold temperatures in summer, slope, water erosion

Dominant Vegetation in Potential Plant Community

Lodgepole pine, whitebark pine, western white pine, white fir

Woodland

General management considerations:

• Accumulations of snow can bend or break small trees.
• The bedrock is of fair quality for use as base and grade material for road construction.
• The content of rock fragments limits planting.
• Wet, unsurfaced roads and skid trails are firm.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
• To maintain the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• Because of the droughtiness and cold temperatures in summer, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:

• To minimize compaction and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring.
• To minimize soil displacement, use cable yarding systems.
• Avoid logging in spring to reduce compaction and erosion.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the surface to reduce sheet and rill erosion.
• Restrict the use of prescribed burning to periods when the slash has a moderate to high content of moisture or consider alternative disposal techniques.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
• Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.

144E—Lorella very stony loam, 2 to 30 percent slopes

Composition

Lorella soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Lorella Soil

Position on landscape: Hillsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 4,800 to 6,000 feet
Climatic factors:

Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days

Typical profile:

0 to 4 inches—dark brown very stony loam
4 to 19 inches—dark brown very cobbly clay loam
19 inches—tuff

Depth class: Shallow (10 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 11 and 19 inches

Contrasting Inclusions

• Lasere soils that are on hillsides and have low sagebrush in the potential plant community
• Booth soils that are on hillsides at the higher elevations and have low sagebrush in the potential plant community
• Nuss soils that are on hillsides at the higher elevations and have curlleaf mountainmahogany in the potential plant community
• Rock outcrop

• Soils that are similar to the Lorella soil but have bedrock at a depth of 20 to 40 inches

Major Use

Livestock grazing

Major Management Factors

Stones on the surface, depth to bedrock, water erosion, available water capacity, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The bedrock restricts rooting depth.
• Livestock herd and graze in the less stony areas of the unit.
• The very stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The shallow depth limits placement of fenceposts and makes special design of fences necessary.
• Development of water impoundments is restricted by the shallow depth to bedrock.
• The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and damage structures and makes special design of fences necessary.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.

145C—Lorella gravelly sandy loam, low precipitation, 2 to 15 percent slopes

Composition

Lorella soil, low precipitation, and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Lorella Soil

Position on landscape: Hillsides
Parent material: Kind—eolian sand over colluvium and residuum; source—tuff, basalt
Elevation: 4,600 to 5,000 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
0 to 8 inches—very dark brown gravelly sandy loam
8 to 12 inches—dark brown very cobbly clay loam
12 inches—tuff
Depth class: Shallow (10 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—moderate; by wind—moderate
Shrink-swell potential: High between depths of 8 and 12 inches

Contrasting Inclusions

• Redcanyon soils that are on steep, north- and south-facing hillsides
• Chewaucan soils that are on high lake terraces
• Soils that have slopes of less than 2 percent or more than 15 percent
• Soils that are similar to the Lorella soil but have bedrock at a depth of 20 to 40 inches

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, available water capacity, permeability, water erosion, wind erosion, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Idaho fescue, antelope bitterbrush

Livestock Grazing

General management considerations:
• The bedrock restricts rooting depth.
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Development of water impoundments is restricted by the shallow depth to bedrock.
• The shallow depth limits placement of fenceposts and makes special design of fences necessary.
• The subsoil expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.
• This soil is suited to grazing in winter.

Suitable management practices:
• Minimize the risk of erosion by preserving the

existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.

146G—Lorella-Itca complex, 30 to 70 percent slopes

Composition

Lorella soil and similar inclusions—55 percent
Itca soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Lorella Soil

Position on landscape: South-facing mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 4 inches—very dark brown very gravelly clay loam
4 to 19 inches—dark brown very cobbly clay loam
19 inches—tuff
Depth class: Shallow (10 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe or very severe
Shrink-swell potential: High between depths of 4 and 19 inches

Characteristics of the Itca Soil

Position on landscape: North-facing mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 90 days
Typical profile:
0 to 5 inches—dark brown very cobbly loam
5 to 12 inches—dark brown very cobbly clay loam
12 to 16 inches—brown extremely cobbly clay
16 inches—basalt
Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe or very severe

Contrasting Inclusions

• Rock outcrop
• Lambring soils that are on north-facing mountainsides
• Badland
• Soils that are similar to the Itca soil but have bedrock at a depth of 20 to 40 inches
• Soils that have slopes of less than 30 percent

Major Use

Livestock grazing

Major Management Factors

Lorella soil—slope, depth to bedrock, water erosion, available water capacity, permeability, shrink-swell potential
Itca soil—slope, depth to the claypan, depth to bedrock, water erosion, available water capacity, permeability, stones and cobbles throughout the soil, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Lorella soil—bluebunch wheatgrass, mountain big sagebrush
Itca soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold temperatures in the Itca soil limit plant growth. Grazing on the north-facing slopes should be delayed until the soil is warm and the forage plants have achieved sufficient growth.
• The bedrock in the Lorella soil restricts rooting depth.
• The bedrock and claypan in the Itca soil restrict rooting depth.
• The content of rock fragments and the shallow depth to bedrock in the Itca soil limit placement of fenceposts.
• Pedestaled plants and an erosion pavement on the Itca soil are the result of past erosion.
• The low available water capacity limits forage production and seedling survival.
• The surface layer of the Itca soil is saturated following snowmelt.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of the unit.

• The subsoil of the Lorella soil expands when wet and contracts when dry, which can rip and tear plant roots.
• The steepness of slope and rock fragments on the surface restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.

Suitable management practices:
• Delay grazing on the Itca soil until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Itca soil is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Lorella soil is seeded, select plants that tolerate droughtiness and shrinking and swelling.
• If the Itca soil is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

147F—Lorella-Lasere complex, 30 to 50 percent south slopes

Composition

Lorella soil and similar inclusions—50 percent
Lasere soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Lorella Soil

Position on landscape: Hillsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 4,800 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 4 inches—dark brown very stony loam
4 to 19 inches—dark brown very cobbly clay loam
19 inches—tuff
Depth class: Shallow (10 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 11 and 19 inches

Characteristics of the Lasere Soil

Position on landscape: Hillsides
Parent material: Kind—colluvium, lake sediment; source—basalt, tuff
Elevation: 4,800 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 3 inches—grayish brown very stony loam
3 to 10 inches—dark grayish brown very stony loam
10 to 15 inches—brown silty clay
15 to 23 inches—light yellowish brown silty clay
23 to 25 inches—pale yellow weathered tuff
25 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow or shallow (4 to 15 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 10 and 23 inches

Contrasting Inclusions

• Nuss soils that are on hillsides at the higher elevations and have curlleaf mountainmahogany in the potential plant community
• Soils that are similar to the Lasere soil but have bedrock at a depth of 10 to 20 inches
• Bullump soils that are on north-facing mountainsides and have mountain big sagebrush in the potential plant community
• Rock outcrop
• Soils that have slopes of less than 30 percent or more than 50 percent

Major Use

Livestock grazing

Major Management Factors

Lorella soil—water erosion, slope, stones on the surface, depth to bedrock, permeability, available water capacity, shrink-swell potential

Lasere soil—water erosion, slope, depth to the claypan, stones on the surface, depth to bedrock, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Lorella soil—bluebunch wheatgrass, mountain big sagebrush

Lasere soil—bluebunch wheatgrass, low sagebrush, Idaho fescue, Sandberg bluegrass, Thurber needlegrass

Livestock Grazing

General management considerations:

- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- Livestock herd and graze in the less stony areas of the unit.
- The bedrock and claypan in the Lasere soil restrict rooting depth.
- The surface layer of the Lasere soil is saturated following snowmelt.
- The shallow depth to bedrock in the Lorella soil limits placement of fenceposts.
- The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
- The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.
- Pedestaled plants and an erosion pavement on the Lasere soil are the result of past erosion.
- The very stony surface layer and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- Slopes are likely to be unstable if this unit is disturbed.

Suitable management practices:

- Delay grazing until the Lasere soil is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.

148F—Lorella-Rock outcrop complex, 30 to 50 percent south slopes

Composition

Lorella soil and similar inclusions—50 percent
Rock outcrop—35 percent
Contrasting inclusions—15 percent

Characteristics of the Lorella Soil

Position on landscape: Hillsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 4,500 to 5,300 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 8 inches—very dark brown very gravelly clay loam
8 to 12 inches—dark brown very cobbly clay
12 inches—tuff
Depth class: Shallow (10 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 8 and 12 inches

Characteristics of the Rock Outcrop

Position on landscape: Hillsides
Kind of rock: Tuff, basalt

Contrasting Inclusions

- Redcanyon soils that are on north- and south-facing hillsides
- Booth soils that are on north-facing hillsides at the higher elevations and have low sagebrush in the potential plant community
- Soils that have slopes of less than 30 percent or more than 50 percent

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, depth to bedrock, available water capacity, permeability, shrink-swell potential, Rock outcrop

Dominant Vegetation in Potential Plant Community

Lorella soil—bluebunch wheatgrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- Livestock herd and graze in the less stony areas of the unit.
- The low precipitation limits forage production and seedling survival.
- The bedrock restricts rooting depth.
- The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots.
- The steepness of slope and areas of Rock outcrop restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The shallow depth to bedrock and areas of Rock outcrop limit placement of fenceposts and make special design of fences necessary.
- The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
- Slopes are likely to be unstable if this unit is disturbed.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.

149G—Lorella-Rubble land complex, 30 to 70 percent south slopes

Composition

Lorella soil and similar inclusions—50 percent
Rubble land—35 percent
Contrasting inclusions—15 percent

Characteristics of the Lorella Soil

Position on landscape: Hillsides and escarpments
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 4,800 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 4 inches—dark brown very stony loam
4 to 19 inches—dark brown very cobbly clay loam
19 inches—tuff
Depth class: Shallow (10 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe or very severe
Shrink-swell potential: High between depths of 11 and 19 inches

Characteristics of the Rubble land

Position on landscape: Escarpments
Parent material: Tuff, basalt

Contrasting Inclusions

- Lasere soils that are on hillsides and have low sagebrush in the potential plant community
- Bullump soils that are on north-facing hillsides at the higher elevations and have mountain big sagebrush in the potential plant community
- Booth soils that are on north-facing hillsides at the higher elevations and have low sagebrush in the potential plant community
- Soils that have slopes of less than 30 percent or more than 70 percent

Major Use

Livestock grazing

Major Management Factors

Stones on the surface, slope, water erosion, depth to bedrock, permeability, available water capacity, shrink-swell potential, Rubble land

Dominant Vegetation in Potential Plant Community

Lorella soil—bluebunch wheatgrass, mountain big sagebrush

Livestock Grazing

General management considerations:
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- Livestock herd and graze in the less stony areas of the unit.
- The bedrock restricts rooting depth.
- The very stony surface layer, steepness of slope, and areas of Rubble land restrict the operation of

ground seeding equipment. Other methods such as broadcast seeding should be used.
• The shallow depth to bedrock and the areas of Rubble land limit placement of fenceposts and make special design of fences necessary.
• Slopes are likely to be unstable if this unit is disturbed.
• The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.

150A—Macyflet-Boulder Lake association, 0 to 2 percent slopes

Composition

Macyflet soil and similar inclusions—50 percent
Boulder Lake soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Macyflet Soil

Position on landscape: Terraces in basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 5,700 to 6,200 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—43 to 47 degrees F
Frost-free period—50 to 90 days
Typical profile:
0 to 9 inches—dark grayish brown silty clay loam
9 to 32 inches—brown clay
32 to 47 inches—olive brown, mottled clay
47 to 49 inches—light gray loamy sand
49 to 60 inches—light brownish gray, mottled loamy fine sand
Depth class: Very deep (more than 60 inches) to bedrock, very shallow (5 to 10 inches) to the claypan
Drainage class: Moderately well drained
Permeability: Very slow
Available water capacity: About 7 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: December through May—60 to 72 inches; rest of year—more than 72 inches
Shrink-swell potential: High between depths of 9 and 47 inches

Characteristics of the Boulder Lake Soil

Position on landscape: Basin floors
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—43 to 47 degrees F
Frost-free period—60 to 90 days
Typical profile:
0 to 2 inches—grayish brown silty clay
2 to 35 inches—grayish brown silty clay
35 to 60 inches—light brownish gray silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Very slow
Available water capacity: About 5 inches
Hazard of erosion by water: None or slight
Depth to perched water table: December through June—6 inches above the surface to 18 inches below the surface; rest of year—more than 18 inches
Shrink-swell potential: High
Carbonates: Between depths of 28 and 42 inches—strongly effervescent; below this depth—violently effervescent

Contrasting Inclusions

• Mudpot soils that are on lower lying lake terraces and do not have shrubs in the potential plant community
• Soils that are similar to the Macyflet soil but are stony, cobbly, or gravelly and are along the edge of basins, adjacent to steeper colluvial slopes

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Macyflet soil—depth to the claypan, permeability, shrink-swell potential

Boulder Lake soil—wetness, shrink-swell potential, permeability, clayey surface layer

Dominant Vegetation in Potential Plant Community

Macyflet soil—Sandberg bluegrass, low sagebrush
Boulder Lake soil—Nevada bluegrass, creeping wildrye, silver sagebrush

Livestock Grazing

General management considerations:
- The Boulder Lake soil provides food and cover for wetland wildlife.
- The surface layer of the Macyflet soil is saturated following snowmelt.
- The low precipitation limits forage production and seedling survival.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The claypan in the Macyflet soil restricts rooting depth.
- Crusting of the surface of the Macyflet soil reduces infiltration and restricts seedling emergence and survival.
- The soils expand when wet and contract when dry, which can rip and tear plant roots and damage structures.
- A seasonal high water table in the Boulder Lake soil increases the amount of available moisture in the soil late in summer.
- Grazing should be deferred during the period of nesting for waterfowl.
- A high water table and ponding on the Boulder Lake soil during the growing season restrict the rooting depth of non-water-tolerant plants.
- Because of the high corrosivity of the Boulder Lake soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Trees and shrubs suitable for windbreaks and environmental plantings on the Macyflet soil should be tolerant of droughtiness.
- The Boulder Lake soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.
- The seedling mortality rate on the Macyflet soil is severe because the high content of clay causes moisture stress.

Suitable management practices:
- Delay grazing on the Boulder Lake soil until late in spring when the soil is adequately drained and forage plants have achieved sufficient growth.
- If the Macyflet soil is seeded, select plants that tolerate a cool growing season.
- If the Boulder Lake soil is seeded, select plants that tolerate seasonal ponding, shrinking and swelling, and a cool growing season and that provide cover for nesting waterfowl.

151C—Madeline-Ninemile complex, 5 to 15 percent slopes

Composition

Madeline soil and similar inclusions—50 percent
Ninemile soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Madeline Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 12 inches—very dark grayish brown gravelly loam
12 to 19 inches—brown gravelly clay loam
19 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (10 to 20 inches) to bedrock, very shallow or shallow (7 to 15 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 12 and 19 inches

Characteristics of the Ninemile Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—dark brown very cobbly loam

7 to 15 inches—dark brown clay
15 to 19 inches—dark brown gravelly clay
19 inches—tuff that has coatings of silica and calcium carbonate in fractures

Depth class: Moderately deep (10 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 7 and 19 inches

Contrasting Inclusions

- Newlands soils that are on toe slopes of mountains
- Carryback soils that are on tablelands

Major Use

Livestock grazing

Major Management Factors

Madeline soil—depth to bedrock, available water capacity, permeability, shrink-swell potential, depth to the claypan, water erosion
Ninemile soil—depth to the claypan, permeability, available water capacity, shrink-swell potential, depth to bedrock, water erosion

Dominant Vegetation in Potential Plant Community

Madeline soil—Idaho fescue, bluebunch wheatgrass, basin big sagebrush, Thurber needlegrass
Ninemile soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The low available water capacity limits forage production and seedling survival.
- The bedrock and claypan restrict rooting depth.
- The shallow depth limits placement of fenceposts and makes special design of fences necessary.
- The depth to bedrock limits construction of water impoundments.
- The surface layer of the Ninemile soil is saturated following snowmelt.
- Pedestaled plants and an erosion pavement on the Ninemile soil are the result of past erosion.
- The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Ninemile soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

151E—Madeline-Ninemile complex, 15 to 30 percent slopes

Composition

Madeline soil and similar inclusions—50 percent
Ninemile soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Madeline Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 12 inches—very dark grayish brown gravelly loam
12 to 19 inches—brown gravelly clay loam
19 inches—tuff that has coatings of silica and calcium carbonate in fractures

Depth class: Shallow (10 to 20 inches) to bedrock, very shallow or shallow (7 to 15 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 12 and 19 inches

Characteristics of the Ninemile Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 7 inches—dark brown very cobbly loam
7 to 15 inches—dark brown clay
15 to 19 inches—dark brown gravelly clay
19 inches—tuff that has coatings of silica and calcium carbonate in fractures

Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 2 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 7 and 19 inches

Contrasting Inclusions

- Newlands soils that are on toe slopes of mountains
- Carryback soils that are on tablelands

Major Use

Livestock grazing

Major Management Factors

Madeline soil—depth to bedrock, slope, permeability, water erosion, depth to the claypan, available water capacity, shrink-swell potential
Ninemile soil—depth to the claypan, depth to bedrock, slope, permeability, water erosion, available water capacity, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Madeline soil—Idaho fescue, bluebunch wheatgrass, basin big sagebrush, Thurber needlegrass
Ninemile soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The low available water capacity limits forage production and seedling survival.
- The bedrock and claypan restrict rooting depth.
- The surface layer of the Ninemile soil is saturated following snowmelt.
- Pedestaled plants and an erosion pavement on the Ninemile soil are the result of past erosion.
- The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.
- The shallow depth limits placement of fenceposts and makes special design of fences necessary.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Ninemile soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

152A—Malin silty clay loam, 0 to 1 percent slopes

Composition

Malin soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Malin Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—alluvium, lacustrine sediment; source—basalt, tuff, rhyolite, volcanic ash
Elevation: 4,700 to 4,780 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days

Typical profile:
0 to 10 inches—black silty clay loam
10 to 15 inches—very dark gray silty clay loam
15 to 25 inches—very dark grayish brown silty clay loam
25 to 37 inches—grayish brown clay loam
37 to 60 inches—dark grayish brown clay loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: March through June—12 inches above the surface to 48 inches below the surface; rest of year—more than 48 inches
Frequency of flooding: Rare
Salinity: Moderately saline or strongly saline
Sodicity: Moderately sodic or strongly sodic
Carbonates: Strongly effervescent throughout

Contrasting Inclusions

• Pit soils that are on adjacent lake terraces and have dominantly creeping wildrye, Nevada bluegrass, and silver sagebrush in the potential plant community
• Ozamis soils that are on adjacent lake terraces and have dominantly alkali sacaton and alkali bluegrass in the potential plant community
• Thunderegg soils that are on adjacent, slightly lower lying lake terraces and have dominantly tufted hairgrass in the potential plant community

Major Uses

Livestock grazing, wildlife habitat, cropland, hayland

Major Management Factors

Salinity, sodicity, available water capacity, wetness, frost action

Dominant Vegetation in Potential Plant Community

Nuttall alkaligrass, inland saltgrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife in spring.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce infiltration, cause ponding, and restrict seedling emergence and survival.
• The low available water capacity limits forage production and seedling survival.

Suitable management practices:
• Delay grazing until the soil is adequately drained and is firm enough to withstand trampling by livestock.
• If this unit is seeded, select plants that tolerate wetness, strong sodicity, strong salinity, and frost heaving and that provide cover for nesting waterfowl.

Cropland and Hayland

General management considerations:
• The concentration of salts and sodium limits the selection and production of hay and pasture plants and other crops.
• Removing salts and sodium is difficult unless the soil is drained.
• Irrigation may be needed to meet plant needs and leach salts below the root zone.
• Wetness limits the choice of plants and increases the risk of winterkill.
• A high water table early in spring restricts rooting depth and plant survival.
• The seasonal high water table provides supplemental moisture for plants late in summer and in fall.
• Because of a high potential for frost action, plants are subject to winterkill and other damage.
• The soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• Irrigation and drainage are needed if this unit is intensively managed.
• The content of sodium in the soil can be reduced by applying proper amounts of soil amendments. Salts can be leached from the soil by applying good-quality irrigation water.
• Unless proper amounts of soil amendments are applied, removing salts causes dispersion and crusting of the soil surface.
• Irrigation water management is needed to prevent a rise in the level of the water table and the subsequent upward movement of salts and sodium in the soil.
• Drainage is difficult because of the nearly level slope and the lack of outlets.
• Trees and shrubs suitable for windbreaks and environmental plantings are limited, and the seedling mortality rate is severe because of the concentration of salts.

153A—McConnel very gravelly sandy loam, 0 to 2 percent slopes

Composition

McConnel soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the McConnel Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium; source—tuff, basalt
Elevation: 4,500 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches

Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days

Typical profile:
0 to 10 inches—dark yellowish brown very gravelly sandy loam
10 to 22 inches—brown very gravelly coarse sandy loam
22 to 60 inches—multicolored extremely gravelly loamy coarse sand

Depth class: Very deep (more than 60 inches) to bedrock, shallow or moderately deep (10 to 25 inches) to sand and gravel
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid over very rapid
Available water capacity: About 2 inches
Hazard of erosion: By water—slight; by wind—slight or moderate
Carbonates: Between depths of 10 and 22 inches—strongly effervescent

Contrasting Inclusions

• Mesman soils that are on adjacent lake terraces and have dominantly basin big sagebrush and some black sagebrush and basin wildrye in the potential plant community
• Zorravista soils that are on adjacent dunes and have fourwing saltbush in the potential plant community
• Deter soils that are on adjacent, slightly higher lying lake terraces and have dominantly bluebunch wheatgrass in the potential plant community
• McNye soils that are on bedrock-controlled lake terraces
• Soils that have slopes of more than 2 percent

Major Uses

Livestock grazing, cropland

Major Management Factors

Gravel, available water capacity, permeability, seepage, wind erosion

Dominant Vegetation in Potential Plant Community

Indian ricegrass, Thurber needlegrass, Wyoming big sagebrush, needleandthread

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• The risk of seepage and the very rapid permeability of the lower part of the soil limit the construction of livestock watering ponds and other water impoundments.
• This soil is subject to wind erosion if the vegetation is removed or degraded.
• This soil is suited to grazing in winter.
• Range seeding controls blowing and drifting sand.

Suitable management practices:
• Minimize the risk of wind erosion by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface.
• If this unit is seeded, select plants that tolerate droughtiness.

Cropland

General management considerations:
• Irrigation is needed for crops.
• Because of the very rapid permeability of the lower part of the soil and the rapid water intake rate, sprinkler irrigation is best suited to this soil.
• Because of the low available water capacity, light and frequent applications of irrigation water are needed.
• Gravel in the surface layer causes rapid abrasion of tillage equipment.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
• The seedling mortality rate is severe because of the low available water capacity.
• Continuous cultivation, use of mulch, or application of herbicides helps to control competing vegetation and ensure establishment and survival of seedlings.

Suitable management practices:
• Irrigate during the dry period in summer.
• Adjust the application of irrigation water to the available water capacity, the water intake rate, and the needs of the crop grown to avoid overirrigating, control runoff, and prevent leaching of plant nutrients.
• Reduce the risk of wind erosion by planting crops in narrow strips at right angles to the prevailing wind, maintaining crop residue on the surface, and using minimum tillage.

153C—McConnel very gravelly sandy loam, 2 to 15 percent slopes

Composition

McConnel soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the McConnel Soil

Position on landscape: Fans, lake terraces
Parent material: Kind—alluvium; source—tuff, basalt
Elevation: 4,500 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 10 inches—dark yellowish brown very gravelly sandy loam
10 to 22 inches—brown very gravelly coarse sandy loam
22 to 60 inches—multicolored extremely gravelly loamy coarse sand
Depth class: Very deep (more than 60 inches) to bedrock, shallow or moderately deep (10 to 25 inches) to sand and gravel
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid over very rapid
Available water capacity: About 2 inches
Hazard of erosion: By water—slight; by wind—slight or moderate
Carbonates: Between depths of 10 and 22 inches—strongly effervescent

Contrasting Inclusions

- Hager and Old Camp soils that are on adjacent tablelands and have spiny hopsage and small amounts of bluebunch wheatgrass in the potential plant community
- Mesman soils that are on adjacent lake terraces and have dominantly basin big sagebrush and some black greasewood and basin wildrye in the potential plant community
- Zorravista soils that are on adjacent dunes and have fourwing saltbush in the potential plant community
- McNye soils that are on bedrock-controlled lake terraces
- Soils that have slopes of less than 2 percent or more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Gravel, available water capacity, permeability, seepage, wind erosion

Dominant Vegetation in Potential Plant Community

Indian ricegrass, Thurber needlegrass, Wyoming big sagebrush, needleandthread

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The steepness of slope and the risk of seepage limit construction of water impoundments.
- This unit is subject to wind erosion if the vegetation is removed or degraded.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This soil is suited to grazing in winter.
- Range seeding controls blowing and drifting sand.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
- The seedling mortality rate may be severe because of the low available water capacity.
- Continuous cultivation, use of mulch, or application of herbicides helps to control competing vegetation and ensure the establishment and survival of seedlings.

Suitable management practices:
- Minimize the risk of wind erosion by maintaining adequate plant cover, seeding, and accumulating litter on the soil surface.
- If this unit is seeded, select plants that tolerate droughtiness.

154C—McConnel extremely stony loam, 5 to 15 percent slopes

Composition

McConnel soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the McConnel Soil

Position on landscape: Fans
Parent material: Kind—alluvium with colluvial material in the upper part; source—basalt, tuff
Elevation: 4,400 to 4,900 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 10 inches—dark yellowish brown extremely stony loam
10 to 22 inches—brown very gravelly coarse sandy loam
22 to 60 inches—multicolored extremely gravelly loamy coarse sand

Depth class: Very deep (more than 60 inches) to bedrock, shallow or moderately deep (10 to 25 inches) to sand and gravel
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid over very rapid
Available water capacity: About 2 inches
Hazard of erosion by water: Slight or moderate
Salinity: Between depths of 22 and 60 inches—slightly saline
Sodicity: Between depths of 22 and 60 inches—moderately sodic
Carbonates: Between depths of 10 and 60 inches—strongly effervescent

Contrasting Inclusions

• Rock outcrop
• Deppy soils that are on adjacent alluvial fans and do not support black greasewood or basin wildrye
• Wildhill soils that are on bedrock-controlled lake terraces and do not support black greasewood or basin wildrye
• Mesman soils that are on adjacent lake terraces
• Soils that have slopes of less than 5 percent or more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Available water capacity, permeability, stones on the surface, sodicity, water erosion

Dominant Vegetation in Potential Plant Community

Shadscale, black greasewood, basin wildrye

Livestock Grazing

General management considerations:
• Salts and sodium in the lower part of the soil reduce the amount of water available to plants.
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Livestock herd and graze in the less stony areas of the unit.
• The extremely stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This soil is suited to grazing in winter.
• If this unit is seeded, select plants that tolerate droughtiness and moderate sodicity.

155C—McConnel very gravelly sandy loam, cold, 2 to 15 percent slopes

Composition

McConnel soil and similar inclusions—90 percent
Contrasting inclusions—10 percent

Characteristics of the McConnel Soil

Position on landscape: Fans
Parent material: Kind—alluvium; source—basalt, tuff
Elevation: 5,000 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 10 inches—dark yellowish brown very gravelly sandy loam
10 to 22 inches—brown very gravelly coarse sandy loam
22 to 60 inches—multicolored extremely gravelly loamy coarse sand
Depth class: Very deep (more than 60 inches) to bedrock, shallow or moderately deep (10 to 25 inches) to sand and gravel
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid over very rapid
Available water capacity: About 2 inches
Hazard of erosion by water: Slight
Carbonates: Between depths of 10 and 22 inches—strongly effervescent

Contrasting Inclusions

• Norad soils that are on adjacent lake terraces and have dominantly winterfat in the potential plant community
• Brace soils that are on tablelands and have dominantly needleandthread in the potential plant community

Major Use

Livestock grazing

Major Management Factors

Available water capacity, permeability, gravel, seepage

Dominant Vegetation in Potential Plant Community

Thurber needlegrass, Sandberg bluegrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
- The low available water capacity limits forage production and seedling survival.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The steepness of slope and risk of seepage limit construction of water impoundments.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
- The seedling mortality rate is severe because of the low available water capacity.
- Continuous cultivation, use of mulch, or application of herbicides helps to control competing vegetation and ensure establishment and survival of seedlings.

Suitable management practices:
- Minimize the risk of erosion by maintaining adequate plant cover, seeding, and accumulating litter on the surface.
- If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

156B—McConnel gravelly sandy loam, sodic substratum, 0 to 5 percent slopes

Composition

McConnel soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the McConnel Soil

Position on landscape: Fans, lake terraces
Parent material: Kind—alluvium; source—tuff, basalt
Elevation: 4,500 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days

Typical profile:
0 to 10 inches—dark yellowish brown gravelly sandy loam
10 to 22 inches—brown very gravelly coarse sandy loam
22 to 60 inches—multicolored extremely gravelly loamy coarse sand

Depth class: Very deep (more than 60 inches) to bedrock, shallow or moderately deep (10 to 25 inches) to sand and gravel
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid over very rapid
Available water capacity: About 2 inches
Hazard of erosion: By water—slight; by wind—slight or moderate
Salinity: Between depths of 22 and 60 inches—slightly saline
Sodicity: Between depths of 22 and 60 inches—moderately sodic
Carbonates: Between depths of 10 and 60 inches—strongly effervescent

Contrasting Inclusions

- McConnel soils that are on slightly higher lying lake terraces, are not influenced by sodium and salt, and have dominantly Thurber needlegrass and Wyoming big sagebrush in the potential plant community
- Wildhill soils that are on bedrock-controlled lake terraces and do not support black greasewood or basin wildrye
- Mesman soils that are on adjacent lake terraces
- Zorravista soils that are on adjacent dunes and have dominantly needleandthread and fourwing saltbush in the potential plant community
- Soils that have slopes of more than 5 percent

Major Use

Livestock grazing

Major Management Factors

Gravel, available water capacity, permeability, sodicity, wind erosion, seepage

Dominant Vegetation in Potential Plant Community

Basin big sagebrush, Indian ricegrass, black greasewood, basin wildrye, spiny hopsage

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The risk of seepage and the very rapid permeability in the lower part of the soil limit the construction of

livestock watering ponds and other water impoundments.
• Salts and sodium in the lower part of the soil reduce the amount of water available to plants.
• This unit is subject to wind erosion if the vegetation is removed or degraded.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This soil is suited to grazing in winter.
• Range seeding controls blowing and drifting sand.

Suitable management practices:
• Minimize the risk of wind erosion by maintaining adequate plant cover, seeding, and accumulating litter on the surface.
• If this unit is seeded, select plants that tolerate droughtiness and moderate sodicity.

157C—McConnel-Icene complex, 0 to 15 percent slopes

Composition

McConnel soil and similar inclusions—55 percent
Icene soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the McConnel Soil

Position on landscape: Fans and lake terraces that have slopes of 1 to 15 percent
Parent material: Kind—alluvium; source—tuff, basalt
Elevation: 4,500 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 10 inches—dark yellowish brown gravelly sandy loam
10 to 22 inches—brown very gravelly coarse sandy loam
22 to 60 inches—multicolored extremely gravelly loamy coarse sand
Depth class: Very deep (more than 60 inches) to bedrock, shallow or moderately deep (10 to 25 inches) to sand and gravel
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid over very rapid
Available water capacity: About 2 inches
Hazard of erosion: By water—slight or moderate; by wind—slight or moderate
Salinity: Between depths of 22 and 60 inches—slightly saline
Sodicity: Between depths of 22 and 60 inches—moderately sodic
Carbonates: Between depths of 10 and 60 inches—strongly effervescent

Characteristics of the Icene Soil

Position on landscape: Lake terraces that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,500 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—very dark grayish brown fine sandy loam
5 to 10 inches—dark brown silt loam
10 to 28 inches—dark brown loam
28 to 60 inches—dark brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to dense, consolidated lacustrine sediment
Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: February through April—24 to 72 inches; rest of year—more than 72 inches
Salinity: Upper 10 inches—slightly saline or moderately saline; below this depth—strongly saline
Sodicity: Upper 10 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

• McConnel soils that are on slightly higher lying lake terraces and fans, are not influenced by sodium and salt, and have dominantly Thurber needlegrass and Wyoming big sagebrush in the potential plant community
• Mesman soils that are on adjacent lake terraces
• Reese soils that are on slightly lower lying lake terraces
• Ozamis soils that are moderately saline and are on slightly lower lying lake basin terraces
• Soils that have slopes of more than 15 percent

Major Use

Livestock grazing

Major Management Factors

McConnel soil—available water capacity, gravel, sodicity, wind erosion, permeability, seepage
Icene soil—available water capacity, salinity, sodicity, permeability, depth to dense, consolidated lacustrine sediment, wind erosion

Dominant Vegetation in Potential Plant Community

McConnel soil—basin big sagebrush, Indian ricegrass, black greasewood, basin wildrye, spiny hopsage
Icene soil—shadscale, black greasewood, basin wildrye

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• The risk of seepage and the very rapid permeability in the lower part of the McConnel soil limit the construction of water impoundments.
• The strongly sodic surface layer of the Icene soil severely limits seedling survival.
• Dense, consolidated lacustrine sediment in the Icene soil restrict rooting depth.
• Excess sodium in the Icene soil results in nutrient imbalances and a caustic root environment.
• Salts in the Icene soil and in the lower part of the McConnel soil reduce the amount of water available to plants and restrict seedling survival.
• Dispersion and crusting of the surface of the Icene soil reduce infiltration and restrict seedling emergence and survival.
• This unit is subject to wind erosion if the vegetation is removed or degraded.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.
• Range seeding controls blowing or drifting sand.

Suitable management practices:
• Delay grazing in spring until the Icene soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of wind erosion by maintaining adequate plant cover, seeding, and accumulating litter on the surface.
• If the McConnel soil is seeded, select plants that tolerate droughtiness.
• If the Icene soil is seeded, select plants that tolerate droughtiness, strong sodicity, and strong salinity.

158F—McConnel association, 30 to 50 percent slopes

Composition

McConnel soil, north slopes, and similar inclusions—45 percent
McConnel soil, south slopes, and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the McConnel Soils

Position on landscape: North- and south-facing side slopes of lake terraces (fig. 13)
• The seedling mortality rate is severe because of the low available water capacity.
• Continuous cultivation, use of mulch, or application of herbicides helps to control competing vegetation and ensure establishment and survival of seedlings.

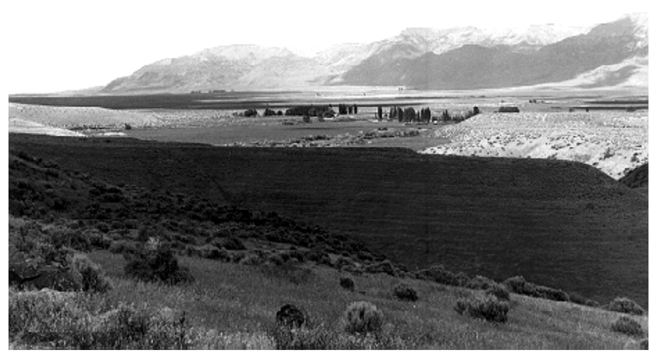


Figure 13.—Area of McConnel association, 30 to 50 percent slopes, on gravelly lake terraces in Warner Valley. The town of Plush is in center, and Hart Mountain is in background.

Parent material: Kind—alluvium; source—basalt, tuff
Elevation: 4,500 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 10 inches—dark yellowish brown very gravelly sandy loam
10 to 22 inches—brown very gravelly coarse sandy loam

22 to 60 inches—multicolored extremely gravelly loamy coarse sand

Depth class: Very deep (more than 60 inches) to bedrock, shallow or moderately deep (10 to 25 inches) to sand and gravel
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid over very rapid
Available water capacity: About 2 inches
Hazard of erosion by water: Severe
Carbonates: Between depths of 10 and 22 inches—strongly effervescent

Contrasting Inclusions

• Hager and Old Camp soils that are on adjacent tablelands
• McNye soils that are on bedrock-controlled lake terraces

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, available water capacity, permeability, gravel

Dominant Vegetation in Potential Plant Community

McConnel soil, north slopes—bluebunch wheatgrass, Thurber needlegrass, Wyoming big sagebrush, ephedra
McConnel soil, south slopes—Indian ricegrass, Wyoming big sagebrush, Thurber needlegrass

Livestock Grazing

General management considerations:
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.

Suitable management practices:
• Minimize erosion of the surface layer to maintain the potential of the soils to produce forage.
• Minimize the risk of erosion by maintaining adequate plant cover, seeding, and accumulating litter on the surface.
• If this unit is seeded, select plants that tolerate droughtiness.

159C—McNye-Wildhill complex, 2 to 15 percent slopes

Composition

McNye soil and similar inclusions—65 percent
Wildhill soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the McNye Soil

Position on landscape: Bedrock-controlled lake terraces
Parent material: Kind—alluvium; source—basalt
Elevation: 4,500 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 7 inches—brown cobbly loam
7 to 16 inches—brown very gravelly sandy loam
16 to 27 inches—brown extremely cobbly loamy sand
27 to 42 inches—brown extremely gravelly loamy sand
42 inches—fractured basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid over very rapid
Available water capacity: About 3 inches
Hazard of erosion by water: Slight or moderate
Carbonates: Between depths of 7 and 16 inches—slightly effervescent

Characteristics of the Wildhill Soil

Position on landscape: Bedrock-controlled lake terraces
Parent material: Kind—alluvium; source—basalt
Elevation: 4,500 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 6 inches—brown very stony loam
6 to 19 inches—brown extremely stony loam
19 to 26 inches—brown extremely gravelly loam
26 inches—basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of erosion by water: Slight or moderate
Carbonates: Between depths of 6 and 19 inches—slightly effervescent; 19 to 26 inches—strongly effervescent

Contrasting Inclusions

- Hager and Old Camp soils that are on adjacent tablelands and have bluebunch wheatgrass in the potential plant community
- Rock outcrop
- Soils that are similar to the Wildhill soil but have bedrock at a depth of 10 to 20 inches
- Soils that have slopes of more than 15 percent

Major Use

Livestock grazing

Major Management Factors

McNye soil—available water capacity, seepage, rock fragments throughout, permeability, water erosion
Wildhill soil—available water capacity, stones on the surface, rock fragments throughout, depth to bedrock, water erosion

Dominant Vegetation in Potential Plant Community

McNye soil—Wyoming big sagebrush, Indian ricegrass, Thurber needlegrass, needleandthread
Wildhill soil—shadscale, bud sagebrush, Indian ricegrass, bottlebrush squirreltail

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The bedrock in the Wildhill soil restricts rooting depth.
- The very stony surface layer of the Wildhill soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The depth to bedrock and moderately rapid permeability of the McNye soil limit construction of water impoundments.
- The rock fragments on and in the soils restrict the placement of fenceposts.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.

Suitable management practices:
- Minimize erosion of the surface layer to maintain the potential of the soils to produce forage.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
- If this unit is seeded, select plants that tolerate droughtiness.

160F—McNye-Wildhill complex, 30 to 50 percent south slopes

Composition

McNye soil and similar inclusions—60 percent
Wildhill soil and similar inclusions—25 percent
Contrasting inclusions—15 percent

Characteristics of the McNye Soil

Position on landscape: South-facing slopes of bedrock-controlled lake terraces
Parent material: Kind—alluvium; source—tuff, basalt
Elevation: 4,500 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 7 inches—brown cobbly loam
7 to 16 inches—brown very gravelly sandy loam
16 to 27 inches—brown extremely cobbly loamy sand
27 to 42 inches—brown extremely gravelly loamy sand
42 inches—fractured basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid over very rapid
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Carbonates: Between depths of 7 and 16 inches—slightly effervescent

Characteristics of the Wildhill Soil

Position on landscape: South-facing slopes of bedrock-controlled lake terraces
Parent material: Kind—alluvium; source—basalt
Elevation: 4,500 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 6 inches—brown very stony loam

6 to 19 inches—brown extremely stony loam
19 to 26 inches—brown extremely gravelly loam
26 inches—basalt

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Carbonates: Between depths of 6 and 19 inches—slightly effervescent; 19 to 26 inches—strongly effervescent

Contrasting Inclusions

- Hager and Old Camp soils that are on adjacent tablelands and have bluebunch wheatgrass in the potential plant community
- Old Camp soils that are on tablelands
- Rock outcrop
- Soils that are similar to the Wildhill soil but have bedrock at a depth of 10 to 20 inches
- Soils that have slopes of less than 30 percent

Major Use

Livestock grazing

Major Management Factors

McNye soil—slope, water erosion, available water capacity, permeability, rock fragments throughout, seepage
Wildhill soil—slope, water erosion, available water capacity, rock fragments throughout, stones on the surface, depth to bedrock

Dominant Vegetation in Potential Plant Community

McNye soil—Indian ricegrass, Wyoming big sagebrush, Thurber needlegrass
Wildhill soil—shadscale, Indian ricegrass, bottlebrush squirreltail

Livestock Grazing

General management considerations:

- The low precipitation and low available water capacity limit forage production and seedling survival.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- The bedrock in the Wildhill soil restricts rooting depth.
- The rock fragments on and in the soils restrict the placement of fenceposts.
- Slope and rock fragments on the surface restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The growing season on the south-facing slopes begins earlier in spring and droughtiness is a limitation earlier in summer on these slopes than on north-facing slopes.
- This unit is suited to grazing in winter.

Suitable management practices:

- Minimize erosion of the surface layer to maintain the potential of the soil to produce forage.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
- If this unit is seeded, select plants that tolerate droughtiness.

161C—Merlin extremely stony loam, 0 to 15 percent slopes

Composition

Merlin soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Merlin Soil

Position on landscape: Tablelands
Parent material: Kind—residuum; source—basalt, tuff
Elevation: 5,000 to 7,000 feet
Climatic factors:
Mean annual precipitation—22 to 24 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark grayish brown extremely stony loam
4 to 7 inches—dark brown gravelly clay loam
7 to 18 inches—dark brown clay
18 inches—hard fractured basalt
Depth class: Shallow (10 to 20 inches) to bedrock, shallow or very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 7 and 18 inches

Contrasting Inclusions

- Booth soils that are on tablelands
- Soils that are similar to the Merlin soil but have bedrock at a depth of 10 inches or less

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, depth to the claypan, shrink-swell potential, available water capacity, water erosion

Dominant Vegetation in Potential Plant Community

Sandberg bluegrass, low sagebrush

Livestock Grazing

General management considerations:
- The surface layer is saturated following snowmelt.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The claypan and bedrock restrict rooting depth.
- The depth to bedrock limits construction of water impoundments.
- The extremely stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The shallow depth limits placement of fenceposts and makes special design of fences necessary.
- The subsoil expands when wet and contracts when dry, which makes special design of fences necessary.
- Livestock herd and graze in the less stony areas of the unit.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

162B—Mesman fine sandy loam, 0 to 5 percent slopes

Composition

Mesman soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Mesman Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—dark brown fine sandy loam
9 to 20 inches—brown sandy clay loam
20 to 25 inches—brown silt loam
25 to 35 inches—brown very fine sandy loam
35 to 60 inches—brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock; moderately deep (20 to 40 inches) to consolidated, compacted sediment
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion: By water—slight; by wind—moderate
Salinity: Upper 9 inches—slightly saline; below this depth—strongly saline
Sodicity: Upper 9 inches—moderately sodic; below this depth—slightly sodic or moderately sodic

Contrasting Inclusions

- Icene soils that are on lake terraces and have dominantly shadscale and black greasewood in the potential plant community
- Helphenstein soils that are on lower lying lake terraces and have dominantly black greasewood and inland saltgrass in the potential plant community
- Als soils that are on dunes

Major Uses

Livestock grazing, wildlife habitat, cropland

Major Management Factors

Salinity, sodicity, permeability, available water capacity, wind erosion, depth to dense, consolidated lacustrine sediment

Dominant Vegetation in Potential Plant Community

Basin big sagebrush, Indian ricegrass, black greasewood, basin wildrye, spiny hopsage

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- Salts reduce the amount of water available to plants and restrict seedling survival.
- Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
- Dispersion and crusting of the soil surface reduce

infiltration and restrict seedling emergence and survival.
- The dense, consolidated lacustrine sediment restricts rooting depth.
- This unit is subject to wind erosion if the vegetation is removed or degraded.
- This unit is suited to grazing in winter.
- If the vegetation is removed, range seeding is needed to control wind erosion.

Suitable management practices:
- Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate slight salinity, moderate sodicity, and droughtiness in summer.
- Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

Cropland

General management considerations:
- Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated.
- This unit is best suited to sprinkler irrigation, but border systems can be used in the more nearly level areas.
- Land leveling is needed for uniform application of irrigation water applied by border systems.
- The salinity and sodicity of the soil limit the selection of crops that can be grown.
- Wind erosion is a concern in barren areas.
- The soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
- Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
- Removing salts without applying proper amounts of soil amendments causes dispersion and crusting of the soil surface.
- If this unit is irrigated, the available water capacity can be improved by leaching salts below the root zone.
- The dense, consolidated lacustrine sediment is softened by applying irrigation water.
- Trees and shrubs suitable for windbreaks and environmental plantings are limited, and the seedling mortality rate is severe because of the concentration of salts.
- Continuous cultivation, use of mulch, or application of herbicides helps to control competing vegetation and ensure establishment and survival of seedlings.

Suitable management practices:
- Irrigate during the dry period in summer.
- Reduce the content of sodium by applying proper amounts of soil amendments and then leaching the salts by carefully applying irrigation water.
- Because of the slow permeability, manage the application of irrigation water to avoid overirrigating.
- Reduce crusting of the surface by returning crop residue to the soil, keeping tillage at a minimum, and regularly adding organic matter.
- Reduce the risk of wind erosion by planting crops in narrow strips at right angles to the prevailing wind, maintaining crop residue on the surface, maintaining a plant cover, and keeping the surface of the soil rough.

163B—Mesman fine sandy loam, mildly alkaline, 0 to 5 percent slopes

Composition

Mesman soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Mesman Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—dark brown fine sandy loam
9 to 20 inches—brown sandy clay loam
20 to 25 inches—brown silt loam
25 to 35 inches—brown very fine sandy loam
35 to 60 inches—brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to consolidated, compacted sediment
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion: By water—slight; by wind—moderate
Salinity: Upper 9 inches—slightly saline; below this depth—strongly saline
Sodicity: Upper 9 inches—slightly sodic; below this depth—slightly sodic or moderately sodic

Contrasting Inclusions

- Icene soils that are on lake terraces and have

dominantly shadscale and black greasewood in the potential plant community
• Helphenstein soils that are on lower lying lake terraces and have dominantly black greasewood and inland saltgrass in the potential plant community
• Als soils that are on dunes
• Mesman soils that are moderately sodic in the upper part and have dominantly basin big sagebrush and black greasewood in the potential plant community

Major Uses

Livestock grazing, cropland, wildlife habitat

Major Management Factors

Salinity, sodicity, permeability, available water capacity, wind erosion, depth to dense, consolidated lacustrine sediment

Dominant Vegetation in Potential Plant Community

Indian ricegrass, basin big sagebrush, Thurber needlegrass, Wyoming big sagebrush, needleandthread

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
• The dense, consolidated lacustrine sediment restricts rooting depth.
• This soil is subject to wind erosion if the vegetation is removed or degraded.
• This soil is suited to grazing in winter.
• Range seeding controls blowing and drifting sand.

Suitable management practices:
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate slight salinity, slight sodicity, and droughtiness in summer.
• Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated.
• Sprinkler irrigation is most efficient, but border irrigation can be used in the more nearly level areas.
• Land leveling is needed for uniform application of irrigation water applied by border systems.
• The salinity and sodicity of the soil limit the kinds of crops that can be grown.
• Wind erosion is a concern in barren areas.
• The soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• Removing salts without applying proper amounts of soil amendments causes dispersion and crusting of the soil surface.
• If this soil is irrigated, the available water capacity is improved by leaching salts below the root zone.
• The dense, consolidated lacustrine sediment in the lower part is softened by applying irrigation water.
• Trees and shrubs suitable for windbreaks and environmental plantings are limited, and the seedling mortality rate is severe because of the concentration of salts.
• Continuous cultivation, use of mulch, or application of herbicides helps to control competing vegetation and ensure establishment and survival of seedlings.

Suitable management practices:
• Irrigate during the dry period in summer.
• Reduce the content of sodium by applying proper amounts of soil amendments and then leaching the salts by carefully applying irrigation water.
• Because of the slow permeability, manage the application of irrigation water to avoid overirrigating.
• Reduce crusting of the surface by returning crop residue to the soil, keeping tillage at a minimum, and regularly adding organic matter.
• Reduce the risk of wind erosion by planting crops in narrow strips at right angles to the prevailing wind, maintaining crop residue on the surface, maintaining a plant cover, and keeping the surface of the soil rough.

163C—Mesman fine sandy loam, mildly alkaline, 5 to 15 percent slopes

Composition

Mesman soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Mesman Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—basalt, tuff, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—dark brown fine sandy loam
9 to 20 inches—brown sandy clay loam
20 to 25 inches—brown silt loam
25 to 35 inches—brown very fine sandy loam
35 to 60 inches—brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock; moderately deep (20 to 40 inches) to consolidated, compacted sediment
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion: By water—moderate; by wind—moderate
Salinity: Upper 9 inches—slightly saline; below this depth—strongly saline
Sodicity: Upper 9 inches—slightly sodic; below this depth—slightly sodic or moderately sodic

Contrasting Inclusions

• Pait soils that are on colluvial fans and foot slopes
• McConnel soils that are on alluvial fans and lake terraces
• Icene soils that are on lake terraces and have dominantly shadscale and black greasewood in the potential plant community
• Soils that have slopes of less than 5 percent or more than 15 percent

Major Uses

Livestock grazing, wildlife habitat, cropland

Major Management Factors

Slope, salinity, sodicity, available water capacity, permeability, water erosion, wind erosion, depth to dense, consolidated lacustrine sediment

Dominant Vegetation in Potential Plant Community

Indian ricegrass, basin big sagebrush, Thurber needlegrass, Wyoming big sagebrush, needleandthread

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
• The dense, consolidated lacustrine sediment restricts rooting depth.
• This soil is subject to wind erosion if the vegetation is removed or degraded.
• This soil is suited to grazing in winter.
• Range seeding controls blowing and drifting sand.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate slight salinity, slight sodicity, and droughtiness in summer.
• Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated.
• Because of the slope, sprinkler irrigation is best suited to this soil.
• The salinity and sodicity of the soil limit the kinds of crops that can be grown.
• The soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• Removing salts without applying proper amounts of soil amendments causes dispersion and crusting of the soil surface.
• If this soil is irrigated, the available water capacity is improved by leaching salts below the root zone.

• The dense, consolidated lacustrine sediment in the lower part is softened by applying irrigation water.
• Trees and shrubs suitable for windbreaks and environmental plantings are limited, and the seedling mortality rate is severe because of the concentration of salts.
• Continuous cultivation, use of mulch, or application of herbicides helps to control competing vegetation and ensure establishment and survival of seedlings.

Suitable management practices:
• Reduce the risk of water erosion by farming across the slope.
• Reduce the risk of wind erosion by planting crops in narrow strips at right angles to the prevailing wind, maintaining crop residue on the surface, maintaining a plant cover, and keeping the surface of the soil rough.
• Irrigate during the dry period in summer.
• Reduce the amount of sodium in the soil by applying proper amounts of soil amendments and then leaching the salts by carefully applying irrigation water.
• Reduce crusting of the surface by returning crop residue to the soil, keeping tillage at a minimum, and regularly adding organic matter.

164C—Mesman-Als complex, 0 to 15 percent slopes

Composition

Mesman soil and similar inclusions—50 percent
Als soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Mesman Soil

Position on landscape: Lake terraces that have slopes of 0 to 2 percent
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—dark brown fine sandy loam
9 to 20 inches—brown sandy clay loam
20 to 25 inches—brown silt loam
25 to 35 inches—brown very fine sandy loam
35 to 60 inches—brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock; moderately deep (20 to 40 inches) to consolidated, compacted sediment
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion: By water—slight or moderate; by wind—moderate
Salinity: Upper 9 inches—slightly saline; below this depth—strongly saline
Sodicity: Upper 9 inches—slightly sodic; below this depth—slightly sodic or moderately sodic

Characteristics of the Als Soil

Position on landscape: Sand dunes in lake basins that have slopes of 2 to 15 percent
Parent material: Kind—eolian sand over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 45 inches—very dark grayish brown fine sand
45 to 60 inches—dark brown fine sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Excessively drained
Permeability: Moderate
Available water capacity: About 4 inches
Hazard of erosion: By water—slight or moderate; by wind—very severe
Sodicity: Slightly sodic or moderately sodic

Contrasting Inclusions

• Icene soils that are on adjacent lake terraces and have dominantly shadscale and black greasewood in the potential plant community
• Helphenstein soils that are on lower lying lake terraces and have dominantly black greasewood and inland saltgrass in the potential plant community

Major Uses

Cropland, livestock grazing, wildlife habitat

Major Management Factors

Mesman soil—available water capacity, salinity, sodicity, permeability, depth to dense, consolidated lacustrine sediment, wind erosion
Als soil—available water capacity, sodicity, wind erosion, slope

Dominant Vegetation in Potential Plant Community

Mesman soil—basin big sagebrush, Indian ricegrass, Wyoming big sagebrush, Thurber needlegrass, needleandthread

Als soil—Indian ricegrass, basin big sagebrush, black greasewood, fourwing saltbush, needleandthread, basin wildrye

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- Excess sodium in the Mesman soil results in nutrient imbalances and a caustic root environment.
- Dispersion and crusting of the surface of the Mesman soil reduce infiltration and restrict seedling emergence and survival.
- Salts in the Mesman soil reduce the amount of water available to plants and restrict seedling survival.
- The soils in this unit are subject to wind erosion if the vegetation is removed or degraded.
- The dense, consolidated lacustrine sediment in the Mesman soil restricts rooting depth.
- Water movement is slow through the Mesman soil and rapid through the upper part of the Als soil.
- This unit is suited to grazing in winter.
- Range seeding controls blowing and drifting sand.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If the Mesman soil is seeded, select plants that tolerate droughtiness in summer, slight sodicity, and slight salinity.
- If the Als soil is seeded, select plants that tolerate moderate sodicity and droughtiness in summer.

Cropland

General management considerations:
- Because of the limited precipitation, continuous cropping is suitable only if the soils are irrigated.
- Sprinkler irrigation is most efficient and best suited to the soils in this unit.
- Light and frequent applications of irrigation water are needed on the Als soil because of the rapid permeability in the upper part of the soil.
- Leveling is needed for uniform application of water.
- To avoid exposing the more strongly saline and sodic lower part of the profile, land leveling that involves only shallow cuts is best suited.
- The concentration of salts and sodium limits the selection of crops.
- The soils in this unit tie up large amounts of phosphorus, which limits the amount that is available to plants.
- Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
- Removing salts from the Mesman soil without applying proper amounts of soil amendments causes dispersion and crusting of the soil surface.
- If the soils in this unit are irrigated. the available water capacity is improved by leaching salts below the root zone.
- The dense, consolidated lacustrine sediment in the lower part of the Mesman soil is softened by applying irrigation water.
- Trees and shrubs suitable for windbreaks and environmental plantings on the Mesman soil are limited, and the seedling mortality rate is severe because of the concentration of salts.
- Continuous cultivation, use of mulch, or application of herbicides helps to control competing vegetation and ensure establishment and survival of seedlings on the Mesman soil.
- The Als soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.

Suitable management practices:
- Irrigate during the dry period in summer.
- Reduce the amount of sodium in the soils by applying proper amounts of soil amendments and then leaching the salts by carefully applying irrigation water.
- Reduce crusting and compaction of the soil surface by returning crop residue to the soil, keeping tillage at a minimum, and regularly adding organic matter.
- Reduce the risk of wind erosion by planting crops in narrow strips at right angles to the prevailing wind, maintaining crop residue on the surface, planting field windbreaks, maintaining a plant cover, and limiting the width of strips of unprotected soils.

165C—Mound stony loam, 0 to 15 percent slopes

Composition

Mound soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Mound Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium over residuum; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—18 to 25 inches

Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days

Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February

Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and limbs
0 to 13 inches—very dark grayish brown stony loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—brown partially weathered tuff
45 inches—brown tuff

Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Moderate

Contrasting Inclusions

- Booth soils that are on adjacent benches and hillsides and have low sagebrush or mountain big sagebrush in the potential plant community
- Rock outcrop
- Soils that have slopes of more than 15 percent
- Mound soils that are very cobbly loam or very stony loam in the upper part
- Soils that are similar to the Mound soil but have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Stones on the surface and in the soil, permeability

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 69 cubic feet per acre per year for ponderosa pine at age 40; 64 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 225 board feet per acre per year for ponderosa pine at age 150

General management considerations:
- Wet, unsurfaced roads and skid trails are slippery and sticky.
- The clayey layer restricts permeability.
- The rock fragments on the surface make tree planting and the operation of ground seeding equipment difficult.
- Accumulations of snow can bend or break small trees.

Suitable management practices:
- To minimize compaction and soil displacement, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.
- To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
- Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the surface.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the surface to reduce sheet and rill erosion.

166G—Mound stony loam, 40 to 60 percent north slopes

Composition

Mound soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Mound Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium over residuum; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—18 to 25 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days

Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February

Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and limbs
0 to 13 inches—very dark grayish brown stony loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—brown partially weathered tuff
45 inches—brown tuff

Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Booth soils that are on adjacent hillsides and have low sagebrush or mountain big sagebrush in the potential plant community
• Rock outcrop
• Soils that have slopes of less than 40 percent or more than 60 percent
• Mound soils that are very cobbly loam or very stony loam in the upper part
• Soils that are similar to the Mound soil but have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Stones on the surface and in the soil, permeability, slope, water erosion

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 69 cubic feet per acre per year for ponderosa pine at age 40; 64 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 225 board feet per acre per year for ponderosa pine at age 150

General management considerations:
• Wet, unsurfaced roads are slippery and sticky.
• The clayey layer restricts permeability.
• The rock fragments on the surface can make tree planting and road construction difficult.
• Roads located at midslope are difficult to construct and maintain and require large cuts and fills that remove land from production.
• Cuts and fills slough when wet.
• Cutbanks are difficult to revegetate because of the clayey layer.
• Accumulations of snow can bend or break small trees.
• To maintain the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
• To minimize soil displacement, cable yarding systems should be used.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
• To minimize compaction and erosion, avoid logging in spring when the soil is wet.
• Leave slash on the soil surface to minimize sheet and rill erosion.
• Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
• Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
• Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the surface.

167E—Mound stony loam, slump, 2 to 30 percent slopes

Composition

Mound soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Mound Soil

Position on landscape: Slump benches on mountains
Parent material: Kind—colluvium over residuum; source—tuff
Elevation: 4,700 to 5,500 feet
Climatic factors:
Mean annual precipitation—22 to 25 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and limbs
0 to 13 inches—very dark grayish brown stony loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—brown partially weathered tuff
45 inches—brown tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Winterim soils that are on adjacent plateaus and mountainsides and have dominantly ponderosa pine in the potential plant community
- Royst soils that are on adjacent hillsides and have dominantly western juniper and mountain big sagebrush and scattered ponderosa pine in the potential plant community
- Nuss stony loam that is on adjacent hillsides and has dominantly mountain big sagebrush and Idaho fescue in the potential plant community
- Rock outcrop
- Soils that have slopes of more than 30 percent
- Soils that are similar to the Mound soil but are stony throughout
- Soils that are similar to the Mound soil but have bedrock at a depth of more than 60 inches

Major Use

Woodland

Major Management Factors

Permeability, stones on the surface and in the soil, water erosion

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 69 cubic feet per acre per year for ponderosa pine at age 40; 64 cubic feet per acre per year for white fir at age 70

Estimated yield (Scribner rule): 225 board feet per acre per year for ponderosa pine at age 150

General management considerations:

- This unit slumps because of the highly fractured and faulted tuffaceous bedrock.
- The uneven slopes and hummocky topography restrict the operation of equipment.
- Wet, unsurfaced roads and skid trails are slippery and sticky.
- The rock fragments on the surface can make tree planting, operation of ground seeding equipment, and road construction difficult.
- The clayey layer restricts permeability.
- Cuts and fills slough when wet.
- Accumulations of snow can bend or break small trees.

Suitable management practices:

- To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring.
- To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the surface to reduce sheet and rill erosion.
- Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the surface.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.

168F—Mound very bouldery loam, slump, 30 to 50 percent north slopes

Composition

Mound soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Mound Soil

Position on landscape: Slump benches and areas at the base of Winter Rim
Parent material: Kind—colluvium over residuum; source—tuff
Elevation: 4,700 to 5,500 feet
Climatic factors:
Mean annual precipitation—22 to 25 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January through March
Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and small limbs
0 to 13 inches—very dark grayish brown very bouldery loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—brown partially weathered tuff
45 inches—brown tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches

Hazard of erosion by water: Severe

Contrasting Inclusions

- Winterim soils that are on adjacent mountainsides and have dominantly ponderosa pine in the potential plant community
- Royst soils that are on adjacent hillsides and have dominantly western juniper and mountain big sagebrush and scattered ponderosa pine in the potential plant community
- Nuss soils that are on adjacent hillsides and have dominantly mountain big sagebrush and Idaho fescue in the potential plant community
- Rock outcrop
- Soils that have slopes of more than 50 percent or less than 30 percent
- Mound soils that are very stony loam throughout
- Soils that are similar to the Mound soil but have bedrock at a depth of more than 60 inches

Major Use

Woodland

Major Management Factors

Slope, water erosion, boulders on the surface, permeability

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 69 cubic feet per acre per year for ponderosa pine at age 40; 64 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 225 board feet per acre per year for ponderosa pine at age 150

General management considerations:
- This soil slumps because of the highly fractured and faulted tuff.
- Wet, unsurfaced roads are slippery and sticky.
- The rock fragments on the surface make tree planting difficult.
- Accumulations of snow can bend or break small trees.
- The clayey layer restricts permeability.
- Cuts and fills slough when wet.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
- To minimize soil displacement, cable yarding systems should be used.

Suitable management practices:
- To minimize compaction and erosion, avoid logging in spring when the soil is wet.
- Leave slash on the soil to minimize sheet and rill erosion.
- Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
- Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
- Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the surface.

169E—Mound-Polander complex, 15 to 40 percent north slopes

Composition

Mound soil and similar inclusions—50 percent
Polander soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Mound Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium over residuum; source—basalt, tuff
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and limbs
0 to 13 inches—very dark grayish brown stony loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—brown partially weathered tuff
45 inches—brown tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow

Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Rogger and Twelvemile soils that are on adjacent mountainsides
- Soils that are on south-facing slopes
- Soils that have slopes of less than 15 percent or more than 40 percent
- Soils that are similar to the Mound and Polander soils but have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Mound soil—slope, water erosion, stones on the surface, permeability
Polander soil—slope, water erosion

Dominant Vegetation in Potential Plant Community

Mound and Polander soils—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: Mound soil—69 cubic feet per acre per year for ponderosa pine at age 40 and 64 cubic feet per acre per year for white fir at age 70; Polander soil—55 cubic feet per acre per year for ponderosa pine at age 50 and 64 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): Mound soil—225 board feet per acre per year for ponderosa pine at age 150; Polander soil—172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
- The clayey layer in the Mound soil restricts permeability.
- Wet, unsurfaced roads and skid trails on the Mound soil are slippery and sticky, and those on the Polander soil are soft.
- Dry, unsurfaced roads and skid trails on the Polander soil are dusty.
- Cuts and fills on the Mound soil slough when wet, and those on the Polander soil are stable.
- The rock fragments on the surface of the Mound soil can make tree planting and operation of ground seeding equipment difficult.
- Accumulations of snow can bend or break small trees.
- To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
- To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soils are wet.
- To minimize compaction, adjust yarding operations to the content of moisture and organic matter in the surface layer.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance

and exposes the soil. Maintain slash on the surface to reduce sheet and rill erosion.
• Reduce the risk of erosion and minimize displacement of the Mound soil by limiting vehicle access to periods when the soil is dry or frozen.

169G—Mound-Polander complex, 40 to 70 percent north slopes

Composition

Mound soil and similar inclusions—50 percent
Polander soil and similar inclusions—40 percent
Contrasting inclusions—10 percent

Characteristics of the Mound Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium over residuum; source—basalt, tuff
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and limbs
0 to 13 inches—very dark grayish brown stony loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—brown partially weathered tuff
45 inches—brown tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe or very severe

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe or very severe

Contrasting Inclusions

• Rogger and Twelvemile soils that are on adjacent mountainsides
• Soils that are on south-facing slopes
• Soils that have slopes of less than 40 percent
• Soils that are similar to the Mound and Polander soils but have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Mound soil—slope, water erosion, stones on the surface, permeability
Polander soil—slope, water erosion

Dominant Vegetation in Potential Plant Community

Mound and Polander soils—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: Mound soil—69 cubic feet per acre per year for ponderosa pine at age 40 and 64 cubic feet per acre per year for white fir at age 70; Polander soil—55 cubic feet per acre per year for ponderosa pine at age 50 and 64 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): Mound soil—225 board feet per acre per year for ponderosa pine at age 150; Polander soil—172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
• The clayey layer in the Mound soil restricts permeability.
• Wet, unsurfaced roads on the Mound soil are

slippery and sticky, and those on the Polander soil are soft.
• Dry, unsurfaced roads on the Polander soil are dusty.
• Cuts and fills on the Mound soil slough when wet, and those on the Polander soil are stable.
• Roads constructed at midslope are difficult to maintain and require large cuts and fills that remove land from production.
• The rock fragments on the surface of the Mound soil can make tree planting difficult.
• Accumulations of snow can bend or break small trees.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
• To minimize soil displacement, cable yarding systems should be used.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
• To minimize compaction and erosion, avoid logging in spring when the soils are wet.
• Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
• Leave slash on the soil to minimize sheet and rill erosion.
• Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
• Reduce the risk of erosion and minimize displacement of the Mound soil by limiting vehicle access to periods when the soil is dry or frozen.

170E—Mound-Polander complex, 15 to 40 percent south slopes

Composition

Mound soil and similar inclusions—50 percent
Polander soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Mound Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium over residuum; source—basalt, tuff
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and limbs
0 to 13 inches—very dark grayish brown stony loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—brown partially weathered tuff
45 inches—brown tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Rogger and Twelvemile soils that are on adjacent mountainsides
• Soils that are on north-facing slopes
• Soils that have slopes of less than 15 percent or more than 40 percent
• Soils that are similar to the Mound and Polander soils but have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Mound soil—slope, water erosion, stones on the surface, permeability
Polander soil—slope, water erosion

Dominant Vegetation in Potential Plant Community

Mound and Polander soils—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: Mound soil—69 cubic feet per acre per year for ponderosa pine at age 40 and 64 cubic feet per acre per year for white fir at age 70; Polander soil—55 cubic feet per acre per year for ponderosa pine at age 50 and 64 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): Mound soil—225 board feet per acre per year for ponderosa pine at age 150; Polander soil—172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
- Soils on south-facing slopes are more droughty than those on north-facing slopes.
- Artificial or natural shade increases seedling survival.
- Wet, unsurfaced roads and skid trails on the Mound soil are slippery and sticky, and those on the Polander soil are soft.
- Dry, unsurfaced roads and skid trails on the Polander soil are dusty.
- Cuts and fills on the Mound soil slough when wet, and those on the Polander soil are stable.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- The clayey layer in the Mound soil restricts permeability.
- The rock fragments on the surface of the Mound soil can make tree planting and operation of ground seeding equipment difficult.
- Accumulations of snow can bend or break small trees.
- To protect the quality and quantity of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.

Suitable management practices:
- The use of shade cards increases seedling survival.
- To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soils are wet.
- To minimize compaction, adjust yarding operations to the content of moisture and organic matter in the surface layer.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the surface to reduce sheet and rill erosion.
- Reduce the risk of erosion and minimize displacement of the Mound soil by limiting vehicle access to periods when the soil is dry or frozen.

170G—Mound-Polander complex, 40 to 70 percent south slopes

Composition

Mound soil and similar inclusions—50 percent
Polander soil and similar inclusions—40 percent
Contrasting inclusions—10 percent

Characteristics of the Mound Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium over residuum; source—basalt, tuff
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and limbs
0 to 13 inches—very dark grayish brown stony loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—brown partially weathered tuff
45 inches—brown tuff

Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe or very severe

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe or very severe

Contrasting Inclusions

- Rogger and Twelvemile soils that are on adjacent mountainsides
- Soils that are on north-facing slopes
- Soils that have slopes of less than 40 percent
- Soils that are similar to the Mound and Polander soils but have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Mound soil—slope, water erosion, stones on the surface, permeability
Polander soil—slope, water erosion

Dominant Vegetation in Potential Plant Community

Mound and Polander soils—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: Mound soil—69 cubic feet per acre per year for ponderosa pine at age 40 and 64 cubic feet per acre per year for white fir at age 70; Polander soil—55 cubic feet per acre per year for ponderosa pine at age 50 and 64 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): Mound soil—225 board feet per acre per year for ponderosa pine at age 150; Polander soil—172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
- Soils on south-facing slopes are more droughty than those on north-facing slopes.
- Artificial or natural shade increases seedling survival.
- Wet, unsurfaced roads on the Mound soil are slippery and sticky, and those on the Polander soil are soft.
- Dry, unsurfaced roads on the Polander soil are dusty.
- The clayey layer in the Mound soil restricts permeability.
- Cuts and fills on the Mound soil slough when wet, and those on the Polander soil are stable.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
- The rock fragments on the surface of the Mound soil can make tree planting difficult.
- Accumulations of snow can bend or break small trees.
- To protect the quality and quantity of the water, a buffer zone should be maintained around the riparian areas and disturbance of these areas should be minimized.
- The use of shade cards increases seedling survival.
- To minimize soil displacement, cable yarding systems should be used.

Suitable management practices:
- To minimize compaction and erosion, avoid logging in spring when the soils are wet.
- Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
- Leave slash on the soil to minimize sheet and rill erosion.
- Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.

• Reduce the risk of erosion and soil displacement by limiting vehicle access on the Mound soil to periods when the soil is dry or frozen.

171E—Mound-Royst-Nuss association, 15 to 40 percent slopes

Composition

Mound soil and similar inclusions—35 percent
Royst soil and similar inclusions—30 percent
Nuss soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the Mound Soil

Position on landscape: North-facing mountainsides
Parent material: Kind—colluvium over residuum; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—18 to 25 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and limbs
0 to 13 inches—very dark grayish brown stony loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—partially weathered tuff
45 inches—tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Characteristics of the Royst Soil

Position on landscape: Concave and plane areas on south-facing hillsides
Parent material: Kind—residuum, colluvium; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—18 to 25 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
2 inches to 0—ponderosa pine needles and twigs and mountain big sagebrush leaves
0 to 4 inches—black very stony loam
4 to 27 inches—dark brown extremely stony clay
27 to 29 inches—fractured, partially weathered tuff
29 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 27 inches

Characteristics of the Nuss Soil

Position on landscape: Convex areas on south-facing hillsides
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—18 to 25 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown stony loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Booth soils that are on hillsides, mountainsides, and benches and have dominantly low sagebrush or mountain big sagebrush in the potential plant community
• Rock outcrop
• Soils that have slopes of less than 15 percent or more than 40 percent

Major Uses

Mound and Royst soils—livestock grazing, woodland
Nuss soil—livestock grazing

Major Management Factors

Mound soil—stones on the surface and in the soil, water erosion, slope, permeability
Royst soil—stones on the surface and in the soil, shrink-swell potential, available water capacity, slope, depth to bedrock, water erosion, permeability

Nuss soil—depth to bedrock, available water capacity, stones on the surface, slope, water erosion

Dominant Vegetation in Potential Plant Community

Mound soil—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass
Royst soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Ross sedge
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass

Livestock Grazing

Mound, Royst, and Nuss soils

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The bedrock in the Royst and Nuss soils restricts rooting depth.
• Livestock herd and graze in the less stony areas of the unit.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• The low available water capacity of the Royst and Nuss soils limits forage production and seedling survival.
• The stony surface layer and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The Royst soil expands when wet and contracts when dry, which makes special design of fences necessary.
• The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• The shallow depth and stones on the surface of the Nuss soil limit placement of fenceposts and make special design of fences necessary.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.
• Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

Woodland

Mound and Royst soils

Estimated growth at culmination of mean annual increment: Mound soil—69 cubic feet per acre per year for ponderosa pine at age 40 and 64 cubic feet per acre per year for white fir at age 70; Royst soil—50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): Mound soil—225 board feet per acre per year for ponderosa pine at age 150; Royst soil—150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
• The clayey layer restricts permeability.
• Wet, unsurfaced roads and skid trails on the Mound soil are slippery and sticky, and those on the Royst soil are firm.
• Cuts and fills slough when wet.
• Accumulations of snow on the north-facing slopes can bend or break small trees.
• The rock fragments on the surface can make tree planting and operation of ground seeding equipment difficult.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• The soils on south-facing slopes are more droughty than those on north-facing slopes.
• Artificial or natural shade increases seedling survival on the south-facing slopes.
• The bedrock in the Royst soil restricts rooting depth.
• Trees may be blown down during periods of soil wetness and high winds.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
• Because the Royst soil on south-facing slopes is hotter in summer and droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soils are wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Minimize mechanical piling of slash. Heavy

equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
• Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
• Restrict vehicle access to periods when the soils are dry or frozen to minimize puddling, rutting, compaction, and erosion.
• Use shade cards on south-facing slopes to increase seedling survival.
• Use mechanical treatment, chemical treatment, or livestock grazing to control competing vegetation.

171G—Mound-Royst-Nuss association, 40 to 60 percent slopes

Composition

Mound soil and similar inclusions—35 percent
Royst soil and similar inclusions—30 percent
Nuss soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the Mound Soil

Position on landscape: North-facing mountainsides
Parent material: Kind—colluvium over residuum; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—18 to 25 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and limbs
0 to 13 inches—very dark grayish brown stony loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—partially weathered tuff
45 inches—tuff
Depth class: Deep (40 to 60 inches) to bedrock
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Characteristics of the Royst Soil

Position on landscape: Concave and plane areas on south-facing hillsides
Parent material: Kind—residuum, colluvium; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—18 to 25 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
2 inches to 0—ponderosa pine needles and twigs and mountain big sagebrush leaves
0 to 4 inches—black very stony loam
4 to 27 inches—dark brown extremely stony clay
27 to 29 inches—fractured, partially weathered tuff
29 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 27 inches

Characteristics of the Nuss Soil

Position on landscape: Convex areas on south-facing hillsides
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—18 to 25 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown stony loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Booth soils that are on hillsides and mountainsides and have dominantly low sagebrush or mountain big sagebrush in the potential plant community
• Rock outcrop
• Soils that have slopes of less than 40 percent or more than 60 percent

Major Uses

Mound and Royst soils—livestock grazing, woodland
Nuss soil—livestock grazing

Major Management Factors

Mound soil—slope, water erosion, stones on the surface and in the soil, permeability
Royst soil—slope, water erosion, stones on the surface and in the soil, shrink-swell potential, available water capacity, depth to bedrock, permeability
Nuss soil—slope, water erosion, depth to bedrock, available water capacity, stones on the surface

Dominant Vegetation in Potential Plant Community

Mound soil—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass
Royst soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Ross sedge
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass

Livestock Grazing

Mound, Royst, and Nuss soils

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The bedrock in the Royst and Nuss soils restricts rooting depth.
- Livestock herd and graze in the less stony areas of the unit.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- The low available water capacity limits forage production and seedling survival on the Royst and Nuss soils.
- The stony surface layer and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The Royst soil expands when wet and contracts when dry, which makes special design of fences necessary.
- The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
- The shallow depth and stones on the surface of the Nuss soil limit placement of fenceposts and make special design of fences necessary.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.
- Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

Woodland

Mound and Royst soils

Estimated growth at culmination of mean annual increment: Mound soil—69 cubic feet per acre per year for ponderosa pine at age 40 and 64 cubic feet per acre per year for white fir at age 70; Royst soil—50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): Mound soil—225 board feet per acre per year for ponderosa pine at age 150; Royst soil—150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
- The clayey layer restricts permeability.
- Wet, unsurfaced roads on the Mound soil are slippery and sticky, and those on the Royst soil are firm.
- Cuts and fills slough when wet.
- Accumulations of snow on the north-facing slopes can bend or break small trees.
- The rock fragments on the surface can make tree planting difficult.
- Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
- To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
- The south-facing slopes are more droughty than the north-facing slopes.
- Artificial or natural shade increases seedling survival on the south-facing slopes.
- The bedrock in the Royst soil restricts rooting depth.
- Trees may be blown down during periods of soil wetness and high winds.
- To minimize soil displacement, cable yarding systems should be used.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- Because the Royst soil on south-facing slopes is hotter in summer and droughty, larger than normal

planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
- To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
- Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
- Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
- Restrict vehicle access to periods when the soil is dry or frozen to minimize puddling, rutting, compaction, and erosion.
- Use shade cards to increase seedling survival.
- Use mechanical treatment, chemical treatment, or livestock grazing to control competing vegetation.

172A—Mudpot silty clay, 0 to 2 percent slopes

Composition

Mudpot soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Mudpot Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 5 inches—dark grayish brown silty clay
5 to 60 inches—grayish brown silty clay
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: January through July—12 inches above the surface to 12 inches below the surface; rest of year—more than 12 inches
Shrink-swell potential: High
Carbonates: Upper 49 inches—noneffervescent or slightly effervescent; below this depth—strongly effervescent

Contrasting Inclusions

- Anawalt and Floke soils that are on tablelands adjacent to basin floors and have dominantly low sagebrush and bluebunch wheatgrass in the potential plant community
- Freznik soils that are on tablelands adjacent to basin floors and have dominantly low sagebrush and Sandberg bluegrass in the potential plant community
- Swalesilver soils that are on adjacent, slightly higher lying lake basin terraces and have silver sagebrush in the potential plant community
- Bicondoa soils that are on adjacent flood plains
- Norad soils that are on adjacent lake basin terraces and have dominantly winterfat in the potential plant community

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Wetness, permeability, shrink-swell potential, frost action, clayey surface layer

Dominant Vegetation in Potential Plant Community

Spikerush, dock, Baltic rush, povertyweed, mat muhly, bottlebrush squirreltail

Livestock Grazing

General management considerations:
- This unit provides food and cover for wetland wildlife.
- Variable yearly ponding results in an unstable plant community.
- Grazing should be deferred during the period of nesting for waterfowl.
- Grazing when the soil is wet results in compaction of the surface layer.
- The clayey surface layer limits infiltration and restricts seedling emergence and survival.
- The soil expands when wet and contracts when dry, which can rip and tear plant roots and make special design of fences necessary.
- The low precipitation limits forage production and seedling survival.
- A seasonal high water table and ponding during the growing season restrict the rooting depth of non-water-tolerant plants.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Only a sparse stand of perennial grasses is produced in the potential plant community, but abundant annual forbs are produced when precipitation is favorable.

• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Because of a high potential for frost action, seedlings are subject to winterkill and other damage.
• The soil in this unit generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If this unit is seeded, select plants that tolerate wetness, shrinking and swelling, and a cool growing season and that provide cover for nesting waterfowl.

173A—Mudpot-Swalesilver complex, 0 to 2 percent slopes

Composition

Mudpot soil and similar inclusions—50 percent
Swalesilver soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Mudpot Soil

Position on landscape: Lake basin floors
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,000 to 5,300 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 5 inches—dark grayish brown silty clay
5 to 60 inches—grayish brown silty clay
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: January through July—12 inches above the surface to 12 inches below the surface; rest of year—more than 12 inches
Shrink-swell potential: High
Carbonates: Upper 49 inches—noneffervescent or slightly effervescent; below this depth—strongly effervescent

Characteristics of the Swalesilver Soil

Position on landscape: Lake terraces in basins
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,000 to 5,300 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 4 inches—very dark gray loam
4 to 9 inches—light gray silt loam
9 to 12 inches—very dark grayish brown clay
12 to 24 inches—very dark grayish brown silty clay
24 to 36 inches—dark brown clay loam
36 to 60 inches—brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, very shallow (2 to 10 inches) to the claypan
Drainage class: Somewhat poorly drained
Permeability: Upper 9 inches—moderate; between depths of 9 and 24 inches—very slow
Available water capacity: About 5 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: February through May—12 inches above the surface to 6 inches below the surface; rest of year—more than 6 inches
Shrink-swell potential: High between depths of 9 and 24 inches

Contrasting Inclusions

• Spangenburg soils that are on adjacent, slightly higher lying lake terraces and have dominantly Wyoming big sagebrush in the potential plant community

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Mudpot soil—wetness, permeability, shrink-swell potential, clayey surface layer
Swalesilver soil—wetness, permeability, depth to the claypan, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Mudpot soil—Baltic rush, spikerush, mat muhly, bottlebrush squirreltail, povertyweed
Swalesilver soil—silver sagebrush, Nevada bluegrass, creeping wildrye

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soils are wet results in compaction of the surface layer.
• The soils expand when wet and contract when dry, which can rip and tear plant roots and make special design of fences necessary.
• The low precipitation limits forage production and seedling survival.
• The claypan in the Swalesilver soil restricts rooting depth and permeability.
• Variable yearly ponding on the Mudpot soil results in an unstable plant community.
• A seasonal high water table and ponding during the growing season restrict the rooting depth of non-water-tolerant plants.
• Only a sparse stand of perennial grasses generally is produced in the potential plant community on the Mudpot soil, but abundant perennial forbs are produced.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Because of a high potential for frost action in the Mudpot soil, seedlings are subject to winterkill and other damage.
• The Mudpot soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.
• Trees and shrubs for windbreaks and environmental plantings on the Swalesilver soil should be tolerant of droughtiness in summer.
• The seedling mortality rate on the Swalesilver soil is severe because the high content of clay causes moisture stress late in summer and in fall.

Suitable management practices:
• Allow the soils to drain adequately before grazing to prevent damage to the soil and plants.
• If this unit is seeded, select plants that tolerate wetness and provide cover for nesting waterfowl.
• Control competing vegetation on the Swalesilver soil by cultivating or applying herbicides.

174C—Newlands-Hart complex, 5 to 15 percent slopes

Composition

Newlands soil and similar inclusions—50 percent
Hart soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Newlands Soil

Position on landscape: Mountain foot slopes
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark brown loam
7 to 36 inches—dark brown gravelly clay loam
36 to 49 inches—strong brown gravelly clay loam
49 inches—tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 7 inches
Hazard of erosion by water: Moderate

Characteristics of the Hart Soil

Position on landscape: Fans
Parent material: Kind—alluvium, residuum; source—basalt, tuff
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 9 inches—dark brown very gravelly loam
9 to 19 inches—brown clay
19 to 25 inches—dark brown very gravelly silty clay loam
25 to 30 inches—brown very gravelly loam
30 to 43 inches—brown extremely gravelly loam
43 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Deep (40 to 60 inches) to bedrock, very shallow (7 to 10 inches) to the claypan
Drainage class: Well drained

Permeability: Very slow
Available water capacity: About 5 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 19 inches
Carbonates: Between depths of 19 and 25 inches—violently effervescent; below this depth—strongly effervescent

Contrasting Inclusions

• Ninemile soils that are on tablelands
• Mascamp soils that are on foothills and toe slopes
• Soils that are similar to the Newlands soil but have bedrock or a hardpan at a depth of less than 40 inches or more than 60 inches
• Soils that are similar to the Newlands soil but have more than 35 percent coarse fragments throughout

Major Use

Livestock grazing (fig. 14)

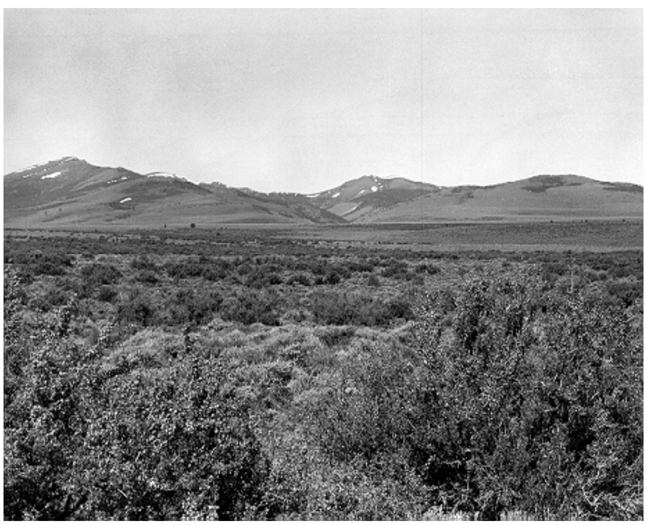


Figure 14.—Area of Newlands-Hart complex, 5 to 15 percent slopes. The Newlands soil supports dominantly antelope bitterbrush and mountain big sagebrush (dark-colored vegetation), and the Hart soil supports dominantly low sagebrush (light-colored vegetation).

Major Management Factors

Newlands soil—water erosion
Hart soil—shrink-swell potential, depth to the claypan, permeability, calcareous layer, water erosion

Dominant Vegetation in Potential Plant Community

Newlands soil—Idaho fescue, mountain big sagebrush, Canby bluegrass, antelope bitterbrush
Hart soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The claypan and calcareous layer in the lower part of the Hart soil restrict rooting depth.
• The surface layer of the Hart soil is saturated following snowmelt.
• Pedestaled plants and an erosion pavement on the Hart soil are the result of past erosion.
• The subsoil of the Hart soil expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.
• Because of the high corrosivity of the Hart soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Hart soil is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Newlands soil is seeded, select plants that tolerate a cool growing season.
• If the Hart soil is seeded, select plants that tolerate shrinking and swelling and a cool growing season.

175E—Newlands-Hart-Mascamp complex, 15 to 30 percent slopes

Composition

Newlands soil and similar inclusions—35 percent
Hart soil and similar inclusions—30 percent
Mascamp soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the Newlands Soil

Position on landscape: Mountain foot slopes, mountainsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark brown loam

7 to 36 inches—dark brown gravelly clay loam
36 to 49 inches—strong brown gravelly clay loam
49 inches—tuff

Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 7 inches
Hazard of erosion by water: Severe

Characteristics of the Hart Soil

Position on landscape: Fans
Parent material: Kind—alluvium, residuum; source—basalt, tuff
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 9 inches—dark brown very gravelly loam
9 to 19 inches—brown clay
19 to 25 inches—dark brown very gravelly silty clay loam
25 to 30 inches—brown very gravelly loam
30 to 43 inches—brown extremely gravelly loam
43 inches—tuff that has coatings of silica and calcium carbonate in fractures

Depth class: Deep (40 to 60 inches) to bedrock, very shallow (7 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 9 and 19 inches
Carbonates: Between depths of 19 and 25 inches—violently effervescent; below this depth—strongly effervescent

Characteristics of the Mascamp Soil

Position on landscape: Mountain toe slopes, mountainsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 2 inches—very dark grayish brown very gravelly loam
2 to 5 inches—very dark grayish brown very gravelly clay loam
5 to 12 inches—dark brown very gravelly clay loam
12 inches—basalt

Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe

Contrasting Inclusions

- Ninemile soils that are on tablelands
- Soils that are similar to the Newlands soil but have bedrock or a hardpan at a depth of less than 40 inches or more than 60 inches
- Soils that are similar to the Newlands soil but have more than 35 percent rock fragments throughout
- Soils that are similar to the Mascamp soil but are more than 20 inches deep to bedrock
- Soils that have slopes of less than 15 percent or more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Newlands soil—water erosion, slope
Hart soil—permeability, calcareous layer, depth to the claypan, shrink-swell potential, water erosion, slope
Mascamp soil—depth to bedrock, available water capacity, water erosion, slope

Dominant Vegetation in Potential Plant Community

Newlands soil—Idaho fescue, mountain big sagebrush, Canby bluegrass, antelope bitterbrush
Hart soil—Idaho fescue, low sagebrush, bluebunch wheatgrass
Mascamp soil—Idaho fescue, mountain big sagebrush, bluebunch wheatgrass, basin wildrye

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The claypan and calcareous layer in the lower part of the Hart soil restrict rooting depth.
- The surface layer of the Hart soil is saturated following snowmelt.
- The bedrock in the Mascamp soil restricts rooting depth.

• Pedestaled plants and an erosion pavement on the Hart and Mascamp soils are the result of past erosion.
• The subsoil of the Hart soil expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.
• The shallow depth of the Mascamp soil limits placement of fenceposts.
• Because of the high corrosivity of the Hart soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Hart soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

176F—Newlands-Hart-Mascamp complex, 30 to 50 percent north slopes

Composition

Newlands soil and similar inclusions—35 percent
Hart soil and similar inclusions—30 percent
Mascamp soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the Newlands Soil

Position on landscape: Mountainsides, mountain foot slopes
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark brown loam
7 to 36 inches—dark brown gravelly clay loam
36 to 49 inches—strong brown gravelly clay loam
49 inches—tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 7 inches
Hazard of erosion by water: Severe

Characteristics of the Hart Soil

Position on landscape: Fans
Parent material: Kind—alluvium, residuum; source—basalt, tuff
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 9 inches—dark brown very gravelly loam
9 to 19 inches—brown clay
19 to 25 inches—dark brown very gravelly silty clay loam
25 to 30 inches—brown very gravelly loam
30 to 43 inches—brown extremely gravelly loam
43 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Deep (40 to 60 inches) to bedrock, very shallow (7 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 9 and 19 inches
Carbonates: Between depths of 19 and 25 inches—violently effervescent; below this depth—strongly effervescent

Characteristics of the Mascamp Soil

Position on landscape: Mountain toe slopes, mountainsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—very dark grayish brown very gravelly loam
2 to 5 inches—very dark grayish brown very gravelly clay loam
5 to 12 inches—dark brown very gravelly clay loam
12 inches—basalt
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe

Contrasting Inclusions

- Ninemile soils that are on tablelands
- Soils that are similar to the Newlands soil but have bedrock or a hardpan at a depth of less than 40 inches or more than 60 inches
- Soils that are similar to the Newlands soil but have more than 35 percent rock fragments throughout
- Soils that are similar to the Mascamp soil but have bedrock at a depth of more than 20 inches
- Soils that have slopes of less than 30 percent or more than 50 percent

Major Use

Livestock grazing

Major Management Factors

Newlands soil—slope, water erosion
Hart soil—slope, water erosion, permeability, calcareous layer, depth to the claypan, shrink-swell potential
Mascamp soil—slope, water erosion, depth to bedrock, available water capacity

Dominant Vegetation in Potential Plant Community

Newlands soil—Idaho fescue, mountain big sagebrush, bluebunch wheatgrass, basin wildrye, antelope bitterbrush
Hart soil—Idaho fescue, low sagebrush, bluebunch wheatgrass
Mascamp soil—Idaho fescue, mountain big sagebrush, bluebunch wheatgrass, basin wildrye

Livestock Grazing

General management considerations:
- The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The claypan and calcareous layer in the lower part of the Hart soil restrict rooting depth.
- Livestock prefer to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
- The surface layer of the Hart soil is saturated following snowmelt.
- The bedrock in the Mascamp soil restricts rooting depth.
- Pedestaled plants and an erosion pavement on the Hart soil are the result of past erosion.
- The subsoil of the Hart soil expands when wet and contracts when dry, which can rip and tear plant roots.
- Slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The shallow depth of the Mascamp soil limits placement of fenceposts.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Hart soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

177C—Newlands-Ninemile complex, 5 to 15 percent slopes

Composition

Newlands soil and similar inclusions—50 percent
Ninemile soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Newlands Soil

Position on landscape: Mountain foot slopes, mountainsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark brown loam
7 to 26 inches—dark brown gravelly clay loam
26 to 36 inches—dark brown gravelly clay loam
34 to 49 inches—strong brown gravelly clay loam
49 inches—tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 7 inches
Hazard of erosion by water: Moderate

Characteristics of the Ninemile Soil

Position on landscape: Mountainsides, tablelands
Parent material: Kind—residuum, colluvium; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches

Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 7 inches—dark brown very gravelly loam
7 to 15 inches—dark brown clay
15 to 19 inches—dark brown gravelly clay
19 inches—tuff that has coatings of silica and calcium carbonate in fractures

Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate or severe
Shrink-swell potential: High between depths of 7 and 19 inches

Contrasting Inclusions

• Carryback soils that are on tablelands
• Soils that are similar to the Newlands soil but have bedrock or a hardpan at a depth of 20 to 40 inches
• Soils that are similar to the Ninemile soil but have bedrock at a depth of less than 10 inches

Major Use

Livestock grazing

Major Management Factors

Newlands soil—water erosion
Ninemile soil—available water capacity, depth to the claypan, permeability, depth to bedrock, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Newlands soil—Idaho fescue, mountain big sagebrush, Canby bluegrass, antelope bitterbrush
Ninemile soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The surface layer of the Ninemile soil is saturated following snowmelt.
• The claypan and bedrock in the Ninemile soil restrict rooting depth.
• The low available water capacity of the Ninemile soil limits forage production and seedling survival.
• The shallow depth of the Ninemile soil limits placement of fenceposts.
• The subsoil of the Ninemile soil expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.
• The depth to bedrock in the Ninemile soil limits construction of water impoundments.
• Pedestaled plants and an erosion pavement on the Ninemile soil are the result of past erosion.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Ninemile soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

178C—Ninemile very cobbly loam, 2 to 15 percent slopes

Composition

Ninemile soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Ninemile Soil

Position on landscape: Tablelands
Parent material: Kind—residuum, colluvium; source—basalt, tuff
Elevation: 5,300 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 7 inches—dark brown very cobbly loam
7 to 15 inches—dark brown clay
15 to 19 inches—dark brown gravelly clay
19 inches—tuff that has coatings of silica and calcium carbonate in fractures

Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 7 and 19 inches

Contrasting Inclusions

• Derapter and Riddleranch soils that are on south-

facing mountainsides and have Wyoming big sagebrush in the potential plant community
• Newlands and Westbutte soils that are on north-facing mountainsides and have mountain big sagebrush in the potential plant community
• Carryback and Hart soils that are on tablelands
• Ninemile soils that have a very stony loam surface layer

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, depth to the claypan, shrink-swell potential, available water capacity, permeability, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The surface layer is saturated following snowmelt.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The claypan and bedrock restrict rooting depth.
• The depth to bedrock limits construction of water impoundments.
• Crusting of the soil surface reduces infiltration and restricts seedling emergence and survival.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The shallow depth limits placement of fenceposts and makes special design of fences necessary.
• The low available water capacity limits forage production and seedling survival.
• The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

179C—Ninemile very cobbly loam, low precipitation, 2 to 15 percent slopes

Composition

Ninemile soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Ninemile Soil

Position on landscape: Tablelands
Parent material: Kind—residuum, colluvium; source—tuff, basalt
Elevation: 4,500 to 5,500 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—dark brown very cobbly loam
7 to 15 inches—dark brown clay
15 to 19 inches—dark brown gravelly clay
19 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 7 and 19 inches

Contrasting Inclusions

• Oreneva soils that are on adjacent tablelands and have Wyoming big sagebrush in the potential plant community
• Rock outcrop
• Soils that are similar to the Ninemile soils but have bedrock at a depth of 20 to 40 inches or less than 10 inches
• Soils that have slopes of more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Available water capacity, depth to the claypan, permeability, depth to bedrock, water erosion, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, low sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The claypan and bedrock restrict rooting depth.
- The surface layer is saturated following snowmelt.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- The low available water capacity limits forage production and seedling survival.
- Crusting of the soil surface reduces infiltration and restricts seedling emergence and survival.
- The depth to bedrock limits construction of water impoundments.
- The shallow depth limits placement of fenceposts and makes special design of fences necessary.
- The soil expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

180C—Ninemile extremely gravelly loam, thin surface, 2 to 15 percent slopes

Composition

Ninemile soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Ninemile Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—dark brown extremely gravelly loam
2 to 8 inches—dark brown clay
8 to 17 inches—dark brown gravelly clay
17 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (1 to 3 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 2 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 2 and 17 inches

Contrasting Inclusions

- Hart soils that are on fan piedmonts and have bluebunch wheatgrass and Idaho fescue in the potential plant community
- Newlands soils that are on mountain toe slopes and have mountain big sagebrush in the potential plant community
- Soils that are similar to the Ninemile soil but have bedrock at a depth of less than 10 inches
- Ninemile soils that have more than 35 percent of the surface covered with stones or cobbles

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, thin surface layer, depth to bedrock, permeability, available water capacity, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Sandberg bluegrass, low sagebrush

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The surface layer is saturated following snowmelt.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- The depth to bedrock limits construction of water impoundments.

- The claypan and bedrock restrict rooting depth.
- Crusting of the surface layer reduces infiltration and restricts seedling emergence and survival.
- The low available water capacity limits forage production and seedling survival.
- The shallow depth limits placement of fenceposts and makes special design of fences necessary.
- The soil expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

180E—Ninemile extremely gravelly loam, thin surface, 15 to 30 percent slopes

Composition

Ninemile soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Ninemile Soil

Position on landscape: Tablelands
Parent material: Kind—residuum, colluvium; source—basalt, tuff
Elevation: 5,300 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—dark brown extremely gravelly loam
2 to 8 inches—dark brown clay
8 to 17 inches—dark brown gravelly clay
17 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (1 to 3 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 2 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 2 and 17 inches

Contrasting Inclusions

- Hart soils that are on fan piedmonts and have bluebunch wheatgrass and Idaho fescue in the potential plant community
- Newlands soils that are on mountain toe slopes and have mountain big sagebrush in the potential plant community
- Soils that are similar to the Ninemile soils but have bedrock at a depth of less than 10 inches
- Ninemile soils that have more than 35 percent of the surface covered with stones or cobbles

Major Use

Livestock grazing

Major Management Factors

Depth to the claypan, thin surface layer, water erosion, slope, depth to bedrock, permeability, available water capacity, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Sandberg bluegrass, low sagebrush

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The surface layer is saturated following snowmelt.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- The claypan and bedrock restrict rooting depth.
- Crusting of the surface layer reduces infiltration and restricts seedling emergence and survival.
- The low available water capacity limits forage production and seedling survival.
- The shallow depth limits placement of fenceposts and makes special design of fences necessary.
- The soil expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

181C—Ninemile-Westbutte complex, 2 to 15 percent slopes

Composition

Ninemile soil and similar inclusions—60 percent
Westbutte soil and similar inclusions—30 percent
Contrasting inclusions—10 percent

Characteristics of the Ninemile Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,800 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—dark brown very cobbly loam
7 to 15 inches—dark brown clay
15 to 19 inches—dark brown gravelly clay
19 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 7 and 19 inches

Characteristics of the Westbutte Soil

Position on landscape: Mountains, hills
Parent material: Kind—colluvium, loess; source—tuff, basalt
Elevation: 5,300 to 6,800 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark grayish brown extremely stony loam
7 to 16 inches—very dark grayish brown very stony loam
16 to 24 inches—dark brown very stony loam
24 to 33 inches—dark brown very cobbly loam
33 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

- Carryback soils that are on tablelands
- Lambring soils that are on north-facing hillsides and mountainsides
- Felcher and Riddleranch soils that are on south-facing mountainsides and have Wyoming big sagebrush in the potential plant community

Major Use

Livestock grazing

Major Management Factors

Ninemile soil—depth to bedrock, depth to the claypan, available water capacity, shrink-swell potential, permeability, water erosion
Westbutte soil—stones on the surface, water erosion, available water capacity, water erosion, depth to bedrock

Dominant Vegetation in Potential Plant Community

Ninemile soil—Idaho fescue, low sagebrush, bluegrass, wheatgrass
Westbutte soil—Idaho fescue, Thurber needlegrass, mountain big sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The low available water capacity limits forage production and seedling survival.
- Pedestaled plants and an erosion pavement on the Ninemile soil are the result of past erosion.
- The surface layer of the Ninemile soil is saturated following snowmelt.
- The claypan and bedrock in the Ninemile soil restrict rooting depth.
- The bedrock and rock fragments in the Westbutte soil restrict rooting depth.
- The depth to bedrock limits construction of water impoundments.
- Livestock herd and graze in the less stony areas of the unit.
- The extremely stony surface layer of the Westbutte soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The shallow depth of the Ninemile soil limits placement of fenceposts.
- The subsoil of the Ninemile soil expands when wet

and contracts when dry, which can rip and tear plant roots and damage structures.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Ninemile soil is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Ninemile soil is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.
• If the Westbutte soil is seeded, select plants that tolerate droughtiness and a cool growing season.

182A—Norad silt loam, 0 to 2 percent slopes

Composition

Norad soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Norad Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,000 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 2 inches—dark gray silt loam
2 to 4 inches—dark grayish brown silty clay loam
4 to 6 inches—very dark grayish brown and dark grayish brown silty clay loam
6 to 10 inches—dark brown silty clay
10 to 24 inches—dark brown and brown silty clay loam
24 to 33 inches—dark grayish brown silty clay loam
33 to 60 inches—dark grayish brown clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: About 11 inches
Hazard of erosion: By water—slight; by wind—moderate
Depth to seasonal high water table: February through March—48 to 60 inches; rest of year—more than 60 inches

Contrasting Inclusions

• Westside soils that are on adjacent, slightly higher lying tablelands and lake terraces and have dominantly needleandthread and Wyoming big sagebrush in the potential plant community
• McConnel soils that are on adjacent lake terraces and have dominantly Thurber needlegrass and Wyoming big sagebrush
• Soils that are similar to the Norad soils but have a hardpan or bedrock at a depth of 40 to 60 inches

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Permeability, wind erosion

Dominant Vegetation in Potential Plant Community

Winterfat, Indian ricegrass, fourwing saltbush

Livestock Grazing

General management considerations:
• This unit provides habitat for antelope in winter.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The low precipitation limits forage production and seedling survival.
• Crusting of the soil surface reduces infiltration.
• The very shallow depth to the clayey layer restricts permeability and results in very brief periods of ponding or saturation of the surface layer during snowmelt.
• Wind erosion is a concern if the vegetation is removed or degraded.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This soil is suited to grazing in winter.
• Range seeding is needed if the plant cover is not sufficient to protect the soil from wind erosion.

Suitable management practices:
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
• If this unit is seeded, select plants that tolerate a cool growing season.

183B—Nuss gravelly loam, 0 to 5 percent slopes, eroded

Composition

Nuss soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Nuss Soil

Position on landscape: Rock benches, wave-cut terraces on hills
Parent material: Kind—residuum; source—tuff, basalt, volcanic ash
Elevation: 4,900 to 5,100 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown gravelly loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

- Booth soils that are on hills
- Winterim soils that are in north-facing ravines and have ponderosa pine in the potential plant community
- Soils that are similar to the Nuss soils but have bedrock at a depth of 4 to 10 inches
- Soils that have slopes of more than 5 percent
- Soils that have as much as 35 percent of the surface covered with stones

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, available water capacity, water erosion, thin surface layer

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Pedestaled plants and an erosion pavement are the result of past erosion.
- The bedrock restricts rooting depth.
- The low available water capacity limits forage production and seedling survival.
- The depth to bedrock limits construction of water impoundments.
- The shallow depth limits the placement of fenceposts and makes special design of fences necessary.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

184C—Observation-Booth complex, 0 to 15 percent slopes

Composition

Observation soil and similar inclusions—50 percent
Booth soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Observation Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,500 to 7,600 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark grayish brown cobbly loam
7 to 14 inches—very dark grayish brown clay loam
14 to 25 inches—dark yellowish brown clay loam
25 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Slight or moderate

Characteristics of the Booth Soil

Position on landscape: Foot slopes and benches on hills
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,500 to 7,600 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown silty clay
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown, partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 4 and 24 inches

Contrasting Inclusions

- Nuss soils that are in convex areas and have curlleaf mountainmahogany and scattered ponderosa pine and western juniper in the potential plant community
- Swalesilver soils that are in depressional areas and have silver sagebrush in the potential plant community
- Merlin soils that are on benches on tablelands
- Soils that have more than 15 percent of the surface covered with stones
- Soils that have slopes of more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Observation soil—depth to bedrock, permeability, available water capacity, water erosion
Booth soil—depth to the claypan, depth to bedrock, shrink-swell potential, available water capacity, permeability, water erosion

Dominant Vegetation in Potential Plant Community

Observation soil—Idaho fescue, antelope bitterbrush, bluebunch wheatgrass
Booth soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The bedrock in the Observation soil and the claypan in the Booth soil restrict rooting depth.
- The depth to bedrock limits construction of water impoundments.
- The Booth soil expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.
- The surface layer of the Booth soil is saturated following snowmelt.
- Pedestaled plants and an erosion pavement on the Booth soil are the result of past erosion.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Booth soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If the Observation soil is seeded, select plants that tolerate droughtiness and a cool growing season.
- If the Booth soil is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

185C—Old Camp very cobbly loam, 2 to 15 percent slopes

Composition

Old Camp soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Old Camp Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 4,500 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—dark brown very cobbly loam
5 to 9 inches—dark brown very cobbly clay loam
9 to 15 inches—dark yellowish brown extremely cobbly clay loam

15 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (10 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate

Contrasting Inclusions

- McConnel soils that are on adjacent lake terraces and have dominantly needleandthread and some basin big sagebrush in the potential plant community
- Hager soils that are on adjacent tablelands
- Soils that are similar to the Old Camp soil but have bedrock at a depth of 20 to 40 inches

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, available water capacity, water erosion, rock fragments

Dominant Vegetation in Potential Plant Community

Thurber needlegrass, Wyoming big sagebrush, Indian ricegrass, bottlebrush squirreltail, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The depth to bedrock restricts rooting depth and construction of water impoundments.
- The shallow depth to bedrock and content of rock fragments limit placement of fenceposts and make special design of fences necessary.
- This soil is suited to grazing in winter.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
- If this unit is seeded, select plants that tolerate droughtiness.

186F—Old Camp very cobbly loam, 30 to 50 percent south slopes

Composition

Old Camp soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Old Camp Soil

Position on landscape: Hillsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—dark brown very cobbly loam
5 to 9 inches—dark brown very cobbly clay loam
9 to 15 inches—dark yellowish brown extremely cobbly clay loam
15 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (10 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Rock outcrop
- Diaz soils that are on adjacent tablelands and have dominantly needleandthread and some basin big sagebrush in the potential plant community
- Soils that have slopes of less than 30 percent or more than 50 percent

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, available water capacity, depth to bedrock

Dominant Vegetation in Potential Plant Community

Indian ricegrass, Wyoming big sagebrush, Thurber needlegrass

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- The depth to bedrock restricts rooting depth.
- The shallow depth to bedrock and content of rock fragments limit placement of fenceposts and make special design of fences necessary.
- Slope restricts the operation of ground seeding

equipment. Other methods such as broadcast seeding should be used.

• The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.

Suitable management practices:

• Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.

• If this unit is seeded, select plants that tolerate droughtiness.

187C—Oreneva very gravelly loam, 2 to 15 percent slopes

Composition

Oreneva soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Oreneva Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 5,700 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—dark brown very gravelly loam
4 to 21 inches—dark brown very gravelly clay loam and very gravelly loam
21 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

• Anawalt soils that are on tablelands and have low sagebrush in the potential plant community

• Soils that are similar to the Oreneva soil but have bedrock or a hardpan at a depth of 10 to 20 inches or 40 to 60 inches

• Soils that have slopes of more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, water erosion, permeability, available water capacity

Dominant Vegetation in Potential Plant Community

Thurber needlegrass, Sandberg bluegrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:

• The depth to bedrock restricts rooting depth.

• Cold soil temperatures and a short growing season limit the period of plant growth.

• The depth to bedrock limits the construction of water impoundments.

• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:

• Delay grazing until late in spring when forage plants have achieved sufficient growth.

• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.

• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

187E—Oreneva very gravelly loam, 15 to 30 percent slopes

Composition

Oreneva soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Oreneva Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 5,700 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—dark brown very gravelly loam

4 to 21 inches—dark brown very gravelly clay loam and very gravelly loam
21 inches—tuff that has coatings of silica and calcium carbonate in fractures

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Anawalt soils that are on tablelands and have low sagebrush in the potential plant community
• Soils that are similar to the Oreneva soil but have bedrock or a hardpan at a depth of 10 to 20 inches or 40 to 60 inches

Major Use

Livestock grazing

Major Management Factors

Water erosion, depth to bedrock, slope, available water capacity, permeability

Dominant Vegetation in Potential Plant Community

Thurber needlegrass, Sandberg bluegrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
• The depth to bedrock restricts rooting depth.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

188B—Orovada-Mesman complex, 0 to 5 percent slopes

Composition

Orovada soil and similar inclusions—50 percent
Mesman soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Orovada Soil

Position on landscape: Alluvial fans
Parent material: Kind—alluvium over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 7 inches—very dark grayish brown silt loam
7 to 31 inches—very dark grayish brown, very dark brown, and dark brown silt loam, loam, and sandy loam
31 to 34 inches—dark yellowish brown extremely gravelly sand
34 to 42 inches—brown and yellowish brown sandy loam that has brittle nodules
42 to 65 inches—strongly cemented hardpan
Depth class: Deep (40 to 60 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 8 inches
Hazard of erosion: By water—slight; by wind—moderate
Salinity: Between depths of 31 and 42 inches—moderately saline
Carbonates: Between depths of 34 and 65 inches—slightly effervescent to strongly effervescent

Characteristics of the Mesman Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches

Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days

Typical profile:
0 to 9 inches—dark brown fine sandy loam
9 to 20 inches—dark brown sandy clay loam
20 to 25 inches—brown silt loam
25 to 35 inches—brown very fine sandy loam
35 to 60 inches—brown silt loam

Depth class: Very deep (more than 60 inches) to bedrock; moderately deep (20 to 40 inches) to consolidated, compacted sediment
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion: By water—slight; by wind—moderate
Salinity: Upper 9 inches—slightly saline; below this depth—strongly saline
Sodicity: Upper 9 inches—moderately sodic; below this depth—slightly sodic or moderately sodic

Contrasting Inclusions

• Icene soils that are on lower lying lake terraces and have black greasewood and shadscale in the potential plant community
• Lofftus soils that are on lower lying lake terraces and have basin wildrye, black greasewood, and inland saltgrass in the potential plant community

Major Uses

Cropland, livestock grazing, wildlife habitat

Major Management Factors

Orovada soil—depth to the hardpan, water erosion, wind erosion, available water capacity
Mesman soil—available water capacity, salinity, sodicity, permeability, depth to dense, consolidated lacustrine sediment, wind erosion

Dominant Vegetation in Potential Plant Community

Orovada soil—basin wildrye, creeping wildrye
Mesman soil—basin big sagebrush, Indian ricegrass, black greasewood, basin wildrye, spiny hopsage

Livestock Grazing

General management considerations:
• The low precipitation limits forage production and seedling survival.
• The low available water capacity because of the salts and sodium limits forage production and seedling survival on the Mesman soil.
• Excess sodium in the Mesman soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface of the Mesman soil reduce infiltration and restrict seedling emergence and survival.
• The hardpan in the Orovada soil restricts rooting depth.
• The dense, consolidated lacustrine sediment in the Mesman soil restricts rooting depth.
• This unit is subject to wind erosion if the vegetation is removed or degraded.
• This unit is suited to grazing in winter.
• If the vegetation is removed, range seeding is needed to control wind erosion.

Suitable management practices:
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Orovada soil is seeded, select plants that tolerate droughtiness in summer.
• If the Mesman soil is seeded, select plants that tolerate moderate sodicity, slight salinity, and droughtiness in summer.
• Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soils are irrigated.
• Sprinkler irrigation is most efficient, but border irrigation can be used in the more nearly level areas.
• Land leveling is needed for uniform application of irrigation water applied by the border method.
• The salinity and sodicity of the Mesman soil limit the selection of crops that can be grown.
• The Mesman soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• If the Mesman soil is irrigated, the available water capacity can be improved by leaching salts below the root zone.
• Because of the slow permeability of the Mesman soil, the application of irrigation water should be managed to avoid overirrigating.
• Irrigation water management is needed to prevent the development of a perched water table above the hardpan and the dense, consolidated lacustrine sediment.
• Removing salts from the Mesman soil without

applying proper amounts of soil amendments causes dispersion and crusting of the soil surface.
• The dense, consolidated lacustrine sediment in the lower part of the Mesman soil can be softened by applying irrigation water or by ripping.
• Trees and shrubs for windbreaks and environmental plantings on the Orovada soil should be tolerant of droughtiness.
• Trees and shrubs suitable for windbreaks and environmental plantings on the Mesman soil are limited, and the seedling mortality rate is severe because of the concentration of salts.

Suitable management practices:
• Irrigate during the dry period in summer.
• Reduce the content of salts and sodium in the Mesman soil by applying proper amounts of soil amendments, leaching, and carefully applying irrigation water.
• Reduce the risk of wind erosion by planting crops in narrow strips at right angles to the prevailing wind, maintaining crop residue on the surface, and maintaining a plant cover.
• The rooting depth in the Orovada soil can be improved by ripping the hardpan.

189B—Oxwall gravelly loam, 0 to 5 percent slopes

Composition

Oxwall soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Oxwall Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—rhyolite, tuff, volcanic ash
Elevation: 4,700 to 5,200 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 2 inches—very dark gray gravelly loam
2 to 11 inches—dark brown gravelly clay loam
11 to 16 inches—dark brown and dark yellowish brown gravelly clay
16 to 24 inches—indurated hardpan
24 to 60 inches—variegated, stratified very gravelly loam and gravelly sandy loam
Depth class: Very shallow or shallow (5 to 12 inches) to the claypan; shallow (10 to 20 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 11 and 16 inches

Contrasting inclusions

• Salisbury soils that are on adjacent lake terraces and have mountain big sagebrush in the potential plant community
• Drews and Drewsgap soils that are on adjacent, slightly lower lying lake terraces and have mountain big sagebrush in the potential plant community
• Lasere soils that are on adjacent hillsides and foot slopes
• Soils that have slopes of more than 5 percent

Major Uses

Livestock grazing, cropland

Major Management Factors

Depth to the claypan, depth to the hardpan, available water capacity, shrink-swell potential, permeability, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The claypan and hardpan restrict rooting depth.
• The shallow depth to the hardpan limits placement of fenceposts and makes special design of fences necessary.
• Pedestaled plants and an erosion pavement are the result of past erosion.
• The low available water capacity limits forage production and seedling survival.
• The surface layer is saturated following snowmelt because of the slow permeability of the claypan.

Suitable management practices:
• Delay grazing until the surface layer is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.

• If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.
• Seed on the contour to reduce erosion.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated. A suitable cropping system includes small grain and summer fallow.
• Suitable irrigation methods include sprinkler and border systems.
• If border irrigation is used, leveling is needed for uniform application of water.
• To avoid exposing the claypan or the hardpan, land smoothing that involves only shallow cuts is best suited.
• The depth to the hardpan and claypan limits rooting depth.
• Irrigation water management is needed to prevent the buildup of a perched water table above the claypan.
• Because of the slow permeability of the claypan, irrigation water should be managed so that it does not pond on the surface and damage crops.
• When the soil is dry, subsoiling or deep plowing to rip the hardpan can increase the effective rooting depth and improve internal drainage.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
• The seedling mortality rate is severe because the high content of clay causes moisture stress.

Suitable management practices:
• Irrigate during the dry period in summer.
• Apply water at a slow rate over a long period to ensure that the root zone is properly wetted.
• Use minimum tillage and return crop residue to the soil to minimize compaction and improve soil tilth.
• Cultivate or apply herbicides to control competing vegetation.

190B—Oxwall-Salisbury complex, 0 to 5 percent slopes

Composition

Oxwall soil and similar inclusions—50 percent
Salisbury soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Oxwall Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—rhyolite, tuff, volcanic ash
Elevation: 4,700 to 5,200 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 2 inches—very dark gray gravelly loam
2 to 11 inches—dark brown gravelly clay loam
11 to 16 inches—dark brown and dark yellowish brown gravelly clay
16 to 24 inches—indurated hardpan
24 to 60 inches—variegated, stratified very gravelly loam and gravelly sandy loam
Depth class: Very shallow or shallow (5 to 12 inches) to the claypan; shallow (10 to 20 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 11 and 16 inches

Characteristics of the Salisbury Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt, rhyolite
Elevation: 4,700 to 5,200 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 11 inches—very dark brown and very dark grayish brown loam
11 to 16 inches—dark brown clay
16 to 20 inches—dark brown clay loam
20 to 28 inches—dark brown indurated hardpan
28 to 43 inches—dark grayish brown strongly cemented hardpan
43 to 60 inches—yellowish brown silt loam
Depth class: Shallow (10 to 20 inches) to the claypan, very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to the hardpan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 11 and 16 inches

Contrasting inclusions

• Lasere soils that are on adjacent hills or foot slopes

• Donica soils that are on alluvial fans on adjacent lake terraces
• Drews and Drewsgap soils that are on slightly lower lying lake terraces
• Soils that have slopes of more than 5 percent

Major Uses

Livestock grazing, cropland

Major Management Factors

Oxwall soil—depth to the hardpan, depth to the claypan, permeability, available water capacity, shrink-swell potential, water erosion
Salisbury soil—depth to the claypan, permeability, depth to the hardpan, water erosion, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Oxwall soil—Idaho fescue, low sagebrush, bluebunch wheatgrass
Salisbury soil—Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The claypan and hardpan in the Oxwall soil restrict rooting depth.
• The surface layer is saturated following snowmelt.
• Pedestaled plants and an erosion pavement on the Oxwall soil are the result of past erosion.
• The low available water capacity of the Oxwall soil limits forage production and seedling survival.
• The subsoil of the Oxwall and Salisbury soils expands when wet and contracts when dry, which makes special design of fences necessary.
• The shallow depth to the hardpan in the Oxwall soil limits the placement of fenceposts.

Suitable management practices:
• Delay grazing until the surface layer is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and shrinking and swelling.
• Seed on the contour to reduce erosion.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soils are irrigated. A suitable cropping system includes small grain and summer fallow.
• Suitable irrigation methods include sprinkler and border systems.
• If border irrigation is used, leveling is needed for uniform application of water.
• To avoid exposing the claypan or the hardpan, land smoothing that involves only shallow cuts is best suited.
• The depth to the claypan and hardpan limits rooting depth.
• When the soils are dry, subsoiling or deep plowing to rip the hardpan can increase the effective rooting depth and improve internal drainage.
• Use minimum tillage and return crop residue to the soil to minimize compaction and improve soil tilth.
• Because of the slow permeability of the claypan, irrigation water needs to be managed so that it does not pond on the surface and damage crops.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
• The seedling mortality rate is severe because the high content of clay causes moisture stress.

Suitable management practices:
• Irrigate during the dry period in summer.
• Apply water at a slow rate over a long period to ensure that the root zone is properly wetted.
• Manage irrigation water to prevent the buildup of a perched water table above the claypan.
• Cultivate or apply herbicides to control competing vegetation.

191A—Ozamis loam, 0 to 1 percent slopes

Composition

Ozamis soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Ozamis Soil

Position on landscape: Stream bottoms and areas adjacent to alluvial flats in lake basins
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 14 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 10 inches—black loam
10 to 34 inches—dark gray silt loam
34 to 36 inches—very pale brown coarse pumice sand
36 to 60 inches—dark gray very fine sandy loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: March through September—6 inches above the surface to 48 inches below the surface; rest of year—more than 48 inches
Frequency of flooding: Rare or occasional

Contrasting inclusions

- Reese soils that are on adjacent, higher lying alluvial flats in Warner and Chewaucan Valleys
- Crump soils that are on adjacent, lower lying alluvial flats in Warner and Chewaucan Valleys
- Lakeview soils that are on adjacent stream terraces in Goose Lake Valley
- Pit soils that are on adjacent alluvial flats

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Wetness, frost action

Dominant Vegetation in Potential Plant Community

Tufted hairgrass, Nebraska sedge, Baltic rush, northern mannagrass, reedgrass

Livestock Grazing

General management considerations:
- Because the water on the surface is from spring snowmelt, the amount and duration varies.
- This unit provides food and cover for wetland wildlife.
- Grazing should be deferred during the period of nesting for waterfowl.
- Grazing when the soil is wet results in compaction and puddling of the surface.
- The low precipitation limits forage production.
- A seasonal high water table increases the amount of moisture available for plant growth.
- A high water table and ponding early in the growing season restrict rooting depth.
- This unit is suited to grazing in winter.

Suitable management practices:
- Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
- If this unit is seeded, select plants that tolerate wetness and frost heaving and that provide cover for nesting waterfowl.

Hayland

General management considerations:
- Wetness limits the period of access and the choice of hay and pasture plants.
- Unless the soil is adequately drained, machinery compacts the surface layer and becomes embedded.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Haying operations are restricted to periods late in summer or early in fall because of seasonal wetness.
- Because of a high potential for frost action, plants are subject to winterkill and other damage.
- This soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.

192A—Ozamis silty clay loam, 0 to 1 percent slopes

Composition

Ozamis soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Ozamis Soil

Position on landscape: Alluvial flats in lake basins (see fig. 15, next page)
Parent material: Kind—lacustrine sediment; alluvium; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 14 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 10 inches—black silty clay loam
10 to 34 inches—dark gray silt loam
34 to 36 inches—very pale brown coarse pumice sand
36 to 60 inches—dark gray very fine sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow

Figure 15.—Area of Ozamis silty clay loam, 0 to 1 percent slopes, on alluvial flats in foreground. Well drained Drews loam on lake terraces in background.

Available water capacity: About 5 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: March through September—6 inches above the surface to 48 inches below the surface; rest of year—more than 48 inches
Frequency of flooding: Rare

Contrasting inclusions

- Reese soils that are on slightly higher lying alluvial flats in Warner and Chewaucan Valleys and support dominantly alkali sacaton, inland saltgrass, and alkali bluegrass
- Crump soils that are on slightly lower lying alluvial flats in Warner and Chewaucan Valleys and support dominantly sedges and cattails
- Lakeview soils that are on adjacent stream terraces in Goose Lake Valley
- Pit soils that are on adjacent alluvial flats and support dominantly spikerush, Baltic rush, dock, povertyweed, and mat muhly

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Wetness, frost action, silty surface layer

Dominant Vegetation in Potential Plant Community

Tufted hairgrass, Nebraska sedge, Baltic rush, northern mannagrass, reedgrass

Livestock Grazing

General management considerations:

- Because the water on the surface is from spring snowmelt, the amount and duration varies. During years when the winters are wet, ponding lasts until midsummer or late in summer. During years when the winters are dry, ponding lasts for only short periods in spring.
- This unit provides food and cover for wetland wildlife.
- Grazing should be deferred during the period of nesting for waterfowl.
- Grazing when the soil is wet results in compaction and puddling of the surface.
- The low precipitation limits forage production.
- A seasonal high water table increases the amount of moisture available for plant growth.
- A high water table and ponding early in the growing season restrict rooting depth.
- Because the surface layer is silty, the season of use begins later in summer because of increased water content.
- This unit is suited to grazing in winter.

Suitable management practices:

- Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
- If this unit is seeded, select plants that tolerate wetness and frost heaving and that provide cover for nesting waterfowl.

Hayland

General management considerations:

- Wetness limits the period of access for haying operations.
- Unless the soil is adequately drained, machinery compacts the soil surface layer and becomes embedded.
- Wetness limits the choice of hay and pasture plants and increases the risk of winterkill.
- Haying operations are restricted to periods late in summer or early in fall because of seasonal wetness.
- Because of a high potential for frost action, seedlings are subject to winterkill and other damage.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.

193A—Ozamis silty clay, saline, 0 to 1 percent slopes

Composition

Ozamis soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Ozamis Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—black silty clay
9 to 12 inches—black clay loam
12 to 19 inches—black silty clay
19 to 60 inches—dark grayish brown loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: March through June—12 to 48 inches; rest of year—more than 48 inches
Frequency of flooding: Rare
Salinity: Upper 9 inches—moderately saline; below this depth—slightly saline

Contrasting inclusions

- Crump soils that are on slightly lower lying alluvial flats
- Icene soils that are on slightly higher lying lake terraces
- Reese soils that are on adjacent alluvial flats

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Salinity, wetness, available water capacity, frost action, clayey surface layer

Dominant Vegetation in Potential Plant Community

Alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:
- This unit provides food and cover for wetland wildlife early in spring.
- The low precipitation and low available water capacity of the surface layer limit forage production and seedling survival.
- Grazing when the soil is wet results in compaction and puddling of the surface.
- The moderately saline surface layer limits range recovery and seedling survival.
- The surface layer expands when wet and contracts when dry, which can rip and tear plant roots.
- A high water table early in the growing season restricts rooting depth.
- A seasonal high water table increases the amount of moisture available for plant growth.
- This unit is suited to grazing in winter.

Suitable management practices:
- Allow the soil to adequately drain before grazing to prevent damage to the soil and plants.
- If this unit is seeded, select plants that tolerate wetness, moderate salinity, and frost heaving.

Hayland

General management considerations:
- Wetness limits the period of access for haying operations.
- Unless the soil is adequately drained, machinery compacts the surface layer and becomes embedded.
- Wetness limits the choice of hay and pasture plants and increases the risk of winterkill.
- The soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
- Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
- Haying operations are restricted to periods late in summer or early in fall because of seasonal wetness.

• Because of a high potential for frost action, plants are subject to winterkill and other damage.
• Trees and shrubs suitable for windbreaks and environmental plantings are limited, and the seedling mortality rate is severe because of the concentration of salts.

194A—Ozamis-Crump-Reese complex, 0 to 1 percent slopes

Composition

Ozamis soil and similar inclusions—35 percent
Crump soil and similar inclusions—30 percent
Reese soil and similar inclusions—25 percent
Contrasting inclusions—10 percent

Characteristics of the Ozamis Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—black silty clay
9 to 12 inches—black clay loam
12 to 19 inches—black silty clay
19 to 60 inches—dark grayish brown loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: March through June—12 to 48 inches; rest of year—more than 48 inches
Frequency of flooding: Rare
Salinity: Upper 9 inches—moderately saline; below this depth—slightly saline

Characteristics of the Crump Soil

Position on landscape: Concave areas on alluvial flats adjacent to open water areas in lake basins
Parent material: Kind—silty lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 8 inches—black muck
8 to 13 inches—black silt
13 to 60 inches—very dark grayish brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Very poorly drained
Permeability: Moderate
Available water capacity: About 14 inches
Hazard of erosion by water: None or slight
Depth to water table: 12 inches above the surface to 42 inches below the surface throughout the year
Frequency of flooding: Rare
Load supporting capacity when wet: Low

Characteristics of the Reese Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark brown loam
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: None or slight
Depth to seasonal high water table: November through August—12 inches above the surface to 24 inches below the surface; rest of year—more than 24 inches
Frequency of flooding: Rare
Salinity: Upper 10 inches—strongly saline; below this depth—moderately saline or slightly saline
Sodicity: Upper 33 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Ozamis soil—wetness, salinity, frost action, available water capacity, clayey surface layer
Crump soil—wetness, frost action, load supporting capacity
Reese soil—wetness, salinity, sodicity, permeability, frost action, available water capacity

Dominant Vegetation in Potential Plant Community

Ozamis soil—alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass
Crump soil—sedges, rushes, cattails
Reese soil—unstable plant community

Livestock Grazing

General management considerations:
• Because the water on the surface of the Crump and Reese soils is from spring snowmelt, the amount and duration varies. During years when the winters are wet, ponding lasts until midsummer or late in summer. During years when the winters are dry, ponding lasts for only short periods in spring.
• This unit provides food and cover for wetland wildlife.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction of the surface layer and poor tilth.
• A high water table during the growing season and spring ponding restrict rooting depth.
• The low precipitation and low available water capacity of the surface layer limit forage production and seedling survival.
• Excess sodium in the Reese soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
• The strong sodicity and salinity of the surface layer of the Reese soil severely limit range recovery and seedling survival.
• The moderately salinity of the surface layer of the Ozamis soil limits range recovery and seedling survival.
• The surface layer of the Ozamis soil expands when wet and contracts when dry, which can rip and tear plant roots.
• This unit is suited to grazing in winter.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If the Ozamis soil is seeded, select plants that tolerate wetness, moderate salinity, and frost heaving.
• If the Crump soil is seeded, select plants that tolerate frost heaving and periods of inundation and that provide cover for nesting waterfowl.
• If the Reese soil is seeded, select plants that tolerate periods of inundation, strong salinity, frost heaving, and strong sodicity and that provide cover for nesting waterfowl.

Hayland

General management considerations:
• Wetness limits the period of access for haying operations.
• The seasonal high water table provides supplemental moisture for plants.
• Wetness, salinity, and sodicity limit the choice of hay and pasture plants.
• Unless the soils are adequately drained, machinery compacts the surface layer and becomes embedded.
• The Ozamis and Reese soils tie up large amounts of phosphorus, which limits the amount that is available to plants.
• Because of the high content of organic matter in the surface layer of the Crump soil, removing the plant cover when the soil is dry increases the risk of wind erosion.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• Haying operations are restricted to periods late in summer or early in fall because of seasonal wetness.
• Because of the high potential for frost action, plants are subject to winterkill and other damage.
• To minimize the risk of wind erosion on the Crump soil, restrict disturbance of the surface and maintain plant cover.
• Trees and shrubs suitable for windbreaks and environmental plantings on the Ozamis soil are limited, and the seedling mortality rate is severe because of the concentration of salts.
• The Crump and Reese soils generally are not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.

195A—Ozamis-Reese complex, 0 to 1 percent slopes

Composition

Ozamis soil and similar inclusions—50 percent
Reese soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Ozamis Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—alluvium, lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 10 inches—black loam
10 to 34 inches—dark gray silt loam
34 to 36 inches—very pale brown coarse pumice sand
36 to 60 inches—dark gray very fine sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: March through September—6 inches above the surface to 48 inches below the surface; rest of year—more than 48 inches
Frequency of flooding: Rare

Characteristics of the Reese Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark brown very fine sandy loam
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: March through July—12 to 36 inches; rest of year—more than 36 inches
Frequency of flooding: Rare
Salinity: Upper 10 inches—strongly saline; below this depth—moderately saline or slightly saline
Sodicity: Upper 33 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting inclusions

- Crump soils that are on slightly lower lying alluvial flats
- Als soils that are on adjacent dunes
- Mesman soils that are on adjacent, higher lying lake terraces

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Ozamis soil—wetness, frost action
Reese soil—salinity, sodicity, wetness, permeability, available water capacity, frost action, wind erosion

Dominant Vegetation in Potential Plant Community

Ozamis soil—tufted hairgrass, northern mannagrass, Nebraska sedge, reedgrass, Baltic rush
Reese soil—alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:
- Because the water on the surface of the Ozamis soil is from spring snowmelt, the amount and duration varies. During years when the winters are wet, ponding lasts until midsummer or late in summer. During years when the winters are dry, ponding lasts for only short periods in spring.
- This unit provides food and cover for wetland wildlife.
- Grazing should be deferred during the period of nesting for waterfowl.
- Grazing when the soils are wet results in compaction and puddling of the surface.
- The low precipitation limits forage production.

• A seasonal high water table increases the amount of moisture available for plant growth.
• A high water table and ponding on the Ozamis soil early in the growing season restrict the rooting depth.
• The strongly sodic and saline surface layer and low available water capacity of the Reese soil limit range recovery and seedling survival.
• Excess sodium in the Reese soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface of the Reese soil reduce infiltration and restrict seedling emergence and survival.
• The Reese soil is subject to wind erosion if the vegetation is removed or degraded and the soil surface is exposed.
• This unit is suited to grazing in winter.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If the vegetation is removed from the Reese soil, range seeding is needed to control wind erosion.
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Ozamis soil is seeded, select plants that tolerate wetness and frost heaving and that provide cover for nesting waterfowl.
• If the Reese soil is seeded, select plants that tolerate strong sodicity, strong salinity, droughtiness in summer, wetness, and frost heaving.

Hayland

General management considerations:
• Wetness limits the period of access for haying operations.
• Wetness limits the choice of hay and pasture plants and increases the risk of winterkill.
• Unless the soils are adequately drained, machinery compacts the surface layer and becomes embedded.
• Because of a high potential for frost action, plants are subject to winterkill and other damage.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Haying operations are restricted to periods late in summer or early in fall because of seasonal wetness.
• The Ozamis soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings. Onsite investigation is needed to determine whether trees and shrubs can be grown if special treatment is used.
• Trees and shrubs suitable for windbreaks and environmental plantings on the Reese soil are limited, and the seedling mortality rate is severe because of the concentration of salts.

196C—Pait gravelly loam, 5 to 15 percent slopes

Composition

Pait soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Pait Soil

Position on landscape: Fans and foot slopes below escarpments
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 4,500 to 5,000 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 8 inches—very dark grayish brown gravelly loam
8 to 24 inches—dark brown extremely gravelly loam
24 to 41 inches—dark brown very gravelly sandy loam and very gravelly loamy sand
41 to 60 inches—dark brown very gravelly loamy sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate

Contrasting inclusions

• Icene soils that are on adjacent, lower lying lake terraces and have dominantly shadscale and black greasewood in the potential plant community
• Mesman soils that are on adjacent, lower lying lake terraces and have dominantly needleandthread and Indian ricegrass in the potential plant community
• Pait soils that have a stony loam or cobbly loam surface layer

Major Uses

Hay and pasture, livestock grazing

Major Management Factors

Available water capacity, rock fragments, water erosion

Dominant Vegetation in Potential Plant Community

Bottlebrush squirreltail, Thurber needlegrass, Indian ricegrass, bluebunch wheatgrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The high content of rock fragments restricts the placement of fenceposts.
- This unit is suited to grazing in winter.

Suitable management practices:
- If this unit is seeded, select plants that tolerate droughtiness.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.

Cropland

General management considerations:
- Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated.
- Because of the slope, sprinkler irrigation is best suited to this unit.
- Because of the low available water capacity, light and frequent applications of irrigation water are needed.
- The rock fragments in the surface layer cause rapid wear of tillage equipment.
- Irrigation water management is needed to ensure optimum production and to control deep percolation, runoff, and water erosion.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
- The seedling mortality rate is moderate because of the low available water capacity.

Suitable management practices:
- Irrigate during the dry period in summer.
- Reduce the risk of erosion by maintaining crop residue on the surface, stripcropping, farming across the slope, and keeping the surface of the soil rough.
- Cultivate or apply herbicides to control competing vegetation.

197E—Pait very cobbly loam, 5 to 30 percent slopes

Composition

Pait soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Pait Soil

Position on landscape: Fans and foot slopes below escarpments
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 4,500 to 5,000 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 8 inches—very dark grayish brown very cobbly loam
8 to 24 inches—dark brown extremely gravelly loam
24 to 41 inches—dark brown very gravelly sandy loam and very gravelly loamy sand
41 to 60 inches—dark brown very gravelly loamy sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate or severe

Contrasting inclusions

- Icene soils that are on adjacent, lower lying lake terraces and have dominantly shadscale and black greasewood in the potential plant community
- Mesman soils that are on adjacent lake terraces and have dominantly needleandthread and Indian ricegrass in the potential plant community
- Riddleranch soils that are on north-facing hillsides and have dominantly Idaho fescue in the potential plant community
- Old Camp soils that are on adjacent tablelands

Major Use

Livestock grazing

Major Management Factors

Available water capacity, cobbles on the surface, water erosion

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Wyoming big sagebrush, Thurber needlegrass, Indian ricegrass, bottlebrush squirreltail (fig. 16)

Figure 16.—Wyoming big sagebrush and bluebunch wheatgrass in an area of Pait very cobbly loam, 5 to 30 percent slopes. This soil extends from the old shoreline of the Pleistocene lake to the basin floor.

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The high content of rock fragments in the soil restricts the placement of fenceposts.
- This unit is suited to grazing in winter.

Suitable management practices:
- Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
- If this unit is seeded, select plants that tolerate droughtiness.

198C—Pait-Icene complex, 0 to 15 percent slopes

Composition

Pait soil and similar inclusions—50 percent
Icene soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Pait Soil

Position on landscape: Slump benches that have slopes of 1 to 15 percent
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 4,500 to 5,000 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 8 inches—very dark grayish brown very stony loam
8 to 24 inches—dark brown extremely gravelly loam
24 to 41 inches—dark brown very gravelly sandy loam and very gravelly loamy sand
41 to 60 inches—dark brown very gravelly loamy sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Slight or moderate

Characteristics of the Icene Soil

Position on landscape: Lake terraces that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—very dark grayish brown fine sandy loam
5 to 10 inches—dark brown silt loam
10 to 28 inches—dark brown loam
28 to 65 inches—dark brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock; moderately deep (20 to 40 inches) to dense, consolidated lacustrine sediment
Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: February through April—24 to 72 inches; rest of year—more than 72 inches

Salinity: Upper 10 inches—slightly saline or moderately saline; below this depth—strongly saline
Sodicity: Upper 10 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting inclusions

• Helphenstein soils that are near the Icene soil, are on adjacent, slightly lower lying lake terraces, and do not have shadscale in the potential plant community
• Icene and Pait soils that have boulders scattered on the surface

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Pait soil—available water capacity, stones on the surface, water erosion
Icene soil—salinity, sodicity, available water capacity, permeability, depth to dense, consolidated lacustrine sediment, wind erosion

Dominant Vegetation in Potential Plant Community

Pait soil—bluebunch wheatgrass, Wyoming big sagebrush, Thurber needlegrass, Indian ricegrass, bottlebrush squirreltail
Icene soil—shadscale, black greasewood, basin wildrye

Livestock Grazing

General management considerations:
• The low precipitation limits forage production and seedling survival.
• Livestock herd and graze in the less stony areas of the Pait soil.
• Excess sodium in the Icene soil results in nutrient imbalances and a caustic root environment.
• Salts in the Icene soil reduce the amount of water available to plants and restrict seedling survival.
• Dispersion and crusting of the surface of the Icene soil reduce infiltration and restrict seedling emergence and survival.
• The strongly sodic surface layer of the Icene soil severely limits seedling survival.
• The dense, consolidated lacustrine sediment in the Icene soil restricts rooting depth.
• The Icene soil is subject to wind erosion if the vegetation is removed or degraded and the soil surface is exposed.
• Because of the high corrosivity of the Icene soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• The very stony surface layer of the Pait soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• This unit is suited to grazing in winter.

Suitable management practices:
• Delay grazing until the Icene soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of wind and water erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
• If the Pait soil is seeded, select plants that tolerate droughtiness.
• If the Icene soil is seeded, select plants that tolerate droughtiness, slight or moderate salinity, and strong sodicity.

199E—Pearlwise loam, 2 to 30 percent slopes

Composition

Pearlwise soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Pearlwise Soil

Position on landscape: Tablelands and mountains
Parent material: Kind—colluvium, residuum; source—basalt, loess
Elevation: 6,000 to 6,300 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—dark brown loam
4 to 25 inches—very dark grayish brown loam
25 to 35 inches—dark yellowish brown cobbly loam
35 inches—basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 5 inches
Hazard of erosion: By water—moderate or severe; by wind—moderate

Contrasting inclusions

• Rock outcrop
• Anawalt soils that are on tablelands and have low sagebrush in the potential plant community

• Soils that are similar to the Pearlwise soil but are very gravelly or very cobbly throughout
• Soils that are similar to the Pearlwise soil but have bedrock at a depth of 10 to 20 inches
• Soils that have slopes of more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Depth to bedrock, available water capacity, wind erosion, slope

Dominant Vegetation in Potential Plant Community

Idaho fescue, Thurber needlegrass, mountain big sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The bedrock restricts rooting depth.
• The depth to bedrock limits construction of water impoundments.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.
• Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

200E—Pernog-Itca association, 5 to 30 percent slopes

Composition

Pernog soil and similar inclusions—55 percent
Itca soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Pernog Soil

Position on landscape: Mountainsides that have slopes of 15 to 30 percent
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 4,600 to 5,800 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—dark brown very gravelly sandy loam
3 to 12 inches—dark brown very gravelly clay loam
12 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Characteristics of the Itca Soil

Position on landscape: Mountainsides that have slopes of 5 to 15 percent
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 4,600 to 5,800 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 5 inches—dark brown very cobbly loam
5 to 12 inches—dark brown very cobbly clay loam
12 to 16 inches—brown extremely cobbly clay
16 inches—basalt
Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Severe

Contrasting inclusions

• Rock outcrop
• Bullump soils that are on north-facing mountainsides
• Nuss soils that are on hillsides and have dominantly curlleaf mountainmahogany in the potential plant community
• Soils that have slopes of less than 5 percent or more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Pernog soil—depth to bedrock, available water capacity, water erosion
Itca soil—depth to bedrock, stones and cobbles throughout, water erosion, available water capacity, depth to the claypan, permeability, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Pernog soil—Idaho fescue, antelope bitterbrush, bluebunch wheatgrass
Itca soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The surface layer of the Itca soil is saturated following snowmelt.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The bedrock and rock fragments restrict rooting depth.
- The low available water capacity limits forage production and seedling survival.
- Pedestaled plants and an erosion pavement on the Itca soil are the result of past erosion.
- The shallow depth and rock fragments limit the placement of fenceposts and make special design of fences necessary.
- Cobbles on the surface of the Itca soil can restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be considered.
- Development of water impoundments is restricted by the shallow depth to bedrock.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Itca soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

201A—Pit silty clay, 0 to 1 percent slopes

Composition

Pit soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Pit Soil

Position on landscape: Alluvial flats and flood plains in lake basins
Parent material: Kind—alluvium over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 16 inches
Mean annual air temperature—45 to 58 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 5 inches—black silty clay
5 to 24 inches—black clay
24 to 40 inches—very dark grayish brown clay
40 to 60 inches—very dark grayish brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: None or slight
Depth to water table: December through May—6 inches above the surface to 36 inches below the surface; rest of year—more than 36 inches
Frequency of flooding: Rare
Shrink-swell potential: Upper 40 inches—high

Contrasting inclusions

- Ozamis soils that are on adjacent lake terraces
- Crump soils that are on adjacent, slightly lower lying lake terraces in Warner Valley and support dominantly sedges, rushes, and cattails
- Reese soils that are on adjacent, slightly higher lying lake terraces in Warner Valley and have dominantly alkali sacaton, inland saltgrass, alkali cordgrass, and alkali bluegrass in the potential plant community

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Wetness, shrink-swell potential, permeability, frost action, clayey surface layer

Dominant Vegetation in Potential Plant Community

Creeping wildrye, Nevada bluegrass, silver sagebrush, mat muhly, sedge

Livestock Grazing

General management considerations:
- Because the water on the surface is from spring snowmelt, the amount and duration varies. During years when the winters are wet, ponding lasts until midsummer or late in summer. During years when the winters are dry, ponding lasts for only short periods in spring.
- This unit provides food and cover for wetland wildlife.
- Grazing should be deferred during the period of nesting for waterfowl.

• Grazing when the soil is wet results in compaction and puddling of the surface layer.
• The soil expands when wet and contracts when dry, which can rip and tear plant roots and make special design of fences necessary.
• A seasonal high water table during the growing season and ponding in spring restrict rooting depth.
• This soil is very sticky when wet.
• This soil is suited to grazing in winter.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If this unit is seeded, select plants that tolerate shrinking and swelling, seasonal wetness, and frost heaving and that provide cover for nesting waterfowl.

Hayland

General management considerations:
• Wetness limits the period of access for haying operations.
• Unless the soil is adequately drained, machinery compacts the surface layer, causes puddling, and becomes embedded.
• The seasonal high water table provides supplemental moisture for plants.
• Wetness limits the choice of hay and pasture plants and increases the risk of winterkill.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Haying operations are restricted to periods late in summer or early in fall because of seasonal wetness.
• Because of the high potential for frost action, plants are subject to winterkill and other damage.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of wetness.

202A—Pit silty clay loam, drained, 0 to 1 percent slopes

Composition

Pit soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Pit Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—alluvium over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—black silty clay loam
5 to 10 inches—black silty clay
10 to 25 inches—black clay
25 to 40 inches—very dark grayish brown clay
40 to 60 inches—very dark grayish brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock, very shallow (3 to 8 inches) to the clay layer
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: None or slight
Depth to water table (artificially lowered): December through May—6 to 48 inches; rest of year—more than 48 inches
Frequency of flooding: Rare
Shrink-swell potential: High between depths of 5 and 40 inches

Contrasting inclusions

• Ozamis soils that are on adjacent lake terraces and support dominantly tufted hairgrass and Nebraska sedge
• Reese soils that are on adjacent, slightly higher lying lake terraces and support dominantly creeping wildrye

Major Uses

Hayland, cropland, livestock grazing, wildlife habitat

Major Management Factors

Shrink-swell potential, permeability, slope, frost action

Dominant Vegetation in Potential Plant Community

Spikerush, dock, Baltic rush, povertyweed, mat muhly, bottlebrush squirreltail

Livestock Grazing

General management considerations
• This unit provides food and cover for wetland wildlife early in spring.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• Because this soil is nearly level, maintaining adequate drainage is difficult.
• The soil expands when wet and contracts when dry, which makes special design of fences necessary.
• This unit is suited to grazing in winter.

Suitable management practices:
• Delay grazing until the soil is adequately drained and

is firm enough to withstand trampling by livestock.
- Maintain drainage ditches to remove surface water.
- If this unit is seeded, select plants that tolerate shrinking and swelling and frost heaving.

Cropland and Hayland

General management considerations:
- Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated. A suitable cropping system includes small grain and summer fallow.
- Suitable irrigation methods include sprinkler and border systems.
- Because of the slow permeability, irrigation water should be managed to prevent ponding.
- A high water table early in the growing season restricts the rooting depth of non-water-tolerant plants.
- The seasonal high water table provides supplemental moisture for hay and pasture plants.
- The soil expands when wet and contracts when dry, which can rip and tear plant roots.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Because of the high potential for frost action, plants are subject to winterkill and other damage.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of wetness.
- Spring planting may be delayed because of wetness.

Suitable management practices:
- Maintain drainage systems to allow the soil to drain more effectively.
- Maintain surface and subsurface drains to prevent ponding of soil surface, to keep the water table at desired depths, and to allow for earlier access for haying operations.
- Irrigate during the dry period in summer.
- Manage irrigation water to prevent ponding and a rise in the level of the water table.
- Cultivate or apply herbicides to control competing vegetation.

203A—Pit silty clay, drained, 0 to 1 percent slopes

Composition

Pit soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Pit Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—alluvium over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—black silty clay
5 to 25 inches—black clay
25 to 40 inches—very dark grayish brown clay
40 to 60 inches—very dark grayish brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: None or slight
Depth to water table (artificially lowered): December through May—6 to 48 inches; rest of year—more than 48 inches
Frequency of flooding: Rare
Shrink-swell potential: Upper 40 inches—high

Contrasting inclusions

- Ozamis soils that are on adjacent lake terraces and support dominantly tufted hairgrass and Nebraska sedge
- Pit soils that have a silty clay loam surface layer
- Reese soils that are on adjacent, slightly higher lying lake terraces and support dominantly creeping wildrye

Major Uses

Cropland, hayland, livestock grazing, wildlife habitat

Major Management Factors

Shrink-swell potential, permeability, clayey surface layer, frost action, slope

Dominant Vegetation in Potential Plant Community

Spikerush, dock, Baltic rush, povertyweed, mat muhly, bottlebrush squirreltail

Livestock Grazing

General management considerations:
- This unit provides food and cover for wetland wildlife early in spring.

• Grazing when the soil is wet results in compaction and puddling of the surface.
• The low precipitation limits forage production and seedling survival.
• Because this soil is nearly level, maintaining adequate drainage is difficult.
• The soil expands when wet and contracts when dry, which makes special design of fences necessary.
• This unit is suited to grazing in winter.

Suitable management practices:
• Delay grazing until the soil is adequately drained and is firm enough to withstand trampling by livestock.
• Maintain drainage ditches to remove surface water.
• If this unit is seeded, select plants that tolerate shrinking and swelling and frost heaving.

Cropland and Hayland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated. A suitable cropping system includes small grain and summer fallow.
• Suitable irrigation methods include sprinkler and border systems.
• Because of the slow permeability, irrigation water should be managed to prevent ponding.
• A high water table early in the growing season restricts the rooting depth of non-water-tolerant hay and pasture plants.
• The seasonal high water table provides supplemental moisture for hay and pasture plants.
• The soil is very sticky when wet and very hard when dry.
• The soil expands when wet and contracts when dry, which can rip and tear plant roots.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Because of the high potential for frost action, plants are subject to winterkill and other damage.
• Because the clayey surface layer is very sticky, machinery becomes embedded unless the soil is adequately drained.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of wetness.
• Spring planting may be delayed because of wetness.

Suitable management practices:
• Maintain the drainage systems to allow the soil to drain more effectively.
• Maintain surface and subsurface drains to prevent ponding of the surface, to keep the water table at desired depths, and to allow for earlier access for haying operations.
• Irrigate during the dry period in summer.
• Manage irrigation water to prevent ponding and a rise in the level of the water table.
• Cultivate or apply herbicides to control competing vegetation.

204A—Pit-Ozamis complex, drained, 0 to 1 percent slopes

Composition

Pit soil and similar inclusions—45 percent
Ozamis soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Pit Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—alluvium over lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—black silty clay
5 to 25 inches—black clay
25 to 40 inches—very dark grayish brown clay
40 to 60 inches—very dark grayish brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 8 inches
Hazard of erosion by water: None or slight
Depth to water table: December through May—6 to 48 inches; rest of year—more than 48 inches
Frequency of flooding: Rare
Shrink-swell potential: Upper 40 inches—high

Characteristics of the Ozamis Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—alluvium over lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:

0 to 10 inches—black silty clay loam
10 to 34 inches—dark gray silt loam
34 to 36 inches—very pale brown coarse pumice sand
36 to 60 inches—dark gray very fine sandy loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: None or slight
Depth to water table: March through June—18 to 48 inches; rest of year—more than 48 inches
Frequency of flooding: Rare

Contrasting inclusions

- Crump soils that are on adjacent, slightly lower lying alluvial flats and support dominantly sedges and cattails
- Reese soils that are on adjacent, slightly higher lying alluvial flats and support dominantly alkali sacaton, inland saltgrass, and alkali bluegrass
- Pit soils that have a silty clay loam surface layer

Major Uses

Cropland, hayland, livestock grazing, wildlife habitat

Major Management Factors

Pit soil—shrink-swell potential, clayey surface layer, slope, frost action, permeability
Ozamis soil—slope, frost action

Dominant Vegetation in Potential Plant Community

Pit soil—spikerush, dock, Baltic rush, povertyweed, mat muhly, bottlebrush squirreltail
Ozamis soil—tufted hairgrass, Nebraska sedge, Baltic rush, northern mannagrass, reedgrass

Livestock Grazing

General management considerations:
- This unit provides food and cover for wetland wildlife early in spring.
- Grazing when the soil is wet results in compaction and puddling of the surface.
- The low precipitation limits forage production and seedling survival.
- Because the soils in this unit are nearly level, maintaining adequate drainage is difficult.
- The Pit soil expands when wet and contracts when dry, which makes special design of fences necessary.
- This unit is suited to grazing in winter.

Suitable management practices:
- Delay grazing until the soils are adequately drained and are firm enough to withstand trampling by livestock.
- Maintain drainage ditches to remove surface water.
- If the Pit soil is seeded, select plants that tolerate shrinking and swelling and frost heaving.
- If the Ozamis soil is seeded, select plants that tolerate frost heaving.

Cropland and Hayland

General management considerations:
- Because of the limited precipitation, continuous cropping is suitable only if the soils are irrigated. A suitable cropping system includes small grain and summer fallow.
- Suitable irrigation methods include sprinkler and border systems.
- Because of the slow permeability of the Pit soil, irrigation water needs to be managed to prevent ponding of soil surface.
- The Pit soil expands when wet and contracts when dry, which can rip and tear plant roots.
- The surface of the Pit soil is very sticky when wet and very hard when dry.
- A high water table early in the growing season restricts the rooting depth of non-water-tolerant plants.
- The seasonal high water table provides supplemental moisture for hay and pasture plants.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Because of the high potential for frost action, plants are subject to winterkill and other damage.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of wetness.
- Spring planting may be delayed because of wetness.

Suitable management practices:
- Maintain drainage systems to allow the soils to drain more effectively.
- Maintain surface and subsurface drains to prevent ponding of the soil surface, to keep the water table at desired depths, and to allow for earlier access for haying operations.
- Irrigate during the dry period in summer.
- Manage irrigation water to prevent ponding and a rise in the level of the water table.
- Cultivate or apply herbicides to control competing vegetation.

205A—Playas

Composition

Playas—90 percent
Contrasting inclusions—10 percent

Characteristics of the Playas

Position on landscape: Basin floors that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 12 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Reference profile:
0 to 6 inches—silty clay loam
6 to 60 inches—stratified silty clay and silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Very slow
Hazard of erosion by wind: None to severe, depending on the time of year
Depth to seasonal high water table: February through September—12 inches above the surface to 12 inches below the surface; rest of year—more than 12 inches
Shrink-swell potential: High
Salinity: Moderately saline or strongly saline
Sodicity: Strongly sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting inclusions

• Helphenstein soils that are on adjacent, slightly higher lying lake terraces and have black greasewood, inland saltgrass, and basin wildrye in the potential plant community
• Reese soils that are on slightly higher lying lake terraces and have alkali sacaton, alkali bluegrass, inland saltgrass, and alkali cordgrass in the potential plant community
• Als soils that are on adjacent sand dunes and have Indian ricegrass, basin big sagebrush, black greasewood, fourwing saltbush, needleandthread, basin wildrye, spiny hopsage, and creeping wildrye in the potential plant community
• Mesman soils that are on adjacent, higher lying lake terraces and have basin big sagebrush, black greasewood, Indian ricegrass, and spiny hopsage in the potential plant community

Major Use

Wildlife habitat

Major Management Factors

Available water capacity, salinity, sodicity, seasonal wetness, permeability, wind erosion, shrink-swell potential

Dominant Vegetation in Potential Plant Community

None or annuals

Livestock Grazing

General management considerations:
• The unit provides habitat for wetland waterfowl in spring and early in summer.
• Variable yearly ponding results in an unstable plant community.
• Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface reduce infiltration.
• Because of the lack of vegetation, this unit is subject to wind erosion late in summer and early in fall.

205B—Playas, dissected

Composition

Playas—85 percent
Contrasting inclusions—15 percent

Characteristics of the Playas

Position on landscape: Lake terraces that have slopes of 2 to 5 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Reference profile:
0 to 6 inches—silty clay loam
6 to 60 inches—stratified silty clay and silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained

Permeability: Very slow
Hazard of erosion: By water—moderate; by wind—moderate or severe
Depth to seasonal high water table: February through April—24 to 48 inches; rest of year—more than 48 inches
Shrink-swell potential: High
Salinity: Moderately saline or strongly saline
Sodicity: Strongly sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting features:

• Reese soils that are on adjacent lake terraces and have alkali sacaton, alkali bluegrass, inland saltgrass, and alkali cordgrass in the potential plant community

Major Use

Wildlife habitat

Major Management Factors

Available water capacity, salinity, sodicity, seasonal wetness, permeability, shrink-swell potential, slope, wind erosion

Dominant Vegetation in Potential Plant Community

Little permanent vegetation

Livestock Grazing

General management considerations:
• Because of the slope and the lack of vegetation, this unit is subject to wind and water erosion.
• Excess sodium results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface reduce infiltration.

206A—Playas-Helphenstein complex, 0 to 2 percent slopes

Composition

Playas and similar inclusions—55 percent
Helphenstein soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Playas

Position on landscape: Basin floors that have slopes of 0 to 1 percent (fig. 17)

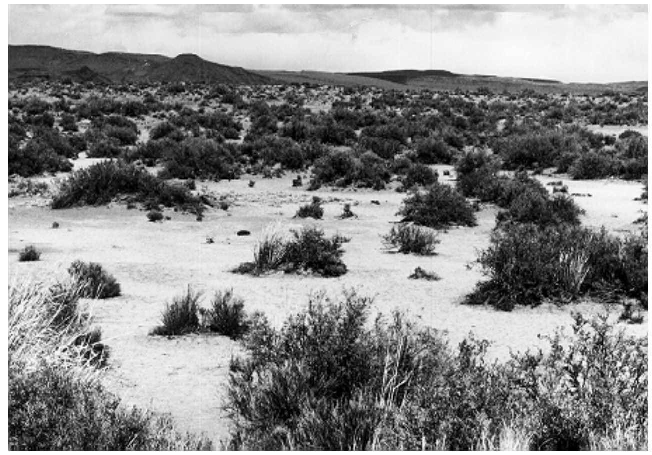


Figure 17.—Area of Playas-Helphenstein complex, 0 to 2 percent slopes. The areas of Playas are barren, and the Helphenstein soil supports vegetation.

Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Reference profile:
0 to 6 inches—silty clay
6 to 60 inches—stratified silty clay and silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Very slow
Hazard of erosion by wind: None to severe, depending on the time of year
Depth to seasonal high water table: February through September—12 inches above the surface to 12 inches below the surface; rest of year—more than 12 inches
Salinity: Moderately saline or strongly saline
Sodicity: Strongly sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Helphenstein Soil

Position on landscape: Lake terraces that have slopes of 0 to 2 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches

Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days

Typical profile:
0 to 7 inches—very dark grayish brown fine sandy loam
7 to 36 inches—brown loam
36 to 50 inches—dark brown silt loam
50 to 55 inches—brown silt loam
55 to 65 inches—light gray and brown very fine sandy loam and silt loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat poorly drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion: By water—slight; by wind—moderate
Depth to seasonal high water table: February through April—24 to 48 inches; rest of year—more than 48 inches
Salinity: Slightly saline
Sodicity: Strongly sodic
Carbonates: Strongly effervescent or violently effervescent in the upper part

Contrasting inclusions

• Icene soils that are on slightly higher lying lake terraces and have shadscale, black greasewood, spiny hopsage, basin wildrye, creeping wildrye, and saltgrass in the potential plant community
• Reese soils that are on adjacent lake terraces and have alkali sacaton, alkali bluegrass, inland saltgrass, and alkali cordgrass in the potential plant community
• Als soils that are on adjacent sand dunes and have Indian ricegrass, basin big sagebrush, black greasewood, fourwing saltbush, needleandthread, basin wildrye, spiny hopsage, and creeping wildrye in the potential plant community

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Playas—wind erosion, available water capacity, salinity, sodicity, seasonal wetness, permeability, shrink-swell potential
Helphenstein soil—available water capacity, salinity, sodicity, permeability, wind erosion

Dominant Vegetation in Potential Plant Community

Helphenstein soil—black greasewood, basin wildrye, inland saltgrass

Livestock Grazing

General management considerations:
• Variable yearly ponding on the Playas results in an unstable plant community.
• The areas of Playas provide habitat for wetland wildlife in spring and early in summer.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• The low precipitation and low available water capacity limit forage production and seedling survival.
• The strongly sodic surface layer severely limits range recovery and seedling survival.
• Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• Because of the fine sandy loam surface layer and the poor structure of the Helphenstein soil, wind erosion is a concern when the soil is dry.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.
• Trees and shrubs suitable for windbreaks and environmental plantings are limited, and the seedling mortality rate is severe because of the concentration of salts.

Suitable management practices:
• Delay grazing in spring until the Helphenstein soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Helphenstein soil is seeded, select plants that tolerate droughtiness in summer, strong sodicity, and slight salinity.

207C—Polander sandy loam, 0 to 15 percent slopes

Composition

Polander soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Slight or moderate

Contrasting inclusions

• Mound, Rogger, and Twelvemile soils that are on adjacent mountainsides
• Soils that are similar to the Polander soil but have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

None

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 55 cubic feet per acre per year for ponderosa pine at age 50 and 57 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
• Wet, unsurfaced roads and skid trails are soft.
• Dry, unsurfaced roads and skid trails are dusty

Suitable management practices:
• To minimize compaction and displacement, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when soils are wet.
• To minimize compaction, adjust yarding operations to the content of moisture and organic matter in the surface layer.

208E—Polander sandy loam, 15 to 40 percent north slopes

Composition

Polander soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting inclusions

• Mound, Rogger, and Twelvemile soils that are on adjacent mountainsides
• Soils that are similar to the Polander soil but have more than 35 percent rock fragments throughout
• Soils on south-facing slopes
• Soils that are similar to the Polander soil but have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Slope, water erosion

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 55 cubic feet per acre per year for ponderosa pine at age 50 and 57 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
- Wet, unsurfaced roads and skid trails are soft.
- Dry, unsurfaced roads and skid trails are dusty.
- Cuts and fills are stable.
- Accumulations of snow can bend and break small trees
- To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
- To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.
- To minimize compaction, adjust yarding operations to the content of moisture and organic matter in the surface layer.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

209E—Polander sandy loam, 15 to 40 percent south slopes

Composition

Polander soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—residuum, colluvium; source—pyroclastic rock
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting inclusions

- Mound, Rogger, and Twelvemile soils that are on adjacent mountainsides
- Soils that are similar to the Polander soil but have more than 35 percent rock fragments throughout
- Soils on south-facing slopes
- Soils that are similar to the Polander soil but have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Slope, water erosion

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 55 cubic feet per acre per year for ponderosa pine at age 50 and 57 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
- Soils on south-facing slopes are more droughty than those on north-facing slopes.
- Artificial or natural shade increases seedling survival.
- Wet, unsurfaced roads and skid trails are soft.
- Dry, unsurfaced roads and skid trails are dusty.
- Cuts and fills are stable.
- Accumulations of snow can bend or break small trees.
- To protect the quality and quantity of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
- Use shade cards to increase seedling survival.
- To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.
- To minimize compaction, adjust yarding operations to the content of moisture and organic matter in the surface layer.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

210E—Polander-Twelvemile-Mound complex, 15 to 40 percent north slopes

Composition

Polander soil and similar inclusions—35 percent
Twelvemile soil and similar inclusions—25 percent
Mound soil and similar inclusions—25 percent
Contrasting inclusions—15 percent

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Characteristics of the Twelvemile Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—partially decomposed conifer needles
0 to 11 inches—dark brown very gravelly fine sandy loam
11 to 24 inches—dark yellowish brown very gravelly fine sandy loam
24 to 37 inches—brown very cobbly fine sandy loam
37 to 60 inches—brown very cobbly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid

Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Characteristics of the Mound Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium over residuum; source—basalt, tuff
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and limbs
0 to 13 inches—very dark grayish brown stony loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—brown partially weathered tuff
45 inches—brown tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Contrasting inclusions

• Rogger soils that are on adjacent mountainsides
• Winterim soils that are on adjacent mountainsides at lower elevations
• Soils on south-facing slopes
• Soils that have slopes of less than 15 percent or more than 40 percent
• Soils that have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Polander soil—slope, water erosion
Twelvemile soil—slope, water erosion, available water capacity, rock fragments
Mound soil—slope, water erosion, permeability, stones on the surface

Dominant Vegetation in Potential Plant Community

Polander, Twelvemile, and Mound soils—ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: Polander soil—55 cubic feet per acre per year for ponderosa pine at age 50 and 57 cubic feet per acre per year for white fir at age 70; Twelvemile soil—62 cubic feet per acre per year for ponderosa pine at age 50 and 64 cubic feet per acre per year for white fir at age 70; Mound soil—69 cubic feet per acre per year for ponderosa pine at age 40 and 64 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): Polander soil—172 board feet per acre per year for ponderosa pine at age 160; Twelvemile soil—198 board feet per acre per year for ponderosa pine at age 160; Mound soil—225 board feet per acre per year for ponderosa pine at age 150

General management considerations:
• Wet, unsurfaced roads and skid trails on the Polander soil are soft, on the Twelvemile soil are firm, and on the Mound soil are slippery and sticky.
• Dry, unsurfaced roads and skid trails on the Polander and Twelvemile soils are dusty.
• When dry, cuts and fills on the Twelvemile soil ravel.
• When wet, cuts and fills on the Mound soil slough.
• The clayey layer in the Mound soil restricts permeability.
• The rock fragments on the surface of the Mound soil can make tree planting and the operation of ground seeding equipment difficult.
• The rock fragments on the Twelvemile soil make tree planting difficult.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• Accumulations of snow can bend or break small trees.
• Because the Twelvemile soil is droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
• To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen

surface layer, and avoid logging in spring when the soils are wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
• Reduce the risk of soil erosion and displacement by limiting vehicle access on the Mound soil to periods when the soil is dry or frozen.

211E—Polander-Twelvemile-Mound complex, 15 to 40 percent south slopes

Composition

Polander soil and similar inclusions—35 percent
Twelvemile soil and similar inclusions—25 percent
Mound soil and similar inclusions—25 percent
Contrasting inclusions—15 percent

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Characteristics of the Twelvemile Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—partially decomposed conifer needles
0 to 11 inches—dark brown very gravelly fine sandy loam
11 to 24 inches—dark yellowish brown very gravelly fine sandy loam
24 to 37 inches—brown very cobbly fine sandy loam
24 to 60 inches—brown very cobbly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Characteristics of the Mound Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—partially decomposed ponderosa pine needles, cones, and limbs
0 to 13 inches—very dark grayish brown stony loam
13 to 18 inches—dark brown very cobbly clay loam
18 to 29 inches—dark brown very cobbly clay
29 to 42 inches—dark brown clay loam
42 to 45 inches—brown partially weathered tuff
45 inches—brown tuff
Depth class: Deep (40 to 60 inches) to bedrock

Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Contrasting inclusions

- Rogger soils that are on adjacent mountainsides
- Winterim soils that are on adjacent mountainsides at lower elevations
- Soils on north-facing slopes
- Soils that have slopes of less than 15 percent or more than 40 percent
- Soils that have bedrock at a depth of 20 to 40 inches

Major Use

Woodland

Major Management Factors

Polander soil—slope, water erosion
Twelvemile soil—slope, water erosion, available water capacity, rock fragments
Mound soil—slope, water erosion, permeability, stones on the surface

Dominant Vegetation in Potential Plant Community

Polander, Twelvemile, and Mound soils—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: Polander soil—55 cubic feet per acre per year for ponderosa pine at age 50 and 57 cubic feet per acre per year for white fir at age 70; Twelvemile soil—62 cubic feet per acre per year for ponderosa pine at age 50 and 64 cubic feet per acre per year for white fir at age 70; Mound soil—69 cubic feet per acre per year for ponderosa pine at age 40 and 64 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): Polander soil—172 board feet per acre per year for ponderosa pine at age 160; Twelvemile soil—198 board feet per acre per year for ponderosa pine at age 160; Mound soil—225 board feet per acre per year for ponderosa pine at age 150

General management considerations:
- Soils on south-facing slopes are more droughty than those on north-facing slopes.
- Artificial or natural shade increases seedling survival.
- The clayey layer in the Mound soil restricts permeability.
- Wet, unsurfaced roads and skid trails on the Polander soil are soft, on the Twelvemile soil are firm, and on the Mound soil are slippery and sticky.
- Dry, unsurfaced roads and skid trails on the Polander and Twelvemile soils are dusty.
- When wet, cuts and fills on the Mound soil slough.
- When dry, cuts and fills on the Twelvemile soil ravel.
- The rock fragments on the surface of the Mound soil can make tree planting and the operation of ground seeding equipment difficult.
- The rock fragments on the surface of the Twelvemile soil make tree planting difficult.
- Accumulations of snow can bend or break small trees.
- To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
- Use shade cards to increase seedling survival.
- To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soils are wet.
- To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
- Reduce the risk of soil erosion and minimize displacement on the Mound soil by limiting vehicle access to periods when the soil is dry or frozen.

212C—Polander-Xerolls complex, 0 to 15 percent slopes

Composition

Polander soil and similar inclusions—45 percent
Xerolls and similar inclusions—45 percent
Contrasting inclusions—10 percent

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 38 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Slight or moderate

Characteristics of the Xerolls

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 38 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March
Reference profile:
0 to 4 inches—dark brown extremely stony loam
4 to 11 inches—dark brown extremely cobbly loam
11 to 27 inches—dark yellowish brown extremely cobbly loam
27 inches—basalt
Depth class: Shallow to very deep (10 to 70 inches) to bedrock
Drainage class: Somewhat excessively drained and well drained
Permeability: Moderately rapid to moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Slight and moderate

Contrasting inclusions

- Mound, Rogger, and Twelvemile soils that are on adjacent mountainsides
- Soils that are similar to the Polander soil but are more than 35 percent rock fragments throughout
- Rock outcrop
- Soils that are similar to the Polander soil but have bedrock at a depth of 60 inches or more

Major Uses

Polander soil—woodland
Xerolls—livestock grazing

Major Management Factors

Polander soil—none
Xerolls—depth to bedrock, rock fragments, available water capacity in some areas

Dominant Vegetation in Potential Plant Community

Polander soil—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass
Xerolls—Idaho fescue, curlleaf mountainmahogany, common snowberry, mountain big sagebrush

Livestock Grazing

Xerolls

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Livestock tend to herd and graze in the less stony areas of the unit.
- The depth to bedrock in some areas restricts rooting depth and placement of fenceposts.
- The low available water capacity limits forage production and seedling survival.
- The extremely stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The rock fragments on the surface limit placement of fenceposts.
- Trees on the Polander soil provide shade and shelter for livestock.

Suitable management practices:
- Delay grazing until summer when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by maintaining the plant cover, accumulating litter on the soil surface, seeding, and preserving the existing plant cover.
- If this unit is seeded, select plants that tolerate a short, cool growing season.

Woodland

Polander soil

Estimated growth at culmination of mean annual increment: 55 cubic feet per acre per year for

ponderosa pine at age 50 and 57 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
- Wet, unsurfaced roads and skid trails are soft.
- Dry, unsurfaced roads and skid trails are dusty.
- Construction of roads and skid trails is difficult because of the stones on the surface of the Xerolls.

Suitable management practices:
- To minimize compaction and displacement, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.
- To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.

213E—Polander-Xerolls complex, 15 to 40 percent north slopes

Composition

Polander soil and similar inclusions—45 percent
Xerolls and similar inclusions—45 percent
Contrasting inclusions—10 percent

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—18 to 38 inches
Mean annual air temperature—45 to 47 degrees
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Characteristics of the Xerolls

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—18 to 38 inches
Mean annual air temperature—45 to 47 degrees
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March
Reference profile:
0 to 4 inches—dark brown extremely stony loam
4 to 11 inches—dark brown extremely cobbly loam
11 to 27 inches—dark yellowish brown extremely cobbly loam
27 inches—basalt
Depth class: Shallow to very deep (10 to 70 inches) to bedrock
Drainage class: Somewhat excessively drained and well drained
Permeability: Moderately rapid to moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting inclusions

- Mound, Rogger, and Twelvemile soils that are on adjacent mountainsides
- Soils that are similar to the Polander soil but are more than 35 percent rock fragments throughout
- Rock outcrop
- Soils that are similar to the Polander soil but have bedrock at a depth of 20 to 40 inches

Major Uses

Polander soil—woodland
Xerolls—livestock grazing

Major Management Factors

Polander soil—slope, water erosion
Xerolls—slope, water erosion, depth to bedrock in some areas; rock fragments in some areas, available water capacity in some areas

Dominant Vegetation in Potential Plant Community

Polander soil—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass
Xerolls—Idaho fescue, curlleaf mountainmahogany, common snowberry, mountain big sagebrush

Livestock Grazing

Xerolls

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Livestock tend to herd and graze in the less stony areas of this unit.
• The depth to bedrock in some areas of the Xerolls restricts rooting depth and the placement of fenceposts.
• The low available water capacity in some areas of the Xerolls limits forage production and seedling survival.
• The extremely stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The rock fragments on the surface limit placement of fenceposts.
• The trees on the Polander soil provide shade and shelter for livestock.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.

Suitable management practices:
• Delay grazing until summer when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by maintaining the plant cover, accumulating litter on the surface, seeding, and preserving the existing plant cover.
• If this unit is seeded, select plants that tolerate a short, cool growing season.

Woodland

Polander soil

Estimated growth at culmination of mean annual increment: 55 cubic feet per acre per year for ponderosa pine at age 50 and 57 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
• Wet, unsurfaced roads and skid trails are soft.
• Dry, unsurfaced roads and skid trails are dusty.
• Cuts and fills are stable.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
• Accumulations of snow can bend or break small trees.
• The rock fragments on the surface of the Xerolls restrict the placement and construction of roads and skid trails.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.

Suitable management practices:
• To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

214E—Polander-Xerolls complex, 15 to 40 percent south slopes

Composition

Polander soil and similar inclusions—45 percent
Xerolls and similar inclusions—45 percent
Contrasting inclusions—10 percent

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 38 inches
Mean annual air temperature—45 to 47 degrees
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock

Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Characteristics of the Xerolls

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 38 inches
Mean annual air temperature—45 to 47 degrees
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March
Reference profile:
0 to 4 inches—dark brown extremely stony loam
4 to 11 inches—dark brown extremely cobbly loam
11 to 27 inches—dark yellowish brown extremely cobbly loam
27 inches—basalt
Depth class: Shallow to very deep (10 to 70 inches) to bedrock
Drainage class: Somewhat excessively drained and well drained
Permeability: Moderately rapid to moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Mound, Rogger, and Twelvemile soils that are on adjacent mountainsides
- Soils that are similar to the Polander soil but are more than 35 percent rock fragments throughout
- Soils on north-facing slopes
- Rock outcrop
- Soils that are similar to the Polander soil but have bedrock at a depth of 20 to 40 inches

Major Uses

Polander soil—woodland
Xerolls—livestock grazing

Major Management Factors

Polander soil—slope, water erosion
Xerolls—slope; water erosion; depth to bedrock, rock fragments, and available water capacity in some areas

Dominant Vegetation in Potential Plant Community

Polander soil—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass
Xerolls—bluebunch wheatgrass, mountain big sagebrush, western juniper

Livestock Grazing

Xerolls

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Livestock tend to herd and graze in the less stony areas of this unit.
- The depth to bedrock in some areas restricts rooting depth and placement of fenceposts.
- The low available water capacity in some areas limits forage production and seedling survival.
- The extremely stony surface layer in some areas restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The shallow depth and rock fragments on the surface limit placement of fenceposts.
- The growing season begins earlier on the south-facing slopes than on the north-facing slopes; however, droughtiness is a limitation earlier in the growing season on the south-facing slopes.
- Trees on the Polander soil provide shade and shelter for livestock.

Suitable management practices:
- Delay grazing until summer when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by maintaining the plant cover, accumulating litter on the surface, seeding, and preserving the existing plant cover.
- If these soils are seeded, select plants that tolerate a short, cool growing season.

Woodland

Polander soil

Estimated growth at culmination of mean annual increment: 55 cubic feet per acre per year for ponderosa pine at age 50; 57 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
- The soils on south-facing slopes are more droughty than those on north-facing slopes.
- Artificial or natural shade increases seedling survival.
- Wet, unsurfaced roads and skid trails are soft.
- Dry, unsurfaced roads and skid trails are dusty.
- Cuts and fills are stable.
- To protect the quantity and quality of the water, a

buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• The rock fragments on the surface of the Xerolls restrict the placement and construction of roads and skid trails.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
• Use shade cards to increase seedling survival.
• To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soils are wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

215C—Ratto very cobbly loam, 2 to 15 percent slopes

Composition

Ratto soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Ratto Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 4,800 to 5,500 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown very cobbly loam
3 to 9 inches—dark brown gravelly clay loam
9 to 13 inches—brown clay loam
13 to 15 inches—brown gravelly clay loam
15 to 19 inches—indurated very gravelly hardpan
19 to 60 inches—grayish brown gravelly loamy sand
Depth class: Shallow (12 to 20 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow above the hardpan; very rapid below the hardpan
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 15 inches
Carbonates: Between depths of 13 and 15 inches—strongly effervescent; below this depth—violently effervescent

Contrasting Inclusions

• Coglin soils that are on tablelands and have black sagebrush in the potential plant community
• Floke soils that are on tablelands and have low sagebrush in the potential plant community
• Rock outcrop
• Soils that have slopes of more than 15 percent
• Soils that are similar to the Ratto soil but have a hardpan at a depth of 20 to 40 inches

Major Use

Livestock grazing

Major Management Factors

Available water capacity, depth to the hardpan, permeability, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The hardpan restricts rooting depth.
• The low available water capacity limits forage production and seedling survival.
• The shallow depth limits placement of fenceposts and makes special design of fences necessary.
• The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.
• A potential for seepage below the pan limits construction of water impoundments.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive

material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

216C—Ratto very gravelly sandy loam, low precipitation, 2 to 15 percent slopes

Composition

Ratto soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Ratto Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 4,800 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 3 inches—very dark grayish brown very gravelly sandy loam
3 to 9 inches—dark brown gravelly clay loam
9 to 13 inches—brown clay loam
13 to 15 inches—brown gravelly clay loam
15 to 19 inches—indurated gravelly hardpan
19 to 60 inches—grayish brown gravelly loamy sand
Depth class: Shallow (12 to 20 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow above the hardpan; very rapid below the hardpan
Available water capacity: About 2 inches
Hazard of erosion: By water—moderate; by wind—slight or moderate
Shrink-swell potential: High between depths of 9 and 15 inches
Carbonates: Between depths of 13 and 15 inches—strongly effervescent; below this depth—violently effervescent

Contrasting Inclusions

• Floke soils that are on tablelands and have low sagebrush in the potential plant community
• Soils that are similar to the Ratto soil but have a hardpan at a depth of 20 to 40 inches

Major Use

Livestock grazing

Major Management Factors

Available water capacity, depth to the hardpan, permeability, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Wyoming big sagebrush, Indian ricegrass, Thurber needlegrass, needleandthread

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• The hardpan restricts rooting depth.
• The shallow depth limits placement of fenceposts and makes special design of fences necessary.
• The clayey layer expands when wet and contracts when dry, which makes special design of fences necessary.
• A potential for seepage below the hardpan limits construction of water impoundments.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

217C—Ratto-Coglin complex, 2 to 15 percent slopes

Composition

Ratto soil and similar inclusions—55 percent
Coglin soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Ratto Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 4,900 to 6,000 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown very cobbly loam
3 to 9 inches—dark brown gravelly clay loam
9 to 13 inches—brown clay loam
13 to 15 inches—brown gravelly clay loam
15 to 19 inches—indurated very gravelly hardpan
19 to 60 inches—grayish brown gravelly loamy sand
Depth class: Shallow (12 to 20 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow above the hardpan; very rapid below the hardpan
Available water capacity: About 2 inches
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 9 and 15 inches
Carbonates: Between depths of 13 and 15 inches—strongly effervescent; below this depth—violently effervescent

Characteristics of the Coglin Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 4,900 to 6,000 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 2 inches—dark brown extremely stony loam
2 to 7 inches—dark brown clay
7 to 16 inches—dark yellowish brown silty clay loam
16 to 60 inches—dark yellowish brown silty clay loam
Depth class: Very shallow (2 to 5 inches) to the claypan; very deep (more than 60 inches) to bedrock
Depth to secondary lime: 10 to 30 inches
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 2 and 7 inches
Carbonates: Between depths of 16 and 60 inches—strongly effervescent

Contrasting Inclusions

- Floke soils that are on tablelands and have low sagebrush in the potential plant community
- Soils that are similar to the Coglin soil but have bedrock or a hardpan at a depth of 40 to 60 inches
- Soils that are similar to the Ratto soil but have bedrock or a hardpan at a depth of 8 to 12 inches or more than 20 inches

Major Use

Livestock grazing

Major Management Factors

Ratto soil—available water capacity, depth to the hardpan, permeability, shrink-swell potential, water erosion
Coglin soil—stones on the surface, calcareous layer, permeability, water erosion, shrink-swell potential, depth to the claypan

Dominant Vegetation in Potential Plant Community

Ratto soil—bluebunch wheatgrass, Wyoming big sagebrush, Sandberg bluegrass
Coglin soil—black sagebrush, bottlebrush squirreltail, Sandberg bluegrass (fig. 18)

Figure 18.—Black sagebrush, bottlebrush squirreltail, and Sandberg bluegrass on the Coglin soil in an area of Ratto-Coglin complex, 2 to 15 percent slopes.

Livestock Grazing

General management considerations:
• Seeding areas of the more favorable Ratto soil in this unit is difficult because of the pattern in which they occur with areas of the Coglin soil.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The calcareous lower layer and claypan in the Coglin soil restrict rooting depth.
• The surface layer of the Coglin soil is saturated following snowmelt.
• The hardpan in the Ratto soil restricts rooting depth.
• The low available water capacity limits forage production and seedling survival.
• The shallow depth of the Ratto soil limits placement of fenceposts.
• Crusting of the surface of the Coglin soil reduces infiltration and restricts seedling emergence and survival.
• The extremely stony surface layer of the Coglin soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Pedestaled plants and an erosion pavement on the Coglin soil are the result of past erosion.
• The shallow depth of the Ratto soil limits placement of fenceposts and makes special design of fences necessary.
• The soils in this unit expand when wet and contract when dry, which makes special design of fences necessary.
• A potential for seepage below the hardpan in the Ratto soil limits construction of water impoundments.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Coglin soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

218C—Ratto-Coglin complex, low precipitation, 2 to 15 percent slopes

Composition

Ratto soil and similar inclusions—50 percent
Coglin soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Ratto Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 4,800 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 3 inches—very dark grayish brown very gravelly sandy loam
3 to 9 inches—dark brown gravelly clay loam
9 to 13 inches—brown clay loam
13 to 15 inches—brown gravelly clay loam
15 to 19 inches—indurated very gravelly hardpan
19 to 60 inches—grayish brown gravelly loamy sand
Depth class: Shallow (12 to 20 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow above the hardpan; very rapid below the hardpan
Available water capacity: About 2 inches
Hazard of erosion: By water—moderate; by wind—slight or moderate
Shrink-swell potential: High between depths of 9 and 15 inches
Carbonates: Between depths of 13 and 15 inches—strongly effervescent; below this depth—violently effervescent

Characteristics of the Coglin Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 4,800 to 5,200 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days

Typical profile:
0 to 2 inches—very dark grayish brown extremely stony loam
2 to 7 inches—dark brown clay
7 to 16 inches—dark yellowish brown silty clay loam
16 to 60 inches—dark yellowish brown silty clay loam

Depth class: Very deep (more than 60 inches) to bedrock, very shallow (2 to 5 inches) to the claypan
Depth to secondary lime: 10 to 30 inches
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 2 and 7 inches
Carbonates: Between depths of 16 and 60 inches—strongly effervescent

Contrasting Inclusions

• Floke soils that are on tablelands and have low sagebrush in the potential plant community
• Soils that are similar to the Coglin soil but have bedrock or a hardpan at a depth of 40 to 60 inches
• Soils that are similar to the Ratto soil but have bedrock or a hardpan at a depth of 8 to 12 inches or more than 20 inches

Major Use

Livestock grazing

Major Management Factors

Ratto soil—available water capacity, depth to the hardpan, permeability, shrink-swell potential, water erosion
Coglin soil—stones on the surface, calcareous layer, permeability, water erosion, shrink-swell potential, depth to the claypan

Dominant Vegetation in Potential Plant Community

Ratto soil—Wyoming big sagebrush, needleandthread, Thurber needlegrass, Indian ricegrass
Coglin soil—black sagebrush, bottlebrush squirreltail, Sandberg bluegrass

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Seeding areas of the more favorable Ratto soil in this unit is difficult because of the pattern in which they occur with areas of the Coglin soil.
• The calcareous lower layer and claypan in the Coglin soil restrict rooting depth.
• The surface layer of the Coglin soil is saturated following snowmelt.
• The hardpan in the Ratto soil restricts rooting depth.
• The shallow depth of the Ratto soil limits placement of fenceposts.
• Crusting of the surface of the Coglin soil reduces infiltration and restricts seedling emergence and survival.
• The extremely stony surface layer of the Coglin soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• Pedestaled plants and an erosion pavement on the Coglin soil are the result of past erosion.
• The soils in this unit expand when wet and contract when dry, which makes special design of fences necessary.
• A potential for seepage below the hardpan in the Ratto soil limits construction of water impoundments.
• This unit is suited to winter grazing.

Suitable management practices:
• Delay grazing until the Coglin soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling, droughtiness, and a cool growing season.

219D—Raz-Brace complex, 2 to 20 percent slopes

Composition

Raz soil and similar inclusions—50 percent
Brace soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Raz Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium and alluvium; source—tuff, basalt
Elevation: 5,000 to 5,500 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 3 inches—dark brown very cobbly loam
3 to 13 inches—dark brown cobbly clay loam
13 to 18 inches—dark yellowish brown gravelly clay loam
18 to 21 inches—indurated hardpan
21 inches—basalt
Depth class: Shallow (10 to 18 inches) to the hardpan; moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate

Characteristics of the Brace Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,000 to 5,500 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—dark brown loam
3 to 9 inches—dark brown cobbly loam
9 to 19 inches—dark brown silty clay loam
19 to 25 inches—yellowish brown extremely gravelly loam
25 to 35 inches—indurated hardpan
35 inches—basalt
Depth class: Moderately deep (20 to 37 inches) to the hardpan; moderately deep (22 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion: By water—slight or moderate; by wind—moderate
Carbonates: Between depths of 19 and 25 inches—violently effervescent

Contrasting Inclusions

• Coglin soils that are on tablelands and have black sagebrush in the potential plant community
• Soils that are similar to the Brace soil but have bedrock or a hardpan at a depth of 40 inches or more

Major Use

Livestock grazing

Major Management Factors

Raz soil—available water capacity, depth to the hardpan, depth to bedrock, water erosion
Brace soil—calcareous layer, available water capacity, depth to the hardpan, depth to bedrock, water erosion

Dominant Vegetation in Potential Plant Community

Raz soil—Thurber needlegrass, Wyoming big sagebrush, bottlebrush squirreltail, Indian ricegrass, bluebunch wheatgrass
Brace soil—Thurber needlegrass, Sandberg bluegrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The calcareous lower layer and hardpan in the Brace soil restrict rooting depth.
• The hardpan in the Raz soil restricts rooting depth.
• The low available water capacity limits forage production and seedling survival.
• The shallow depth of the Raz soil limits placement of fenceposts.
• The depth to bedrock and to the hardpan limits construction of water impoundments.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness.

220C—Raz-Brace complex, overblown, 2 to 15 percent slopes

Composition

Raz soil and similar inclusions—55 percent
Brace soil and similar inclusions—35 percent
Contrasting inclusions—10 percent

Characteristics of the Raz Soil

Position on landscape: Tablelands
Parent material: Kind—eolian sand over colluvium and alluvium; source—tuff, basalt
Elevation: 5,000 to 5,500 feet
Climatic factors:

Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 3 inches—dark brown loamy sand
3 to 13 inches—dark brown cobbly clay loam
13 to 18 inches—dark yellowish brown gravelly clay loam
18 to 21 inches—indurated hardpan
21 inches—basalt

Depth class: Shallow (10 to 18 inches) to the hardpan; moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Upper 3 inches—rapid; below this depth—moderately slow
Available water capacity: About 2 inches
Hazard of erosion: By water—moderate; by wind—severe

Characteristics of the Brace Soil

Position on landscape: Tablelands
Parent material: Kind—eolian sand over colluvium and residuum; source—tuff, basalt
Elevation: 5,000 to 5,500 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 3 inches—dark brown loamy sand
3 to 9 inches—dark brown cobbly loam
9 to 19 inches—dark brown silty clay loam
19 to 25 inches—yellowish brown extremely gravelly loam
25 to 35 inches—indurated hardpan
35 inches—basalt

Depth class: Moderately deep (20 to 37 inches) to the hardpan; moderately deep (22 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Upper 3 inches—rapid; between depths of 3 and 9 inches—moderate; between depths of 9 and 25 inches—moderately slow
Available water capacity: About 3 inches
Hazard of erosion: By water—slight or moderate; by wind—severe
Carbonates: Between depths of 19 and 25 inches—violently effervescent

Contrasting Inclusions

- Coglin soils that are on adjacent tablelands
- Soils that are similar to the Brace soil but have bedrock or a hardpan at a depth of 40 inches or more
- Soils that are similar to the Raz soil but have bedrock at a depth of 20 to 40 inches
- Soils that have slopes of less than 2 percent or more than 15 percent

Major Use

Livestock grazing

Major Management Factors

Raz soil—available water capacity, depth to the hardpan, wind erosion, depth to bedrock
Brace soil—calcareous layer, permeability, available water capacity, depth to the hardpan, wind erosion, depth to bedrock

Dominant Vegetation in Potential Plant Community

Raz and Brace soils—needleandthread, basin big sagebrush, Thurber needlegrass, basin wildrye

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The calcareous lower layer and hardpan in the Brace soil restrict rooting depth.
- The hardpan in the Raz soil restricts rooting depth.
- The low available water capacity limits forage production and seedling survival.
- The shallow depth of the Raz soil limits placement of fenceposts.
- The depth to bedrock and to the hardpan limits construction of water impoundments
- This unit is subject to wind erosion if the vegetation is removed or degraded.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Range seeding controls blowing and drifting sand.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness.

221F—Redcanyon-Rock outcrop complex, 30 to 50 percent north slopes

Composition

Redcanyon soil and similar inclusions—50 percent
Rock outcrop—35 percent
Contrasting inclusions—15 percent

Characteristics of the Redcanyon Soil

Position on landscape: Escarpments, hillsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—12 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 8 inches—dark brown extremely bouldery loam
8 to 18 inches—dark brown very bouldery loam
18 to 31 inches—dark brown extremely bouldery loam
31 inches—basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion: Severe
Carbonates: Between depths of 29 and 31 inches—violently effervescent

Characteristics of the Rock Outcrop

Position on landscape: Escarpments
Kind of rock: Basalt

Contrasting Inclusions

• McConnel soils that are on adjacent, lower lying lake terraces and fans
• Chewaucan soils that are on adjacent, slightly higher lying bedrock-controlled lake terraces
• Lasere soils that are on adjacent, slightly higher lying bedrock-controlled lake terraces and have dominantly low sagebrush in the potential plant community
• Soils that have slopes of less than 30 percent

Major Use

Livestock grazing

Major Management Factors

Slope, rock fragments, available water capacity, water erosion, Rock outcrop

Dominant Vegetation in Potential Plant Community

Redcanyon soil—bluebunch wheatgrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony or bouldery areas of this unit.
• The low available water capacity limits forage production and seedling survival.
• The extremely bouldery surface layer, steepness of slope, and areas of Rock outcrop restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The rock fragments throughout the soil and the areas of Rock outcrop restrict the placement of fenceposts.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness.

222F—Redcanyon-Rock outcrop complex, 30 to 50 percent south slopes

Composition

Redcanyon soil and similar inclusions—50 percent
Rock outcrop—35 percent
Contrasting inclusions—15 percent

Characteristics of the Redcanyon Soil

Position on landscape: Escarpments, hillsides
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—12 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 8 inches—dark brown extremely bouldery loam
8 to 18 inches—dark brown very bouldery loam

18 to 31 inches—dark brown extremely bouldery loam
31 inches—basalt

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion: Severe
Carbonates: Between depths of 29 and 31 inches—violently effervescent

Characteristics of the Rock Outcrop

Position on landscape: Escarpments
Kind of rock: Basalt

Contrasting Inclusions

• McConnel soils that are on adjacent, lower lying lake basin terraces and fans
• Chewaucan soils that are on adjacent, slightly higher lying bedrock-controlled lake terraces
• Lasere soils that are on adjacent, slightly higher lying bedrock-controlled lake terraces and have dominantly low sagebrush in the potential plant community
• Soils that have slopes of less than 30 percent

Major Use

Livestock grazing

Major Management Factors

Slope, rock fragments, available water capacity, water erosion, Rock outcrop

Dominant Vegetation in Potential Plant Community

Redcanyon soil—bluebunch wheatgrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony or bouldery areas of this unit.
• The low available water capacity limits forage production and seedling survival.
• The extremely bouldery surface layer, steepness of slope, and areas of Rock outcrop restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The earlier growing season on the south-facing slopes allows for earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• The rock fragments throughout the soil and the areas of Rock outcrop restrict the placement of fenceposts.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness.

223A—Reese very fine sandy loam, 0 to 1 percent slopes

Composition

Reese soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Reese Soil

Position on landscape: Alluvial flats in basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days

Typical profile:
0 to 4 inches—dark brown very fine sandy loam
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam

Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: March through July—12 to 36 inches; rest of year—more than 36 inches
Frequency of flooding: Rare
Salinity: Upper 10 inches—strongly saline; below this depth—moderately saline or slightly saline
Sodicity: Upper 33 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

• Helphenstein soils that are on adjacent, slightly higher lying lake terraces and have black greasewood in the potential plant community
• Mesman soils that are on adjacent, higher lying lake terraces and have basin big sagebrush and black greasewood in the potential plant community
• Icene soils that are on adjacent, higher lying lake terraces and have shadscale and black greasewood in the potential plant community
• Playas

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Available water capacity, sodicity, salinity, wetness, permeability, wind erosion, frost action

Dominant Vegetation in Potential Plant Community

Alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife early in spring.
• The low precipitation and low available water capacity limit forage production and seedling survival.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• A high water table early in the growing season restricts rooting depth.
• The strong sodicity and salinity of the surface layer severely limit range recovery and seedling survival.
• Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
• This unit is subject to wind erosion if the vegetation is removed or degraded and the soil surface is exposed.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This unit is suited to winter grazing in winter.
• Range seeding controls blowing and drifting sand.
• Because of a high potential for frost action, plants are subject to winterkill and other damage.
• Because of the concentration of salts, trees and shrubs suitable for windbreaks and environmental plantings are limited and the seedling mortality rate is severe.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate strong salinity, strong sodicity, droughtiness in summer, frost heaving, and wetness.

224A—Reese loam, drained, 0 to 1 percent slopes

Composition

Reese soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Reese Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark brown loam
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: None or slight
Depth to water table (artificially lowered): March through July—24 to 36 inches; rest of year—more than 36 inches
Frequency of flooding: Rare
Salinity: Upper 10 inches—slightly saline; below this depth—moderately saline or slightly saline
Sodicity: Upper 10 inches—moderately sodic; below this depth—strongly sodic or moderately sodic

Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

- Reese soils that have not been drained
- Turpin soils that are on adjacent, higher lying lake terraces
- Soils that have a silty clay loam or very fine sandy loam surface layer

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Available water capacity, sodicity, salinity, permeability, slope, frost action

Dominant Vegetation in Potential Plant Community

Creeping wildrye

Livestock Grazing

General management considerations:
- This unit provides food and cover for wetland wildlife early in spring.
- Grazing when the soil is wet results in compaction and puddling of the surface.
- The low precipitation, low available water capacity, salinity, and sodicity limit forage production and seedling survival.
- Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
- Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
- Unless adequate drainage is maintained, salts will move upward in the soil.
- Because this soil is nearly level, adequate drainage is difficult to maintain.
- This unit is suited for grazing in winter.

Suitable management practices:
- Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
- Maintain drainage ditches to remove surface water.
- If this unit is seeded, select plants that tolerate moderate sodicity and frost heaving.

Hayland

General management considerations:
- Salinity and sodicity limit the choice and production of hay and pasture plants.
- Wetness increases the risk of winterkill and restricts the period suitable for haying.
- The seasonal high water table provides supplemental moisture for hay and pasture plants.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Because of the high potential for frost action, plants are subject to winterkill and other damage.
- Because of the concentration of salts, trees and shrubs suitable for windbreaks and environmental plantings are limited and the seedling mortality rate is moderate.

Suitable management practices:
- Maintain the drainage systems to allow the soil to drain more effectively.
- Maintain surface and subsurface drains to prevent ponding of the soil surface, keep the water table at desired depths, and allow for earlier access for haying operations.

225A—Reese loam, wet, 0 to 1 percent slopes

Composition

Reese soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Reese Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 100 days
Typical profile:
0 to 4 inches—dark brown loam
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: None or slight
Depth to seasonal high water table: November through August—12 inches above the surface to 24 inches

below the surface; rest of year—more than 24 inches
Frequency of flooding: Rare
Salinity: Upper 10 inches—strongly saline; below this depth—moderately saline or slightly saline
Sodicity: Upper 33 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

• Turpin soils that are on adjacent, higher lying lake terraces
• Reese soils that are in slightly higher lying areas and are not ponded

Major Uses

Wildlife habitat, livestock grazing

Major Management Factors

Salinity, sodicity, wetness, permeability, frost action, available water capacity

Dominant Vegetation in Potential Plant Community

Unstable

Livestock Grazing

General management considerations:
• Because the water on the surface is from snowmelt in spring, the amount and duration varies. During years when the winters are wet, ponding lasts until midsummer or late in summer. During years when the winters are dry, ponding lasts for only short periods in spring.
• Variable yearly ponding results in an unstable plant community.
• This unit provides food and cover for wetland wildlife.
• Grazing should be deferred during the period of nesting for waterfowl.
• Grazing when the soil is wet results in compaction of the surface layer and poor tilth.
• A high water table during the growing season and spring ponding restrict rooting depth.
• Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
• The strong sodicity and salinity of the surface layer severely limit range recovery and seedling survival.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If this unit is seeded, select plants that tolerate periods of inundation, strong salinity, strong sodicity, and frost heaving and that provide cover for nesting waterfowl.

226A—Reese-Ozamis complex, 0 to 1 percent slopes

Composition

Reese soil and similar inclusions—45 percent
Ozamis soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Reese Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark brown silty clay
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: None or slight
Depth to high water table: March through July—12 to 36 inches; rest of year—more than 36 inches
Frequency of flooding: Rare
Salinity: Upper 10 inches—strongly saline; below this depth—moderately saline or slightly saline

Sodicity: Upper 33 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Ozamis Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—black silty clay
9 to 12 inches—black clay loam
12 to 19 inches—black silty clay
19 to 60 inches—dark grayish brown loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: March through June—12 to 48 inches; rest of year—more than 48 inches
Frequency of flooding: Rare
Salinity: Upper 9 inches—moderately saline; below this depth—slightly saline

Contrasting Inclusions

• Crump soils that are on adjacent, slightly lower lying alluvial flats
• Icene soils that are on adjacent, slightly higher lying lake terraces

Major Uses

Hayland, livestock grazing, wildlife habitat

Major Management Factors

Reese soil—salinity, sodicity, wetness, available water capacity, permeability, frost action, clayey surface layer
Ozamis soil—salinity, wetness, available water capacity, frost action, clayey surface layer

Dominant Vegetation in Potential Plant Community

Reese and Ozamis soils—alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for wetland wildlife early in spring.
• Grazing when the soil is wet results in compaction and puddling of the surface.
• The salinity and sodicity of the surface layer reduce the amount of water available to plants and severely limit seedling survival.
• A high water table early in the growing season restricts the rooting depth.
• A seasonal high water table increases the amount of moisture available for plant growth.
• Excess sodium in the Reese soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
• This unit is suited to grazing in winter.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• If this unit is seeded, select plants that tolerate wetness, salinity, sodicity, and frost heaving.

Hayland

General management considerations:
• Wetness limits the period of access for haying operations.
• Wetness limits the choice of hay and pasture plants and increases the risk of winterkill.
• The salinity and sodicity of the soil limit the choice of hay and pasture plants.
• Unless the soils are adequately drained, machinery compacts the surface layer and becomes embedded.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• The concentration of salts and sodium limits the production of some hay and pasture plants.
• The soils in this unit tie up large amounts of phosphorus, which limits the amount that is available to plants.
• Because of the high corrosivity of the Reese soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Because of the high corrosivity of the Ozamis soil to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized

steel, aluminum, or plastics, is needed for structures or pipelines.
• Haying operations are restricted to periods late in summer or early in fall because of seasonal wetness.
• Because of the high potential for frost action, plants are subject to winterkill and other damage.
• Because of the concentration of salts, trees and shrubs suitable for windbreaks and environmental plantings are limited and the seedling mortality rate is severe. Trees and shrubs should be tolerant of wetness.

227A—Reese-Playas complex, 0 to 1 percent slopes

Composition

Reese soil and similar inclusions—50 percent
Playas—35 percent
Contrasting inclusions—15 percent

Characteristics of the Reese Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark brown very fine sandy loam
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to seasonal high water table: March through July—12 to 36 inches; rest of year—more than 36 inches
Frequency of flooding: Rare
Salinity: Upper 10 inches—strongly saline; below this depth—moderately saline or slightly saline
Sodicity: Upper 33 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Playas

Position on landscape: Basin floors
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Reference profile:
0 to 6 inches—silty clay loam
6 to 60 inches—stratified silty clay and silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Very slow
Hazard of erosion by wind: None to severe, depending on time of year
Depth to seasonal high water table: February through September—12 inches above the surface to 12 inches below the surface; rest of year—more than 12 inches
Shrink-swell potential: High
Salinity: Moderately saline or strongly saline
Sodicity: Strongly sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

• Crump, Boravall, and Ozamis soils that are on adjacent alluvial flats
• Helphenstein soils that are on adjacent lake terraces
• Mesman soils that are on adjacent, higher lying lake terraces
• Icene soils that are on adjacent, higher lying lake terraces

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Reese soil—available water capacity, sodicity, salinity, wetness, permeability, frost action, wind erosion
Playas—available water capacity, sodicity, salinity, permeability, seasonal wetness, wind erosion, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Reese soil—alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:
- Because the water on the surface of the Playas is from snowmelt in spring, the amount and duration varies. During years when the winters are wet, ponding lasts until midsummer or late in summer. During years when the winters are dry, ponding lasts for only short periods in spring.
- The areas of Playas provide habitat for wetland wildlife in spring and early in summer.
- Grazing should be deferred during the period of nesting for waterfowl.
- Grazing when the soil is wet results in compaction and puddling of the surface.
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The strong sodicity and salinity of the surface layer severely limit range recovery and seedling survival.
- Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
- Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
- A high water table in the Reese soil early in the growing season restricts rooting depth.
- Because of the high corrosivity of the Playas to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.
- If the vegetation is removed or degraded, range seeding is needed to control wind erosion.
- Because of a high potential for frost action, plants are subject to winterkill and other damage.
- Because of the concentration of salts, trees and shrubs suitable for windbreaks and environmental plantings are limited and the seedling mortality rate is severe.

Suitable management practices:
- Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
- If this unit is seeded, select plants that tolerate moderate salinity, strong sodicity, droughtiness, frost heaving, and seasonal wetness and that provide cover for nesting waterfowl.

228F—Riddleranch very gravelly loam, 30 to 50 percent north slopes

Composition

Riddleranch soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Riddleranch Soil

Position on landscape: Mountainsides
Parent material: Kind—basalt, tuff; source—colluvium
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 15 inches—very dark brown very gravelly loam
15 to 23 inches—dark brown very gravelly loam
23 to 31 inches—dark yellowish brown extremely cobbly loam
31 inches—highly fractured basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Riddleranch soils that are on mountainsides and have dominantly low sagebrush in the potential plant community
- Felcher soils that are on south-facing slopes at the lower elevations
- Rock outcrop

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, depth to bedrock, available water capacity, rock fragments throughout

Dominant Vegetation in Potential Plant Community

Idaho fescue, bluebunch wheatgrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season

limit the period of plant growth.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
• The bedrock and rock fragments restrict rooting depth.
• The rock fragments throughout the soil restrict the placement of fenceposts.
• The low available water capacity limits forage production and seedling survival.
• Slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

229G—Riddleranch-Rock outcrop complex, 30 to 70 percent north slopes

Composition

Riddleranch soil and similar inclusions—35 percent
Riddleranch soil, thin surface, and similar inclusions—30 percent
Rock outcrop—20 percent
Contrasting inclusions—15 percent

Characteristics of the Riddleranch Soils

Position on landscape: Mountainsides (fig. 19)
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile of the Riddleranch soil:
0 to 15 inches—very dark brown very gravelly loam
15 to 23 inches—dark brown very gravelly loam
23 to 31 inches—dark yellowish brown extremely cobbly loam
31 inches—highly fractured basalt
Typical profile of the Riddleranch soil, thin surface:
0 to 12 inches—very dark brown very gravelly loam
12 to 25 inches—dark yellowish brown extremely cobbly loam
25 inches—highly fractured basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe or very severe

Characteristics of the Rock Outcrop

Position on landscape: Escarpments
Kind of rock: Basalt, tuff

Contrasting Inclusions

• Felcher soils that are on south-facing slopes at the lower elevations
• Rubble land

Major Use

Livestock grazing

Major Management Factors

Slope, depth to bedrock, water erosion, available water capacity, rock fragments throughout the soils, Rock outcrop

Dominant Vegetation in Potential Plant Community

Riddleranch soil—Idaho fescue, bluebunch wheatgrass, Wyoming big sagebrush
Riddleranch soil, thin surface—Idaho fescue, low sagebrush, bluebunch wheatgrass

Figure 19.—Area of Riddleranch-Rock outcrop complex, 30 to 70 percent north slopes, on steep escarpment of Poker Jim Ridge, above the Pleistocene lake shoreline. Riddleranch very gravelly loam, 30 to 50 percent north slopes, in foreground.

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
• The bedrock and rock fragments restrict rooting depth.
• The rock fragments throughout the soils and the areas of Rock outcrop restrict placement of fenceposts.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Slope and the areas of Rock outcrop restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The low available water capacity limits forage production and seedling survival.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

230A—Riverwash

Composition

Riverwash and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Riverwash

Position on landscape: Flood plains that are along the Chewaucan River, near the town of Paisley, and have slopes of 0 to 2 percent
Parent material: Kind—alluvium; source—basalt, tuff, rhyolite
Elevation: 4,300 to 4,400 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Reference profile:
0 to 60 inches—stratified sand and gravel
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained and somewhat poorly drained
Permeability: Rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: April through June—at the surface to a depth of 36 inches; rest of year—more than 36 inches
Frequency of flooding: Frequent for brief to long periods following prolonged, high-intensity storms or snowmelt

Contrasting Inclusions

• McConnel soils
• Soils that have been diked and protected from flooding

Major Uses

Recreation, wildlife habitat

Major Management Factors

Rock fragments, wetness

Wildlife Habitat

General management considerations:
• The frequent periods of flooding result in an unstable plant community.
• This unit is subject to cutting and filling during periods of flooding.
• This unit provides food and cover for wildlife.
• A potential for seepage limits construction of water impoundments.

231G—Rock outcrop-Felcher association, 30 to 70 percent south slopes

Composition

Rock outcrop—50 percent
Felcher soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Rock Outcrop

Position on landscape: Escarpments
Kind of rock: Basalt, tuff

Characteristics of the Felcher Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches

Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days

Typical profile:
0 to 4 inches—brown very cobbly clay loam
4 to 24 inches—dark grayish brown very cobbly loam
24 inches—basalt

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Severe or very severe

Contrasting Inclusions

• Riddleranch soils that are on adjacent, north-facing mountainsides
• Soils that are similar to the Felcher soil but have bedrock at a depth of less than 20 inches
• Rubble land

Major Uses

Watershed, livestock grazing

Major Management Factors

Slope, water erosion, available water capacity, depth to bedrock, rock fragments, Rock outcrop

Dominant Vegetation in Potential Plant Community

Felcher soil—bluebunch wheatgrass, antelope bitterbrush

Livestock Grazing

General management considerations:
• The bedrock and rock fragments restrict rooting depth.
• The low available water capacity limits forage production and seedling survival.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Slope and the areas of Rock outcrop restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The areas of Rock outcrop and the rock fragments in the soil limit placement of fenceposts.
• The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness.

232G—Rock outcrop-Rubble land complex, 50 to 75 percent slopes

Composition

Rock outcrop—45 percent
Rubble land—40 percent
Contrasting inclusions—15 percent

Characteristics of the Rock Outcrop and Rubble land

Position on landscape: Escarpments near Coleman Rim, Warner Rim, Abert Rim, Hart Mountain, Guano Canyon, and Fisher Canyon
Kind of rock: Basalt, tuff
Elevation: 5,000 to 7,000 feet
Climatic factors:
Mean annual precipitation—8 to 18 inches
Mean annual air temperature—43 to 50 degrees F
Frost-free period—50 to 90 days

Contrasting Inclusions

• Riddleranch soils that are near the Hart Mountain escarpment
• Felcher soils that are near the Guano Canyon escarpment
• Bullump and Royst soils that are near the Abert Rim escarpment

Major Use

Watershed

233G—Rock outcrop-Xerolls complex, cool, 10 to 80 percent slopes

Composition

Rock outcrop—50 percent
Xerolls and similar inclusions—40 percent
Contrasting inclusions—10 percent

Characteristics of the Rock Outcrop

Position on landscape: Escarpments, mountainsides
Kind of rock: Tuff, basalt, rhyolite

Characteristics of the Xerolls

Position on landscape: North- and south-facing mountainsides and escarpments

Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,000 to 7,200 feet
Climatic factors:
Mean annual precipitation—14 to 28 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March
Reference profile:
0 to 4 inches—dark brown extremely stony loam
4 to 11 inches—dark brown extremely cobbly loam
11 to 27 inches—dark yellowish brown extremely cobbly loam
27 inches—basalt
Depth class: Shallow to very deep (10 to 70 inches) to bedrock
Drainage class: Somewhat excessively drained and well drained
Permeability: Moderately rapid to moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Severe and very severe

Contrasting Inclusions

- Booth soils that are on adjacent benches and hillsides and have low sagebrush in the potential plant community
- Polander, Rogger, and Woodchopper soils that are on adjacent mountainsides and support dominantly ponderosa pine and white fir
- Rubble land

Major Uses

Watershed, livestock grazing

Major Management Factors

Slope, Rock outcrop, depth to bedrock, rock fragments in some areas

Dominant Vegetation in Potential Plant Community

Xerolls, north-facing—Idaho fescue, curlleaf mountainmahogany, common snowberry, mountain big sagebrush, isolated ponderosa pine
Xerolls, south-facing—bluebunch wheatgrass, mountain big sagebrush, some Idaho fescue and western juniper

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Livestock prefer to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
- Uniform distribution of livestock is difficult because of the slope and the lack of permanent water developments.
- This unit provides food and cover for wildlife.
- Livestock tend to herd and graze in the less stony areas of this unit.
- The depth to bedrock in some areas restricts rooting depth and placement of fenceposts.
- The low available water capacity in some areas limits forage production and seedling survival.
- The extremely stony surface layer, areas of Rock outcrop, and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.

Suitable management practices:
- Delay grazing until summer when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the soil surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate a short, cool growing season.

234F—Rock outcrop-Xerolls complex, warm, 20 to 50 percent slopes

Composition

Rock outcrop—55 percent
Xerolls and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Rock Outcrop

Position on landscape: Hillsides, escarpments
Kind of rock: Tuff, basalt

Characteristics of the Xerolls

Position on landscape: Benches and hillsides that have slopes of 20 to 35 percent
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 4,700 to 5,300 feet
Climatic factors:
Mean annual precipitation—10 to 14 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days

Reference profile:
0 to 3 inches—dark brown very stony loam
3 to 10 inches—dark brown very cobbly clay loam
10 to 25 inches—dark yellowish brown very cobbly loam
12 inches—tuff

Depth class: Shallow to very deep (10 to 70 inches) to bedrock
Drainage class: Moderately well drained and well drained
Permeability: Moderate and moderately rapid
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Lorella soils that are on adjacent hillsides and have dominantly bluebunch wheatgrass and Wyoming big sagebrush in the potential plant community
• Redcanyon soils that are on adjacent steep escarpments and have dominantly bluebunch wheatgrass and Wyoming big sagebrush in the potential plant community
• Soils that have slopes of less than 20 percent or more than 50 percent
• Rubble land

Major Uses

Watershed, livestock grazing

Major Management Factors

Slope; water erosion; Rock outcrop; rock fragments, depth to bedrock, and available water capacity in some areas

Dominant Vegetation in Potential Plant Community

Xerolls—Sandberg bluegrass, low sagebrush

Livestock Grazing

General management considerations:
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock tend to herd and graze in the less stony areas of this unit.
• The depth to bedrock in some areas restricts the rooting depth and placement of fenceposts.
• The low available water capacity in some areas limits forage production and seedling survival.
• Slope and the areas of Rock outcrop restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the soil surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness.

235E—Rogger very gravelly fine sandy loam, 15 to 40 percent north slopes

Composition

Rogger soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Rogger Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days

Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—ponderosa pine and white fir needles
0 to 5 inches—very dark brown very gravelly fine sandy loam
5 to 12 inches—very dark grayish brown very gravelly fine sandy loam
12 to 21 inches—dark yellowish brown very gravelly fine sandy loam
21 to 36 inches—dark yellowish brown very cobbly loam
36 inches—weathered basalt

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Woodchopper soils that are on adjacent mountainsides

• Soils that are similar to the Rogger soil but are less than 35 percent rock fragments throughout
• Soils that are similar to the Rogger soil but have bedrock at a depth of 40 to 60 inches
• Soils on south-facing slopes

Major Use

Woodland

Major Management Factors

Depth to bedrock, water erosion, available water capacity, slope, rock fragments

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 69 cubic feet per acre per year for ponderosa pine at age 40 and 91 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 225 board feet per acre per year for ponderosa pine at age 150

General management considerations:
• Wet, unsurfaced roads and skid trails are firm.
• Dry, unsurfaced roads and skid trails are dusty.
• The rock fragments make tree planting difficult.
• Cuts and fills ravel when dry.
• Accumulations of snow can bend or break small trees.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• The bedrock restricts rooting depth.
• Because this soil is droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

235G—Rogger very gravelly fine sandy loam, 40 to 60 percent north slopes

Composition

Rogger soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Rogger Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—ponderosa pine and white fir needles
0 to 5 inches—very dark brown very gravelly fine sandy loam
5 to 12 inches—very dark grayish brown very gravelly fine sandy loam
12 to 21 inches—dark yellowish brown very gravelly fine sandy loam
21 to 36 inches—dark yellowish brown very cobbly loam
36 inches—weathered basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Chocktoot soils that are on mountainsides at higher elevations
• Polander and Twelvemile soils that are on adjacent mountainsides
• Soils that are similar to the Rogger soil but are less than 35 percent rock fragments throughout

• Soils that are similar to the Rogger soil but have bedrock at a depth of 40 to 60 inches

Major Use

Woodland

Major Management Factors

Slope, water erosion, depth to bedrock, available water capacity, rock fragments

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 69 cubic feet per acre per year for ponderosa pine at age 40; 91 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 225 board feet per acre per year for ponderosa pine at age 150

General management considerations:
• Wet, unsurfaced roads are firm.
• Dry, unsurfaced roads are dusty.
• The rock fragments make tree planting difficult.
• Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
• Cuts and fills ravel when dry.
• The bedrock restricts rooting depth.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
• Accumulations of snow can bend or break small trees.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
• Because this soil is droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• To minimize soil displacement, use cable yarding systems.
• To minimize compaction and erosion, avoid logging in spring when the soils are wet.
• Leave slash on the soil to minimize sheet and rill erosion.
• Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
• Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

236G—Rogger-Bullump association, 40 to 60 percent north slopes

Composition

Rogger soil and similar inclusions—55 percent
Bullump soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Rogger Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 6,000 to 6,300 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—ponderosa pine and white fir needles
0 to 5 inches—very dark brown very gravelly fine sandy loam
5 to 12 inches—very dark grayish brown very gravelly fine sandy loam
12 to 21 inches—dark yellowish brown very gravelly fine sandy loam
21 to 36 inches—dark yellowish brown very cobbly loam
36 inches—weathered basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Severe

Characteristics of the Bullump Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite, tuff, basalt
Elevation: 6,000 to 6,300 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days

Typical profile:
0 to 11 inches—very dark grayish brown extremely gravelly loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Nuss soils that are on hillsides and have curlleaf mountainmahogany in the potential plant community
• Chocktoot, Polander, and Twelvemile soils that are in higher lying areas on mountainsides
• Rock outcrop
• Soils that have slopes of less than 40 percent or more than 60 percent
• Soils that are similar to the Rogger soil but have bedrock at a depth of 40 to 60 inches
• Soils that are similar to the Rogger soil but are very cobbly clay or clay throughout

Major Uses

Rogger soil—woodland
Bullump soil—livestock grazing

Major Management Factors

Rogger soil—water erosion, slope, available water capacity, depth to bedrock, rock fragments
Bullump soil—water erosion, slope

Dominant Vegetation in Potential Plant Community

Rogger soil—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass
Bullump soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Sandberg bluegrass

Livestock Grazing

Bullump soil

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Livestock tend to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
• Slope restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The rock fragments limit the placement of fenceposts.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the soil surface, and maintaining adequate plant cover.
• If this soil is seeded, select plants that tolerate a cool growing season.

Woodland

Rogger soil

Estimated growth at culmination of mean annual increment: 69 cubic feet per acre per year for ponderosa pine at age 40 and 91 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 225 board feet per acre per year for ponderosa pine at age 150

General management considerations:
• Wet, unsurfaced roads are firm.
• Dry, unsurfaced roads are dusty.
• The rock fragments make tree planting difficult.
• Cuts and fills ravel when dry.
• Roads located at midslope are difficult to maintain and require large cuts and fills.
• The bedrock restricts rooting depth.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
• Accumulations of snow can bend or break small trees.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
• Because this soil is droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• To minimize soil displacement, use cable yarding systems.
• To minimize compaction and erosion, avoid logging in spring when the soil is wet.
• Leave slash on the soil to minimize sheet and rill erosion.
• Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
• Reduce the risk of erosion on temporary roads by

seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

237E—Rogger-Polander complex, 15 to 40 percent north slopes

Composition

Rogger soil and similar inclusions—60 percent
Polander soil and similar inclusions—30 percent
Contrasting inclusions—10 percent

Characteristics of the Rogger Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—ponderosa pine and white fir needles
0 to 5 inches—very dark brown very gravelly fine sandy loam
5 to 12 inches—very dark grayish brown very gravelly fine sandy loam
12 to 21 inches—dark yellowish brown very gravelly fine sandy loam
21 to 36 inches—dark yellowish brown very cobbly loam
36 inches—weathered basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Severe

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Mound, Twelvemile, and Woodchopper soils that are on adjacent mountainsides
- Soils on south-facing slopes

Major Use

Woodland

Major Management Factors

Rogger soil—depth to bedrock, water erosion, available water capacity, slope, rock fragments
Polander soil—slope, water erosion

Dominant Vegetation in Potential Plant Community

Rogger and Polander soils—white fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: Rogger soil—69 cubic feet per acre per year for ponderosa pine at age 40 and 91 cubic feet per acre per year for white fir at age 70; Polander soil—55 cubic feet per acre per year for ponderosa pine at age 50 and 57 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): Rogger soil—225 board feet per acre per year for ponderosa pine at age 150; Polander soil—172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
- Wet, unsurfaced roads and skid trails on the Rogger soil are firm, and those on the Polander soil are soft.
- Dry, unsurfaced roads and skid trails are dusty.
- The rock fragments in the Rogger soil make tree planting difficult.
- The bedrock in the Rogger soil restricts rooting depth.

• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• Accumulations of snow can bend or break small trees.
• Because the Rogger soil is droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soils are wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

238E—Royst-Nuss complex, 2 to 30 percent slopes

Composition

Royst soil and similar inclusions—50 percent
Nuss soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Royst Soil

Position on landscape: Hills
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 20 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
2 inches to 0—ponderosa pine needles and twigs, mountain big sagebrush leaves
0 to 4 inches—black very stony loam
4 to 27 inches—dark brown extremely stony clay
27 to 29 inches—fractured, partially weathered tuff
29 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 27 inches

Characteristics of the Nuss Soil

Position on landscape: Hills
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 20 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown stony loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Booth soils that are on hills, benches, and foot slopes and have low sagebrush in the potential plant community
• Bullump soils that are on hills and mountains
• Winterim soils that are on plateaus and mountains and have dominantly ponderosa pine in the potential plant community
• Soils that have slopes of less than 2 percent or more than 30 percent
• Rock outcrop

Major Uses

Royst soil—livestock grazing and woodland
Nuss soil—livestock grazing

Major Management Factors

Royst soil—stones on the surface, available water capacity, permeability, water erosion, slope, depth to bedrock, shrink-swell potential
Nuss soil—stones on the surface, available water capacity, depth to bedrock, water erosion, slope

Dominant Vegetation in Potential Plant Community

Royst soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Ross sedge
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass

Livestock Grazing

Royst and Nuss soils

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Livestock herd and graze in the less stony areas of this unit.
- The bedrock restricts rooting depth.
- The low available water capacity limits forage production and seedling survival.
- The shallow depth of the Nuss soil limits placement of fenceposts
- The stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The Royst soil expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.
- Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

Woodland

Royst soil

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 100 board feet per acre per year for ponderosa pine at age 190

General management considerations:
- Wet, unsurfaced roads and skid trails are firm.
- The clayey subsoil restricts permeability.
- The rock fragments on the surface make tree planting and the operation of ground seeding equipment difficult.
- The bedrock restricts rooting depth.
- Trees may be blown down during periods of wetness and high winds.
- Cuts and fills are stable.
- Because this soil is hot in summer and droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
- To minimize compaction, use designated skid trails and low-pressure ground equipment and avoid logging in spring when the soil is wet.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
- Control competing vegetation by mechanical treatment, chemical treatment, or livestock grazing.

239F—Royst-Nuss-Rock outcrop complex, 30 to 50 percent north slopes

Composition

Royst soil and similar inclusions—35 percent
Nuss soil and similar inclusions—30 percent
Rock outcrop—20 percent
Contrasting inclusions—15 percent

Characteristics of the Royst Soil

Position on landscape: Hillsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 20 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
2 inches to 0—ponderosa pine needles and twigs, mountain big sagebrush leaves
0 to 4 inches—black very stony loam
4 to 27 inches—dark brown extremely stony clay
27 to 29 inches—fractured, partially weathered tuff
29 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches

Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 27 inches

Characteristics of the Nuss Soil

Position on landscape: Hillsides
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 20 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown stony loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Characteristics of the Rock Outcrop

Position on landscape: Hillsides
Kind of rock: Tuff, basalt

Contrasting Inclusions

- Booth soils that are on hillsides, benches, and foot slopes and have low sagebrush in the potential plant community
- Bullump soils that are on hillsides
- Winterim soils that are on mountainsides and have dominantly ponderosa pine in the potential plant community
- Mound soils that are on mountainsides and have white fir in the potential plant community
- Soils that have slopes of less than 30 percent or more than 50 percent
- Rubble land

Major Uses

Royst soil—livestock grazing, woodland
Nuss soil—livestock grazing

Major Management Factors

Royst soil—slope, stones on the surface, available water capacity, water erosion, permeability, shrink-swell potential, depth to bedrock, Rock outcrop
Nuss soil—slope, stones on the surface, water erosion, available water capacity, depth to bedrock, Rock outcrop

Dominant Vegetation in Potential Plant Community

Royst soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Ross sedge
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass

Livestock Grazing

Royst and Nuss soils

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
- The low available water capacity limits forage production and seedling survival.
- The bedrock restricts rooting depth.
- Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
- Livestock herd and graze in the less stony areas of this unit.
- The stony surface layer, areas of Rock outcrop, and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The shallow depth and stones on the surface of the Nuss soil and the areas of Rock outcrop limit placement of fenceposts.
- The Royst soil expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
- Delay grazing until summer when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

Woodland

Royst soil

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 100 board feet per acre per year for ponderosa pine at age 190

General management considerations:
- Wet, unsurfaced roads are firm.
- The rock fragments on the surface make tree planting and the operation of ground seeding equipment difficult.
- The bedrock restricts rooting depth.
- Trees may be blown down during periods of wetness and high winds.
- Cuts and fills slough when wet.
- The clayey subsoil restricts permeability.
- Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
- To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
- The areas of Rock outcrop force yarding and skidding paths to converge, which increases the risks of compaction and erosion.
- Because this soil is hot in summer and droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
- To minimize soil displacement, use cable yarding systems.
- To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
- Leave slash on the soil to minimize sheet and rill erosion.
- Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the surface, or accumulating slash on the surface.
- To minimize compaction, displacement, and erosion, restrict the use of equipment to periods when the soil is dry or frozen.
- Control competing vegetation mechanical treatment, chemical treatment, or livestock grazing.

240F—Royst-Nuss-Rock outcrop complex, 30 to 50 percent south slopes

Composition

Royst soil and similar inclusions—35 percent
Nuss soil and similar inclusions—30 percent
Rock outcrop—20 percent
Contrasting inclusions—15 percent

Characteristics of the Royst Soil

Position on landscape: Hillsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 20 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
2 inches to 0—ponderosa pine needles and twigs, mountain big sagebrush leaves
0 to 4 inches—black very stony loam
4 to 27 inches—dark brown extremely stony clay
27 to 29 inches—fractured, partially weathered tuff
29 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 27 inches

Characteristics of the Nuss Soil

Position on landscape: Hillsides
Parent material: Kind—residuum; source—tuff, basalt
Elevation: 5,500 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 20 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—very dark grayish brown stony loam
3 to 17 inches—very dark grayish brown clay loam
17 to 19 inches—fractured, partially weathered tuff
19 inches—tuff
Depth class: Shallow (12 to 20 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 2 inches
Hazard of erosion by water: Severe

Characteristics of the Rock Outcrop

Position on landscape: Hillsides
Kind of rock: Tuff, basalt

Contrasting Inclusions

- Booth soils that are on hillsides, benches, and foot slopes and have low sagebrush in the potential plant community
- Bullump soils that are on hillsides
- Winterim soils that are on mountainsides and have dominantly ponderosa pine in the potential plant community

• Soils that have slopes of less than 30 percent or more than 50 percent
• Rubble land

Major Uses

Royst soil—livestock grazing, woodland
Nuss soil—livestock grazing

Major Management Factors

Royst soil—slope, stones on the surface, available water capacity, water erosion, permeability, shrink-swell potential, depth to bedrock, Rock outcrop
Nuss soil—slope, stones on the surface, water erosion, available water capacity, depth to bedrock, Rock outcrop

Dominant Vegetation in Potential Plant Community

Royst soil—Idaho fescue, bluebunch wheatgrass, antelope bitterbrush, Ross sedge
Nuss soil—Idaho fescue, curlleaf mountainmahogany, mountain big sagebrush, Cusick bluegrass

Livestock Grazing

Royst and Nuss soils

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The bedrock restricts rooting depth.
• The low available water capacity limits forage production and seedling survival.
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of this unit.
• The stony surface layer, areas of Rock outcrop, and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The shallow depth and stones on the surface of the Nuss soil and the areas of Rock outcrop limit placement of fenceposts.
• The Royst soil expands when wet and contracts when dry, which makes special design of fences necessary.
• The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

Woodland

Royst soil

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 100 board feet per acre per year for ponderosa pine at age 190

General management considerations:
• Wet, unsurfaced roads are firm.
• The rock fragments on the surface make tree planting and the operation of ground seeding equipment difficult.
• The bedrock restricts rooting depth.
• Trees may be blown down during periods of wetness and high winds.
• Cuts and fills slough when wet.
• The clayey subsoil restricts permeability.
• Artificial or natural shade increases seedling survival.
• Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
• The areas of Rock outcrop force yarding and skidding paths to converge, which increases the risks of compaction and erosion.
• Because the soils on south-facing slopes are hot in summer and droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
• To minimize soil displacement, use cable yarding systems.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Leave slash on the soil to minimize sheet and rill erosion.
• Use shade cards to increase seedling survival.
• Reduce the risk of erosion on temporary roads by

seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
• To minimize compaction, displacement, and erosion, restrict the use of equipment to periods when the soil is dry or frozen.
• Control competing vegetation by mechanical treatment, chemical treatment, or livestock grazing.

241G—Rubble land-Fitzwater complex, 30 to 70 percent south slopes

Composition

Rubble land—45 percent
Fitzwater soil, thin surface, and similar inclusions—25 percent
Fitzwater soil and similar inclusions—20 percent
Contrasting inclusions—10 percent

Characteristics of the Rubble land

Position on landscape: Escarpments, mountainsides
Parent material: Kind—colluvium; source—basalt, tuff

Characteristics of the Fitzwater Soils

Position on landscape: Escarpments, mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,800 to 7,000 feet
Climatic factors:
Mean annual precipitation—12 to 18 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile of the Fitzwater soil, thin surface:
0 to 3 inches—very dark grayish brown extremely stony loam
3 to 19 inches—dark brown extremely cobbly clay loam
19 to 60 inches—dark brown extremely cobbly loam
Typical profile of the Fitzwater soil:
0 to 10 inches—very dark grayish brown extremely stony loam
10 to 19 inches—dark brown extremely cobbly clay loam
19 to 60 inches—dark brown extremely cobbly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 2 inches
Hazard of erosion by water: Severe or very severe

Contrasting Inclusions

• Harcany soils that are on south-facing mountainsides at the higher elevations
• Newlands soils that are on adjacent foot slopes and north-facing mountainsides
• Rock outcrop

Major Uses

Watershed, livestock grazing

Major Management Factors

Slope, stones on the surface and in the soil, water erosion, available water capacity, Rubble land

Dominant Vegetation in Potential Plant Community

Fitzwater soil, thin surface —Idaho fescue, low sagebrush, bluebunch wheatgrass
Fitzwater soil—bluebunch wheatgrass, mountain big sagebrush

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The low available water capacity limits forage production and seedling survival.
• Livestock herd and graze in the less stony areas of this unit.
• Livestock prefer to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
• The areas of Rubble land, the extremely stony surface layer, and the slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The rock fragments throughout the soil and the areas of Rubble land restrict the placement of fenceposts.
• The earlier growing season on the south-facing slopes permits earlier grazing on these slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

242C—Rutab very gravelly sandy loam, 2 to 15 percent slopes

Composition

Rutab soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Rutab Soil

Position on landscape: Alluvial fans
Parent material: Kind—alluvium; source—tuff, basalt
Elevation: 5,100 to 5,800 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 3 inches—dark brown very gravelly sandy loam
3 to 8 inches—brown very gravelly loam
8 to 30 inches—brown very gravelly sandy loam
30 to 44 inches—brown very gravelly loamy coarse sand
44 to 60 inches—yellowish brown extremely gravelly loamy sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate over rapid
Available water capacity: About 3 inches
Hazard of erosion: By water—slight or moderate; by wind—slight or moderate
Carbonates: Between depths of 25 and 35 inches—strongly effervescent

Contrasting Inclusions

- Coztur and Felcher soils on mountainsides
- Rock outcrop
- Ninemile soils that are on tablelands and have dominantly low sagebrush in the potential plant community

Major Use

Livestock grazing

Major Management Factors

Available water capacity, water erosion, wind erosion, permeability of the lower part

Dominant Vegetation in Potential Plant Community

Thurber needlegrass, Sandberg bluegrass, Wyoming big sagebrush

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The risk of seepage limits the construction of livestock watering ponds and other water impoundments.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness.

243B—Salisbury loam, 0 to 5 percent slopes

Composition

Salisbury soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Salisbury Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—rhyolite, tuff, basalt
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 11 inches—very dark brown and very dark grayish brown loam
11 to 16 inches—dark brown clay
16 to 20 inches—dark brown clay loam
20 to 28 inches—dark brown, indurated hardpan
28 to 43 inches—dark grayish brown, strongly cemented hardpan
43 to 60 inches—yellowish brown silt loam
Depth class: Shallow (10 to 20 inches) to the claypan; moderately deep (20 to 40 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow

Available water capacity: About 4 inches
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 11 and 16 inches

Contrasting Inclusions

- Drews soils that are on slightly lower lying lake terraces
- Oxwall soils that are on adjacent lake terraces and have low sagebrush in the potential plant community
- Donica soils that are on alluvial fans on adjacent lake terraces
- Soils that have slopes of more than 5 percent

Major Uses

Livestock grazing, cropland

Major Management Factors

Depth to the claypan, depth to the hardpan, permeability, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- The claypan and hardpan restrict rooting depth.
- The surface layer is saturated following snowmelt.
- The soil expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
- Delay grazing until the surface layer is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate shrinking and swelling.
- Seed on the contour to minimize erosion.

Cropland

General management considerations:
- Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated. A suitable cropping system includes small grain and summer fallow.
- Suitable irrigation methods include sprinkler and border systems.
- If border irrigation is used, leveling is needed for uniform application of water.
- To avoid exposing the claypan and hardpan during land leveling, land smoothing that involves only shallow cuts is best suited.
- The depth to the claypan and hardpan limits rooting depth.
- Irrigation water management is needed to prevent the buildup of a perched water table above the claypan.
- When the soil is dry, subsoiling or deep plowing to rip the hardpan can increase the effective rooting depth and improve internal drainage.
- A wide variety of trees and shrubs can be used for windbreaks and environmental plantings on this soil.
- The seedling mortality rate is severe because the high content of clay causes moisture stress.

Suitable management practices:
- Irrigate during the dry period in summer.
- Apply water slowly over a long period to ensure that the root zone is properly wetted.
- Because of the slow permeability of the subsoil, manage irrigation water so that it does not pond on the surface and damage crops.
- Use minimum tillage and return crop residue to the soil to reduce compaction and improve soil tilth.
- Cultivate or apply herbicides to control competing vegetation.

243C—Salisbury loam, 5 to 15 percent slopes

Composition

Salisbury soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Salisbury Soil

Position on landscape: Lake terraces
Parent material: Kind—alluvium, lacustrine sediment; source—rhyolite, tuff, basalt
Elevation: 4,700 to 5,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 11 inches—very dark brown and very dark grayish brown loam
11 to 16 inches—dark brown clay
16 to 20 inches—dark brown clay loam
20 to 28 inches—dark brown, indurated hardpan
28 to 43 inches—dark grayish brown, strongly cemented hardpan
43 to 60 inches—yellowish brown silt loam
Depth class: Shallow (10 to 20 inches) to the claypan;

moderately deep (20 to 40 inches) to the hardpan; very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 11 and 16 inches

Contrasting Inclusions

• Drews soils that are on slightly lower lying lake terraces
• Oxwall soils that are on adjacent lake terraces and have low sagebrush in the potential plant community
• Donica soils that are on alluvial fans on adjacent lake terraces
• Soils that have slopes of less than 5 percent or more than 15 percent

Major Uses

Livestock grazing, cropland

Major Management Factors

Slope, permeability, depth to the claypan, depth to the hardpan, shrink-swell potential, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• The claypan and hardpan restrict rooting depth.
• The surface layer is saturated during snowmelt.
• The soil expands when wet and contracts when dry, which makes special design of fences necessary.

Suitable management practices:
• Delay grazing until the surface layer is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling.
• Seed on the contour or across the slope where practical.

Cropland

General management considerations:
• Because of the limited precipitation, continuous cropping is suitable only if the soil is irrigated. A suitable cropping system includes small grain and summer fallow.
• Because of the slope, this soil is best suited to sprinkler irrigation.
• The depth to the claypan and hardpan limits rooting depth.
• Irrigation water management is needed to prevent the buildup of a perched water table above the claypan.
• A wide variety of trees and shrubs can be used for windbreaks and environmental plantings.
• The seedling mortality rate is severe because the high content of clay causes moisture stress.
• When the soil is dry, subsoiling or deep plowing to rip the hardpan can increase the effective rooting depth and improve internal drainage.

Suitable management practices:
• Irrigate during the dry period in summer.
• Regulate the application of irrigation water to control runoff and erosion.
• Reduce the risk of erosion by farming across the slope or along the contour.
• Cultivate or apply herbicides to control competing vegetation.

244D—Sherval very cobbly loam, 5 to 20 percent slopes

Composition

Sherval soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Sherval Soil

Position on landscape: Concave areas on mountains (see fig. 20, next page)

Figure 20.—Aspen in an area of Sherval very cobbly loam, 5 to 20 percent slopes.

Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,800 to 7,400 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—30 to 50 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—partially decomposed grass and aspen leaves
0 to 9 inches—very dark grayish brown very cobbly loam
9 to 24 inches—dark brown very cobbly clay loam
24 to 38 inches—dark brown very gravelly clay loam
24 to 60 inches—dark yellowish brown very gravelly clay
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Moderately well drained
Permeability: Slow
Available water capacity: About 6 inches
Hazard of erosion by water: Moderate or severe
Depth to seasonal high water table: January through June—12 to 24 inches; rest of year—more than 24 inches

Contrasting Inclusions

• Cressler soils that are in upland basins and have tufted hairgrass in the potential plant community
• Rogger and Woodchopper soils that are on plateaus and mountainsides and have white fir and ponderosa pine in the potential plant community
• Seeps or springs
• Soils that are similar to the Sherval soil but have bedrock at a depth of less than 60 inches

Major Uses

Watershed, wildlife habitat, livestock grazing

Major Management Factors

Seasonal wetness, permeability, slope, water erosion

Dominant Vegetation in Potential Plant Community

Quaking aspen, Leiberg bluegrass, common snowberry, slender wheatgrass, big bluegrass, mountain big sagebrush

Livestock Grazing

General management considerations:
• Cold soil temperatures, a short growing season, and extended periods of snow cover limit plant growth.
• The water table rises if trees are removed.
• Development of springs for livestock and wildlife is feasible.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a cool growing season.

245C—Simon-Anawalt complex, 2 to 15 percent slopes

Composition

Simon soil and similar inclusions—50 percent
Anawalt soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Simon Soil

Position on landscape: Terraces adjacent to drainageways on tablelands
Parent material: Kind—alluvium, lacustrine sediment; source—basalt, tuff

Elevation: 5,300 to 6,300 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 14 inches—very dark grayish brown silt loam
14 to 22 inches—dark yellowish brown gravelly clay loam
22 to 40 inches—brown sandy clay loam
40 to 50 inches—yellowish brown sandy loam
50 to 60 inches—olive loamy fine sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Slight or moderate

Characteristics of the Anawalt Soil

Position on landscape: Tablelands
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,300 to 6,300 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown loam
4 to 9 inches—very dark grayish brown loam
9 to 17 inches—dark brown clay
17 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (12 to 20 inches) to bedrock, very shallow (3 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 9 and 17 inches

Contrasting Inclusions

• Rock outcrop
• Swalesilver soils that are in depressions and have dominantly silver sagebrush in the potential plant community
• Deseed soils that have dominantly Wyoming big sagebrush in the potential plant community

Major Use

Livestock grazing

Major Management Factors

Simon soil—water erosion
Anawalt soil—depth to the claypan, depth to bedrock, available water capacity, shrink-swell potential, permeability, water erosion

Dominant Vegetation in Potential Plant Community

Simon soil—basin wildrye, basin big sagebrush
Anawalt soil—bluebunch wheatgrass, low sagebrush, Sandberg bluegrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The claypan and bedrock in the Anawalt soil restrict rooting depth.
• The surface layer of the Anawalt soil is saturated following snowmelt.
• The shallow depth of the Anawalt soil limits placement of fenceposts.
• The depth to bedrock in the Anawalt soil limits construction of water impoundments.
• Pedestaled plants and an erosion pavement on the Anawalt soil are the result of past erosion.
• The subsoil of the Anawalt soil expands when wet and contracts when dry, which can rip and tear plant roots.
• Because of the high corrosivity of the Anawalt soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Anawalt soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Simon soil is seeded, select plants that tolerate a cool growing season.
• If the Anawalt soil is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

246A—Spangenburg complex, 0 to 2 percent slopes

Composition

Spangenburg soil, thick surface, and similar inclusions—45 percent
Spangenburg soil and similar inclusions—40 percent
Contrasting inclusions—15 percent

Characteristics of the Spangenburg Soils

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,000 to 5,300 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile of the Spangenburg soil, thick surface:
0 to 4 inches—very dark grayish brown very fine sandy loam
4 to 15 inches—very dark grayish brown loam
15 to 27 inches—very dark grayish brown clay
27 to 50 inches—dark brown silty clay loam
50 to 60 inches—dark yellowish brown extremely gravelly coarse sand
Typical profile of the Spangenburg soil:
0 to 4 inches—very dark grayish brown very fine sandy loam
4 to 10 inches—very dark grayish brown loam
10 to 22 inches—very dark grayish brown clay
22 to 45 inches—dark brown silty clay loam
45 to 60 inches—dark yellowish brown extremely gravelly coarse sand
Depth class: Spangenburg soils—very deep (more than 60 inches) to bedrock, moderately deep and deep (30 to 50 inches) to the gravelly sand layer; Spangenburg soil, thick surface—shallow (10 to 15 inches) to the claypan; Spangenburg soil—very shallow (2 to 10 inches) to the claypan
Drainage class: Well drained
Permeability: Slow over rapid
Available water capacity: About 8 inches
Hazard of erosion: By water—slight; by wind—moderate
Shrink-swell potential: Spangenburg soil, thick surface—high between depths of 15 and 27 inches; Spangenburg soil—high between depths of 10 and 22 inches
Carbonates: Spangenburg soil, thick surface—strongly effervescent between depths of 27 and 50 inches; Spangenburg soil—strongly effervescent between depths of 22 and 45 inches

Contrasting Inclusions

• Swalesilver soils that are on adjacent, slightly lower lying lake terraces and have dominantly silver sagebrush in the potential plant community

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Spangenburg soil, thick surface—permeability, depth to the claypan, shrink-swell potential, calcareous layer
Spangenburg soil—depth to the claypan, shrink-swell potential, permeability, calcareous layer

Dominant Vegetation in Potential Plant Community

Spangenburg soil, thick surface—Indian ricegrass, needleandthread, Thurber needlegrass, Wyoming big sagebrush
Spangenburg soil—Wyoming big sagebrush, bottlebrush squirreltail, Sandberg bluegrass

Livestock Grazing

General management considerations:
• The claypan restricts rooting depth and permeability.
• The rapid permeability of the substratum restricts development of livestock watering ponds.
• Maintaining the thickness of the surface layer is critical to the management of the plant community.
• Crusting on the soil surface reduces infiltration and restricts seedling emergence and survival.
• Short periods of ponding occur in spring because of the shallow depth to the slowly permeable claypan.
• The low precipitation limits forage production and seedling survival.
• The soil expands when wet and contracts when dry, which can rip and tear plant roots and makes special design of fences necessary.
• Wind erosion is a concern if the vegetation is removed or degraded.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
• The seedling mortality rate is severe because the high content of clay causes moisture stress.

Suitable management practices:
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.

• Increase the water intake rate and minimize the risk of wind erosion by maintaining and improving the plant cover and accumulating litter on the surface.
• If this unit is seeded, select plants that tolerate droughtiness.
• Manage unpalatable brushy plants in areas where these plants are abundant.
• Cultivate or apply herbicides to control competing vegetation.

247A—Spangenburg-Berdugo complex, 0 to 2 percent slopes

Composition

Spangenburg soil and similar inclusions—35 percent
Spangenburg soil, thick surface, and similar inclusions—30 percent
Berdugo soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the Spangenburg Soils

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,000 to 5,300 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile of the Spangenburg soil:
0 to 4 inches—very dark grayish brown very fine sandy loam
4 to 10 inches—very dark grayish brown loam
10 to 22 inches—very dark grayish brown clay
22 to 45 inches—dark brown silty clay loam
45 to 60 inches—dark yellowish brown extremely gravelly coarse sand
Typical profile of the Spangenburg soil, thick surface:
0 to 4 inches—very dark grayish brown very fine sandy loam
4 to 15 inches—very dark grayish brown loam
15 to 27 inches—very dark grayish brown clay
27 to 50 inches—dark brown silty clay loam
50 to 60 inches—dark yellowish brown extremely gravelly coarse sand
Depth class: Spangenburg soils—very deep (more than 60 inches) to bedrock, moderately deep or deep (30 to 50 inches) to the gravelly sand layer; Spangenburg soil—very shallow (2 to 10 inches) to the claypan; Spangenburg soil, thick surface—shallow (10 to 20 inches) to the claypan
Drainage class: Well drained
Permeability: Slow over rapid
Available water capacity: About 8 inches
Hazard of erosion: By water—slight; by wind—moderate
Shrink-swell potential: Spangenburg soil—high between depths of 10 and 22 inches; Spangenburg soil, thick surface—high between depths of 15 and 27 inches
Carbonates: Spangenburg soil—strongly effervescent between depths of 22 and 45 inches; Spangenburg soil, thick surface—strongly effervescent between depths of 27 and 50 inches

Characteristics of the Berdugo Soil

Position on landscape: Lake terraces
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,000 to 5,300 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 5 inches—dark brown fine sandy loam
5 to 10 inches— brown clay
10 to 19 inches—brown silty clay loam
19 to 39 inches—very dark grayish brown clay loam
39 to 50 inches—olive brown very fine sandy loam
50 to 60 inches—olive brown loamy sand
Depth class: Very deep (more than 60 inches) to bedrock; very shallow (1 to 5 inches) to the claypan; moderately deep or deep (20 to 50 inches) to the loamy sand layer
Drainage class: Well drained
Permeability: Slow over rapid
Available water capacity: About 5 inches
Hazard of erosion: By water—slight; by wind—moderate
Sodicity: Between depths of 19 and 50 inches—slightly sodic or moderately sodic
Carbonates: Between depths of 19 and 39 inches—violently effervescent

Contrasting Inclusions

• Swalesilver soils that are on adjacent, slightly lower lying lake terraces and have dominantly silver sagebrush in the potential plant community
• Playas

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Spangenburg soil—depth to the claypan, shrink-swell potential, permeability, calcareous layer
Spangenburg soil, thick surface—permeability, depth to the claypan, shrink-swell potential, calcareous layer
Berdugo soil—permeability, depth to the claypan, calcareous layer, sodicity

Dominant Vegetation in Potential Plant Community

Spangenburg soil—Wyoming big sagebrush, bottlebrush squirreltail, Sandberg bluegrass
Spangenburg soil, thick surface—Thurber needlegrass, Indian ricegrass, needleandthread, Wyoming big sagebrush
Berdugo soil—shadscale, spiny hopsage, bottlebrush squirreltail

Livestock Grazing

General management considerations:
- The claypan restricts rooting depth and permeability.
- The rapid permeability of the substratum restricts development of livestock watering ponds.
- Maintaining the thickness of the surface layer is critical to the management of the plant community.
- The low precipitation limits forage production and seedling survival.
- Crusting of the soil surface reduces infiltration and restricts seedling emergence and survival.
- Short periods of ponding occur early in spring because of the very shallow or shallow depth to the slowly permeable claypan.
- The Berdugo soil supports only sparse perennial grasses in the potential plant community, but it supports abundant annual forbs when the precipitation is adequate.
- Seeding areas of the more favorable Spangenburg soils in this unit is difficult because of the pattern in which they occur with areas of the less favorable Berdugo soil.
- The soils expand when wet and contract when dry, which can rip and tear plant roots.
- Wind erosion is a concern if the vegetation is removed.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness in summer.
- The seedling mortality rate is severe because the high content of clay causes moisture stress late in summer and in fall.

Suitable management practices:
- Delay grazing until the soils are firm and the preferred forage plants can withstand grazing pressure.
- Increase the water intake rate and minimize the risk of wind erosion by maintaining and improving the plant cover and accumulating litter on the surface.
- If the Spangenburg soils are seeded, select plants that tolerate droughtiness.
- If the Berdugo soil is seeded, select plants that tolerate droughtiness and sodicity.
- Cultivate or apply herbicides to control competing vegetation.

248A—Spangenburg-Swalesilver complex, 0 to 1 percent slopes

Composition

Spangenburg soil and similar inclusions—50 percent
Swalesilver soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Spangenburg Soil

Position on landscape: Lake terraces in areas slightly higher than the Swalesilver soil
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,100 to 5,300 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 4 inches—very dark grayish brown very fine sandy loam
4 to 15 inches—very dark grayish brown loam
15 to 27 inches—very dark grayish brown clay
27 to 50 inches—dark brown silty clay loam
50 to 60 inches—dark yellowish brown extremely gravelly coarse sand
Depth class: Very deep (more than 60 inches) to bedrock, shallow (10 to 15 inches) to the claypan, moderately deep or deep (30 to 50 inches) to the gravelly sand layer
Drainage class: Well drained
Permeability: Slow over rapid
Available water capacity: About 8 inches
Hazard of erosion: By water—none or slight; by wind—moderate
Shrink-swell potential: High between depths of 15 and 27 inches

Carbonates: Between depths of 27 and 50 inches—strongly effervescent

Characteristics of the Swalesilver Soil

Position on landscape: Lake terraces in areas slightly lower than the Spangenburg soil
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,100 to 5,300 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 5 inches—very dark gray, mottled loam
5 to 12 inches—very dark grayish brown clay
12 to 35 inches—very dark grayish brown silty clay
35 to 45 inches—dark brown loam
45 to 60 inches—brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, very shallow (2 to 10 inches) to the claypan
Drainage class: Somewhat poorly drained
Permeability: Upper 5 inches—moderate; between depths of 5 and 35 inches—very slow
Available water capacity: About 4 inches
Hazard of erosion by water: None or slight
Depth to perched water table: February through May—12 inches above the surface to 6 inches below the surface; rest of year—more than 6 inches
Shrink-swell potential: High between depths of 5 and 35 inches

Contrasting Inclusions

- Playas
- Locane soils that are on adjacent hillsides and mountainsides
- Soils that have slopes of more than 1 percent

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Spangenburg soil—permeability, depth to the claypan, shrink-swell potential, calcareous layer
Swalesilver soil—wetness, permeability, depth to the claypan, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Spangenburg soil—Indian ricegrass, Thurber needlegrass, Wyoming big sagebrush, needleandthread
Swalesilver soil—Nevada bluegrass, creeping wildrye, silver sagebrush

Livestock Grazing

General management considerations:
- The claypan restricts rooting depth and permeability.
- The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and makes special design of fences necessary.
- The rapid permeability of the substratum in the Spangenburg soil restricts development of excavated livestock ponds.
- The low precipitation limits forage production and seedling survival.
- Seeding areas of the more favorable Spangenburg soil is difficult because of the pattern in which they occur with areas of the Swalesilver soil.
- The Swalesilver soil provides food and cover for wetland wildlife.
- Grazing should be deferred during the period of nesting for waterfowl.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness in summer.
- The seedling mortality rate is severe because the high content of clay causes moisture stress late in summer and in fall.

Suitable management practices:
- Delay grazing until the Spangenburg soil is firm and the preferred forage plants can withstand grazing pressure.
- Allow the Swalesilver soil to drain adequately before grazing to prevent damage to the soil and plants.
- Excavated livestock watering ponds should be developed only in areas of the Swalesilver soil.
- If the Swalesilver soil is seeded, select plants that

tolerate wetness and that provide cover for nesting waterfowl.
- If the Spangenburg soil is seeded, select plants that tolerate droughtiness.
- Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.
- Cultivate or apply herbicides to control competing vegetation.

249A—Stockdrive fine sandy loam, 0 to 1 percent slopes

Composition

Stockdrive soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Stockdrive Soil

Position on landscape: Lake terraces (fig. 21)

Figure 21.—Basin wildrye in an area of Stockdrive fine sandy loam, 0 to 1 percent slopes, in foreground. West slope of Warner Mountains in background.

Parent material: Kind—eolian material over lacustrine sediment; source—tuff, basalt, rhyolite, volcanic ash
Elevation: 4,700 to 4,760 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 3 inches—brown fine sandy loam
3 to 6 inches—dark brown loam
6 to 12 inches—dark brown silty clay loam
12 to 29 inches—dark yellowish brown fine sandy loam
29 to 32 inches—dark yellowish brown very gravelly sand
32 to 34 inches—dark grayish brown extremely gravelly sand
34 to 38 inches—brown very gravelly sand
38 to 44 inches—dark brown sand
44 to 56 inches—dark brown silty clay loam
56 to 66 inches—dark yellowish brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep or deep (25 to 45 inches) to stratified sand and gravel
Drainage class: Somewhat poorly drained
Permeability: Upper part—slow; middle part—rapid; lower part—moderately slow
Available water capacity: About 2 inches
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to perched water table: March through May—6 inches above the surface to 48 inches below the surface; rest of year—below 48 inches
Salinity: Moderately saline or strongly saline
Sodicity: Strongly sodic
Carbonates: Upper 32 inches—violently effervescent

Contrasting Inclusions

- Thunderegg soils that are on adjacent, slightly lower lying lake terraces and have dominantly tufted hairgrass and Nebraska sedge in the potential plant community
- Lakeview soils that are on adjacent stream terraces and lake terraces and have dominantly basin big sagebrush and antelope bitterbrush in the potential plant community
- Goose Lake soils that are on adjacent, slightly lower lying lake terraces

Major Uses

Cropland, hayland, livestock grazing, wildlife habitat

Major Management Factors

Sodicity, salinity, available water capacity, wetness, permeability, wind erosion

Dominant Vegetation in Potential Plant Community

Basin wildrye, inland saltgrass, black greasewood

Livestock Grazing

General management considerations:
- This unit provides food and cover for wetland wildlife in spring.
- Grazing should be deferred during the period of nesting for waterfowl.
- Salts reduce the amount of water available to plants and restrict seedling survival.
- Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
- Dispersion and crusting of the soil surface reduce the water intake rate, which causes ponding, and restrict seedling emergence and survival.
- The low available water capacity limits forage production and seedling survival.
- Wind erosion is a concern if the vegetation is removed or degraded.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Range seeding controls blowing and drifting sand.
- The content of sodium in the soil can be reduced by applying proper amounts of soil amendments and then applying good-quality irrigation water to leach the salts.
- Drainage is difficult because the soil is nearly level and there is a lack of outlets.
- Because of the concentration of salts, trees and shrubs suitable for windbreaks and environmental plantings are limited and the seedling mortality rate is severe.

Suitable management practices:
- Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
- Minimize the risk of wind erosion by maintaining existing plant cover, seeding, and accumulating litter on the soil surface.
- If this unit is seeded, select plants that tolerate wetness, salinity, and sodicity and that provide cover for nesting waterfowl.

Cropland and Hayland

General management considerations:
- The concentration of salts and sodium limits the selection and production of hay and pasture plants and other crops.
- A high water table and ponding early in spring restrict rooting depth and plant survival.
- A seasonal high water table provides supplemental moisture for plants late in summer and in fall.
- Removing salts and sodium is difficult unless the soil is drained.
- Irrigation is needed to meet the needs of the crops grown and to leach salts below the root zone.
- This soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
- Irrigation and drainage are needed for intensive management.

Suitable management practices:
- Minimize the risk of wind erosion by keeping the surface rough and maintaining residue on the surface.
- Manage irrigation water to prevent a rise in the level of the water table and the subsequent upward movement of salts and sodium in the soil.

250A—Swalesilver loam, 0 to 2 percent slopes

Composition

Swalesilver soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Swalesilver Soil

Position on landscape: Depressions in tablelands
Parent material: Kind—lacustrine sediment; source—basalt, tuff
Elevation: 5,100 to 5,300 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile:
0 to 5 inches—very dark gray, mottled loam
5 to 12 inches—very dark grayish brown clay
12 to 35 inches—very dark grayish brown silty clay
35 to 45 inches—dark brown loam
45 to 60 inches—brown silt loam
Depth class: Very deep (more than 60 inches) to bedrock, very shallow (2 to 10 inches) to the claypan
Drainage class: Somewhat poorly drained

Permeability: Upper 5 inches—moderate; between depths of 5 and 35 inches—very slow
Available water capacity: About 4 inches
Hazard of erosion by water: Slight
Depth to perched water table: February through May—12 inches above the surface to 6 inches below the surface; rest of year—more than 6 inches
Shrink-swell potential: High between depths of 5 and 35 inches

Contrasting Inclusions

- Playas
- Locane soils that are on adjacent hillsides and mountainsides and have dominantly Wyoming big sagebrush in the potential plant community
- Spangenburg soils that are on adjacent, slightly higher lying lake terraces and have dominantly Wyoming big sagebrush in the potential plant community
- Mudpot soils that are adjacent, slightly lower lying interplateau basins
- Soils that have slopes of more than 2 percent

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Permeability, wetness, depth to the claypan, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Nevada bluegrass, creeping wildrye, silver sagebrush

Livestock Grazing

General management considerations:
- This unit provides food and cover for wetland wildlife early in spring.
- Grazing should be deferred during the period of nesting for waterfowl.
- The low precipitation limits forage production and seedling survival.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- A seasonal high water table and ponding early in the growing season restrict the rooting depth of non-water-tolerant plants.
- The claypan restricts rooting depth and permeability.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness in summer.
- The seedling mortality rate is severe because the high content of clay causes moisture stress late in summer and in fall.

Suitable management practices:
- Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
- If this soil is seeded, select plants that tolerate wetness and that provide cover for nesting waterfowl.
- Cultivate or apply herbicides to control competing vegetation.

251A—Tandy loamy fine sand, 0 to 1 percent slopes

Composition

Tandy soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Tandy Soil

Position on landscape: Alluvial flats in lake basins
Parent material: Kind—eolian material over lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,690 to 4,725 feet
Climatic factors:
Mean annual precipitation—14 to 16 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 9 inches—dark grayish brown loamy fine sand
9 to 12 inches—gray fine sandy loam
12 to 34 inches—very dark grayish brown loamy fine sand
34 to 40 inches—black silt loam
40 to 60 inches—stratified clay loam and loamy fine sand
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (20 to 40 inches) to the loamy substratum
Drainage class: Somewhat poorly drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion: By water—none or slight; by wind—severe
Depth to seasonal high water table: 6 inches above the

surface to 36 inches below the surface throughout the year, fluctuating with the level of water in Goose Lake
Frequency of flooding: Rare
Salinity: Slightly saline or moderately saline
Sodicity: Slightly sodic or moderately sodic
Carbonates: Strongly effervescent throughout

Contrasting Inclusions

• Goose Lake soils that are on adjacent, slightly higher lying lake terraces
• Thunderegg soils that are in concave areas on adjacent, slightly higher lying lake terraces and have dominantly tufted hairgrass in the potential plant community
• Fluvaquents on adjacent, lower lying lake terraces adjacent to Goose Lake
• Soils that have slopes of more than 1 percent
• Long, narrow beach ridges that are very gravelly loamy sand throughout
• Small, undulating sand dunes

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Wetness, salinity, sodicity, wind erosion, available water capacity

Dominant Vegetation in Potential Plant Community

Nuttall alkaligrass, inland saltgrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for nesting waterfowl.
• Grazing should be deferred during the period of nesting for waterfowl.
• A high water table during the growing season restricts the rooting depth of non-water-tolerant plants.
• Salts reduce the amount of water available to plants and restrict seedling survival.
• The low available water capacity of the surface layer limits forage production and seedling survival.
• If the vegetation is removed or degraded and the soil surface is exposed, wind erosion is a concern.
• A potential for seepage limits construction of water impoundments.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Range seeding controls blowing and drifting sand.
• Because of the concentration of salts, trees and shrubs suitable for windbreaks and environmental plantings are limited and the seedling mortality rate is severe.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• Minimize the risk of wind erosion by maintaining the existing plant cover, seeding, and accumulating litter on the soil surface.
• If this unit is seeded, select plants that tolerate wetness, salinity, and sodicity and that provide cover for nesting waterfowl.

252A—Thunderegg fine sandy loam, 0 to 1 percent slopes

Composition

Thunderegg soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Thunderegg Soil

Position on landscape: Lake terraces
Parent material: Kind—eolian material over lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,690 to 4,725 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Typical profile:
0 to 8 inches—very dark gray fine sandy loam
8 to 15 inches—dark grayish brown silty clay loam
15 to 21 inches—dark brown and dark yellowish brown silty clay loam
21 to 26 inches—yellowish brown and light yellowish brown loam
26 to 70 inches—dark brown sand
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep or deep (25 to 50 inches) to the sandy layer
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 2 inches
Hazard of erosion: By water—none or slight; by wind—moderate
Depth to perched water table: 6 inches above the surface to 48 inches below the surface throughout the year
Shrink-swell potential: High between depths of 8 and 21 inches
Salinity: Moderately saline or strongly saline

Sodicity: Moderately sodic or strongly sodic
Carbonates: Between depths of 1 inch and 31 inches—strongly effervescent or violently effervescent

Contrasting Inclusions

- Stockdrive soils that are on adjacent, slightly higher lying lake terraces and support dominantly basin wildrye and black greasewood
- Tandy soils that are in adjacent sandy areas close to Goose Lake and support dominantly Nuttall alkaligrass and inland saltgrass
- Malin soils that are on lake terraces

Major Uses

Livestock grazing, wildlife habitat, cropland, hayland

Major Management Factors

Salinity, sodicity, wetness, wind erosion, permeability, available water capacity

Dominant Vegetation in Potential Plant Community

Tufted hairgrass

Livestock Grazing

General management considerations:
- This unit provides food and cover for wetland wildlife in spring.
- Grazing should be deferred during the period of nesting for waterfowl.
- Grazing when the soil is wet results in compaction and puddling of the surface.
- Salts reduce the amount of water available to plants and restrict seedling survival.
- Excess sodium in the soil results in nutrient imbalances and a caustic root environment.
- Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
- The low available water capacity limits forage production and seedling survival.
- When the soil is dry, wind erosion is a concern if the vegetation is removed or degraded and the soil surface is exposed.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- If the vegetation is removed, range seeding is needed to control wind erosion.

Suitable management practices:
- Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
- Minimize the risk of wind erosion by maintaining existing plant cover, seeding, and accumulating litter on the soil surface.
- If this unit is seeded, select plants that tolerate wetness, salinity, and sodicity and that provide cover for nesting waterfowl.

Cropland and Hayland

General management considerations:
- Wetness limits the choice of plants, restricts the use of equipment, and increases the risk of winterkill.
- The concentration of salts and sodium limits the selection and production of hay and pasture plants and other crops.
- Removing salts and sodium is difficult unless the soil is drained.
- A high water table early in spring restricts rooting depth and plant survival.
- The seasonal high water table provides supplemental moisture for plants late in summer and in fall.
- Irrigation may be needed to meet the needs of the crops grown and to leach salts below the root zone.
- The soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
- Irrigation and drainage are needed for intensive management.
- The content of sodium in the soil can be reduced by applying proper amounts of soil amendments and then applying good-quality irrigation water to leach the salts from the root zone.
- Removing salts without applying proper amounts of soil amendments causes dispersion and crusting of the soil surface.
- Irrigation water management is needed to prevent a rise in the level of the water table and the subsequent upward movement of salts and sodium in the soil.
- Drainage is difficult because the soil is nearly level and there is a lack of outlets.
- Because of the concentration of salts, trees and shrubs suitable for windbreaks and environmental plantings are limited and the seedling mortality rate is severe.

253A—Tulana mucky silty clay loam, drained, 0 to 1 percent slopes

Composition

Tulana soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Tulana Soil

Position on landscape: Concave areas on alluvial flats in lake basins
Parent material: Kind—lacustrine and eolian sediment;

source—tuff, basalt, volcanic ash, diatoms
Elevation: 4,250 to 4,350 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 11 inches—black mucky silty clay loam
11 to 38 inches—light gray silt loam
38 to 44 inches—light brownish gray fine sandy loam
44 to 60 inches—light brownish gray silt loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 13 inches
Hazard of erosion by water: None or slight
Depth to water table: 24 to 60 inches throughout the year

Contrasting Inclusions

• Crump soils that are on adjacent, slightly lower lying alluvial flats
• Ozamis soils that are on adjacent, slightly higher lying alluvial flats

Major Uses

Hayland, cropland, livestock grazing, wildlife habitat

Major Management Factors

Wetness, permeability, frost action, slope

Hayland and Cropland

General management considerations:
• This unit provides food and cover for wetland wildlife early in spring.
• Most climatically adapted crops can be grown if adequate drainage is maintained.
• Because this soil is nearly level, drainage is difficult to maintain.
• Wetness limits the choice of plants, restricts the period suitable for haying, and increases the risk of winterkill.
• The seasonal high water table provides moisture for hay and pasture plants.
• Supplemental irrigation is needed for most crops late in summer.
• Suitable irrigation methods include sprinkler and border systems.
• The sandy lower layer restricts the growth of deep-rooted plants.
• Because of the high corrosivity to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• Because of a high potential for frost action, plants are subject to winterkill and other damage.
• If border systems or contour ditches are used to apply irrigation water, land leveling may be needed to ensure uniform application of water.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of wetness.
• The seedling mortality rate may be severe because this soil is very poorly drained.

Suitable management practices:
• Maintain drainage systems to allow the soil to drain more effectively.
• Maintain surface and subsurface drains to prevent ponding of the surface, keep the water table at desired depths, and allow for earlier access for haying operations.
• Regulate the application of irrigation water to prevent the buildup of a perched water table above the sandy lower layer.

254A—Turpin-Ozamis complex, 0 to 5 percent slopes

Composition

Turpin soil and similar inclusions—55 percent
Ozamis soil and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Turpin Soil

Position on landscape: Lake terraces that have slopes of 0 to 5 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,600 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—very dark grayish brown sandy clay loam
5 to 20 inches—very dark grayish brown sandy clay loam
20 to 29 inches—dark grayish brown sandy clay loam
29 to 60 inches—dark grayish brown loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained

Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion: By water—slight; by wind—slight or moderate
Salinity: Upper 20 inches—slightly saline; below this depth—moderately saline
Sodicity: Strongly sodic throughout
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Ozamis Soil

Position on landscape: Alluvial flats in lake basins that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,600 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 9 inches—black silty clay
9 to 12 inches—black clay loam
12 to 19 inches—black silty clay
19 to 60 inches—dark grayish brown loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: March through June—12 to 48 inches; rest of year—more than 48 inches
Frequency of flooding: Rare
Salinity: Upper 9 inches—moderately saline; below this depth—slightly saline

Contrasting Inclusions

• Crump soils that are on slightly lower lying alluvial flats and have dominantly sedges and cattails in the plant community
• Reese soils that are on adjacent alluvial flats
• Icene soils that are on adjacent, slightly higher lying lake terraces
• Soils that have slopes of more than 5 percent

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Turpin soil—sodicity, salinity, available water capacity, permeability, wind erosion, water erosion
Ozamis soil—wetness, salinity, available water capacity, frost action, clayey surface layer

Dominant Vegetation in Potential Plant Community

Turpin soil—basin wildrye, black greasewood, inland saltgrass
Ozamis soil—alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass

Livestock Grazing

General management considerations:
• The low precipitation, low available water capacity of the surface layer, and content of salts limit forage production and seedling survival.
• The strongly sodic surface layer of the Turpin soil severely limits range recovery and seedling survival.
• The moderately saline surface layer of the Ozamis soil limits range recovery and seedling survival.
• Water erosion is a concern on the Turpin soil because of the steepness of slope and the poor structure of the surface layer.
• Wind erosion is a concern on the Turpin soil if the vegetation is removed or degraded and the surface is exposed.
• Excess sodium in the Turpin soil results in nutrient imbalances and a caustic root environment.
• Dispersion and crusting of the surface of the Turpin soil reduce infiltration and restrict seedling emergence and survival.
• The Ozamis soil provides food and cover for wetland wildlife early in spring.
• Grazing when the Ozamis soil is wet results in compaction and puddling of the surface.
• Because of a high potential for frost action on the Ozamis soil, plants are subject to winterkill and other damage.
• The surface layer of the Ozamis soil expands when wet and contracts when dry, which can rip and tear plant roots.
• A high water table in the Ozamis soil early in the growing season restricts rooting depth.
• Because of the high corrosivity of the Turpin soil to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• Because of the high corrosivity of the Ozamis soil to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.

• If the vegetation is removed, range seeding is needed to control wind erosion.
• The Turpin soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings.
• Because of the concentration of salts in the Ozamis soil, trees and shrubs suitable for windbreaks and environmental plantings are limited and the seedling mortality rate is severe.

Suitable management practices:
• Allow the Ozamis soil to drain adequately before grazing to prevent damage to the soil and plants.
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Turpin soil is seeded, select plants that tolerate strong sodicity and droughtiness in summer.
• If the Ozamis soil is seeded, select plants that tolerate moderate salinity, wetness, and frost heaving.

255A—Turpin-Reese complex, 0 to 8 percent slopes

Composition

Turpin soil and similar inclusions—45 percent
Reese soil and similar inclusions—30 percent
Reese soil, wet, and similar inclusions—15 percent
Contrasting inclusions—10 percent

Characteristics of the Turpin Soil

Position on landscape: Lake terraces that have slopes of 1 to 8 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 5 inches—very dark grayish brown sandy clay loam
5 to 20 inches—very dark grayish brown sandy clay loam
20 to 29 inches—dark grayish brown sandy clay loam
29 to 60 inches—dark grayish brown loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion: By water—slight; by wind—slight or moderate
Salinity: Upper 20 inches—slightly saline; below this depth—moderately saline
Sodicity: Strongly sodic throughout
Carbonates: Strongly effervescent or violently effervescent throughout

Characteristics of the Reese Soils

Position on landscape: Alluvial flats in lake basins that have slopes of 0 to 1 percent
Parent material: Kind—lacustrine sediment; source—tuff, basalt
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile of the Reese soil:
0 to 4 inches—dark very fine sandy loam
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Typical profile of the Reese soil, wet:
0 to 4 inches—dark brown loam
4 to 10 inches—brown loam
10 to 20 inches—brown clay loam
20 to 33 inches—brown loam
33 to 44 inches—light brownish gray coarse sandy loam
44 to 60 inches—light brownish gray loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Slow
Available water capacity: About 1 inch
Hazard of erosion by water: Reese soil—slight; Reese soil, wet—none or slight
Hazard of erosion by wind: Reese soil—moderate; Reese soil, wet—none
Depth to high water table: Reese soil—12 to 36 inches in March through July; Reese soil, wet—12 inches above the surface to 24 inches below the surface in November through August
Frequency of flooding: Rare
Salinity: Upper 10 inches—strongly saline; below this depth—moderately saline or slightly saline
Sodicity: Upper 33 inches—strongly sodic; below this depth—moderately sodic
Carbonates: Strongly effervescent or violently effervescent throughout

Contrasting Inclusions

- Ozamis soils that are on adjacent alluvial flats
- Icene soils that are on adjacent lake terraces

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Turpin soil—salinity, sodicity, available water capacity, permeability, wind erosion, water erosion
Reese soil—wetness, salinity, sodicity, available water capacity, permeability, frost action, wind erosion
Reese soil, wet—wetness, salinity, sodicity, available water capacity, permeability, frost action

Dominant Vegetation in Potential Plant Community

Turpin soil—shadscale, black greasewood, basin wildrye
Reese soil—alkali sacaton, alkali bluegrass, inland saltgrass, alkali cordgrass
Reese soil, wet—unstable; may or may not support a plant community depending on the amount of runoff on the soil

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The strongly sodic surface layer severely limits range recovery and seedling survival.
- Excess sodium in the soils results in nutrient imbalances and a caustic root environment.
- Dispersion and crusting of the soil surface reduce infiltration and restrict seedling emergence and survival.
- Salts reduce the amount of water available to plants and restrict seedling survival.
- Wind erosion is a concern if the vegetation is removed and the soil surface is exposed.
- Water erosion is a concern on the Turpin soil because of the steepness of slope and the poor structure of the surface layer.
- Because the water on the surface of the Reese soil, wet, is from snowmelt in spring, the amount and duration varies. During years when the winters are wet, ponding lasts until midsummer or late in summer. During years when the winters are dry, ponding lasts for only short periods in spring.
- The Reese soils provide food and cover for wetland wildlife.
- Grazing should be deferred during the period of nesting for waterfowl.
- Grazing when the Reese soils are wet results in compaction and puddling of the surface.
- A high water table during the growing season and spring ponding on the Reese soils restricts rooting depth.
- Because of a high potential for frost action in the Reese soils, plants are subject to winterkill and other damage.
- Because of the high corrosivity of the Turpin and Reese soils to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Because of the high corrosivity of the Reese soil, wet, to uncoated steel and concrete, protection from corrosion or use of noncorrosive material, such as galvanized steel, aluminum, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.
- If the vegetation is removed, range seeding is needed to control wind erosion.
- The soils in this unit generally are not suited to growing trees and shrubs for windbreaks and environmental plantings.

Suitable management practices:
- Allow the Reese soils to drain adequately before grazing to prevent damage to the soils and plants.
- Minimize the risk of wind and water erosion on the Turpin soil by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If the Turpin soil is seeded, select plants that tolerate strong sodicity and droughtiness in summer.
- If the Reese soils are seeded, select plants that tolerate strong sodicity, strong salinity, seasonal wetness, and frost heaving and that provide habitat for waterfowl.

256C—Twelvemile very gravelly fine sandy loam, 0 to 15 percent slopes

Composition

Twelvemile soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Twelvemile Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 5,500 to 7,200 feet
Climatic factors:

Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—partially decomposed conifer needles
0 to 11 inches—dark brown very gravelly fine sandy loam
11 to 24 inches—dark yellowish brown very gravelly fine sandy loam
24 to 37 inches—brown very cobbly fine sandy loam
37 to 60 inches—brown very cobbly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

• Mound, Polander, Rogger, and Woodchopper soils that are on adjacent mountainsides
• Soils that are similar to the Twelvemile soil but have bedrock at a depth of 40 to 60 inches

Major Use

Woodland

Major Management Factors

Rock fragments, available water capacity

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 64 cubic feet per acre per year for white fir at age 70; 62 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 198 board feet per acre per year for ponderosa pine at age 160

General management considerations:
• Wet, unsurfaced roads and skid trails are firm.
• Dry, unsurfaced roads and skid trails are dusty.
• Cuts and fills are stable.
• The rock fragments make tree planting difficult.
• Accumulations of snow can bend and break small trees.
• Because this soil is droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• To minimize compaction and displacement, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.

257E—Twelvemile very gravelly fine sandy loam, 15 to 40 percent north slopes

Composition

Twelvemile soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Twelvemile Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—partially decomposed conifer needles
0 to 11 inches—dark brown very gravelly fine sandy loam
11 to 24 inches—dark yellowish brown very gravelly fine sandy loam
24 to 37 inches—brown very cobbly fine sandy loam
37 to 60 inches—brown very cobbly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Mound, Polander, Rogger, and Woodchopper soils that are on adjacent mountainsides
• Soils that are similar to the Twelvemile soil but have bedrock at a depth of 40 to 60 inches

Major Use

Woodland

Major Management Factors

Slope, rock fragments, available water capacity, water erosion

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 64 cubic feet per acre per year for white fir at age 70; 62 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 198 board feet per acre per year for ponderosa pine at age 160

General management considerations:
- Accumulations of snow can bend and break small trees
- Wet, unsurfaced roads and skid trails are firm.
- Dry, unsurfaced roads and skid trails are dusty.
- The rock fragments make tree planting difficult.
- Cuts and fills ravel when dry.
- To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be skidded through or fallen into riparian areas.
- Because this soil is droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
- To minimize displacement and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

257G—Twelvemile very gravelly fine sandy loam, 40 to 60 percent north slopes

Composition

Twelvemile soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Twelvemile Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 5,500 to 6,300 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—partially decomposed conifer needles
0 to 11 inches—dark brown very gravelly fine sandy loam
11 to 24 inches—dark yellowish brown very gravelly fine sandy loam
24 to 37 inches—brown very cobbly fine sandy loam
37 to 60 inches—brown very cobbly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Longjohn soils that are on mountainsides at higher elevations
- Polander and Rogger soils that are on adjacent mountainsides
- Soils that are similar to the Twelvemile soil but have bedrock at a depth of 40 to 60 inches

Major Use

Woodland

Major Management Factors

Slope, water erosion, rock fragments, available water capacity

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 64 cubic feet per acre per year for white fir at age 70; 62 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 198 board feet per acre per year for ponderosa pine at age 160

General management considerations:
• Wet, unsurfaced roads are firm.
• Dry, unsurfaced roads are dusty.
• The rock fragments make tree planting difficult.
• Cuts and fills ravel when dry.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
• Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
• Accumulations of snow can bend or break small trees.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
• Because this soil is droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• To minimize soil displacement, use cable yarding systems.
• To minimize compaction and erosion, avoid logging in spring when the soil is wet.
• Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
• Leave slash on the soil to reduce sheet and rill erosion.
• Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.

258E—Twelvemile very gravelly fine sandy loam, 15 to 40 percent south slopes

Composition

Twelvemile soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Twelvemile Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—partially decomposed conifer needles
0 to 11 inches—dark brown very gravelly fine sandy loam
11 to 24 inches—dark yellowish brown very gravelly fine sandy loam
24 to 37 inches—brown very cobbly fine sandy loam
37 to 60 inches—brown very cobbly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Mound, Polander, Rogger, and Woodchopper soils that are on adjacent mountainsides
• Soils that are similar to the Twelvemile soil but have bedrock at a depth of 40 to 60 inches

Major Use

Woodland

Major Management Factors

Slope, rock fragments, available water capacity, water erosion

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, Wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 64 cubic feet per acre per year for white fir at age 70; 62 cubic feet per acre per year for ponderosa pine at age 50

Estimated yield (Scribner rule): 198 board feet per acre per year for ponderosa pine at age 160

General management considerations:
- Wet, unsurfaced roads and skid trails are firm.
- Dry, unsurfaced roads and skid trails are dusty.
- Cuts and fills ravel when dry.
- The rock fragments make tree planting difficult.
- Artificial or natural shade increases seedling survival.
- The growing season begins earlier on the south-facing slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
- To protect the quality and quantity of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- Because this soil is droughty and is on south-facing slopes, larger than normal planting stock, a higher planting rate, shade cards, or additional plantings may be needed.

Suitable management practices:
- To minimize soil displacement and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soil is wet.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.

258G—Twelvemile very gravelly fine sandy loam, 40 to 60 percent south slopes

Composition

Twelvemile soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Twelvemile Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—rhyolite
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—partially decomposed conifer needles
0 to 11 inches—dark brown very gravelly fine sandy loam
11 to 24 inches—dark yellowish brown very gravelly fine sandy loam
24 to 37 inches—brown very cobbly fine sandy loam
37 to 60 inches—brown very cobbly sandy loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

- Winterim soils that are on the lower part of slopes
- Mound, Polander, and Rogger soils that are on adjacent mountainsides
- Rock outcrop
- Soils that are similar to the Twelvemile soil but have bedrock at a depth of 40 to 60 inches

Major Use

Woodland

Major Management Factors

Slope, water erosion, rock fragments, available water capacity

Dominant Vegetation in Potential Plant Community

White fir, ponderosa pine, common snowberry, heartleaf arnica, wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: 62 cubic feet per acre per year for ponderosa pine at age 50; 64 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 198 board feet per acre per year for ponderosa pine at age 160

General management considerations:
- Wet, unsurfaced roads are firm.
- Dry, unsurfaced roads are dusty.
- The rock fragments make tree planting difficult.

- Artificial or natural shade increases seedling survival.
- Cuts and fills ravel when dry.
- Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
- The growing season begins earlier on the south-facing slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
- To protect the quality and quantity of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- Because this soil is droughty and is on south-facing slopes, larger than normal planting stock, a higher planting rate, shade cards, or additional plantings may be needed.

Suitable management practices:
- Use cable yarding systems to reduce soil displacement.
- To minimize compaction and erosion, avoid logging in spring when the soil is wet.
- Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
- Leave slash on the soil to reduce sheet and rill erosion.
- Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.

259E—Vitale-Bullump complex, 5 to 30 percent slopes

Composition

Vitale soil and similar inclusions—65 percent
Bullump soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the Vitale Soil

Position on landscape: Hillsides and mountainsides that have slopes of 5 to 15 percent
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark grayish brown gravelly sandy loam
7 to 15 inches—dark brown very gravelly loam
15 to 23 inches—dark yellowish brown extremely gravelly clay loam
23 inches—basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate

Characteristics of the Bullump Soil

Position on landscape: Hillsides and mountainsides that have slopes of 15 to 30 percent
Parent material: Kind—colluvium, residuum; source—basalt, rhyolite, tuff
Elevation: 5,000 to 6,000 feet
Climatic factors:
Mean annual precipitation—14 to 18 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 11 inches—very dark grayish brown extremely stony loam
11 to 22 inches—very dark grayish brown very gravelly clay loam
22 to 42 inches—dark yellowish brown very gravelly clay loam
42 to 60 inches—dark yellowish brown extremely gravelly loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 5 inches
Hazard of erosion: Moderate or severe

Contrasting Inclusions

- Rock outcrop
- Soils that are similar to the Vitale soil but have bedrock at a depth of 10 to 20 inches
- Riddleranch soils that are on south-facing mountainsides
- Pearlwise soils that are at the higher elevations on north-facing mountainsides

Major Use

Livestock grazing

Major Management Factors

Vitale soil—available water capacity, depth to bedrock, water erosion

Bullump soil—stones on the surface, water erosion, slope

Dominant Vegetation in Potential Plant Community

Vitale and Bullump soils—Idaho fescue, antelope bitterbrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Livestock herd and graze in the less stony areas of this unit.
- The bedrock in the Vitale soil restricts rooting depth.
- The low available water capacity of the Vitale soil limits forage production and seedling survival.
- The extremely stony surface layer of the Bullump soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- The rock fragments on the surface of the Bullump soil and throughout the soil restrict the placement of fenceposts.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
- If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

260A—Welch clay loam, ponded, 0 to 1 percent slopes

Composition

Welch soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Welch Soil

Position on landscape: Interplateau basins
Parent material: Kind—alluvium; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—10 to 16 inches
Mean annual air temperature—43 to 47 degrees F
Frost-free period—50 to 90 days
Typical profile:
0 to 9 inches—black clay loam
9 to 27 inches—black clay loam
27 to 62 inches—very dark brown silty clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Very poorly drained
Permeability: Moderately slow
Available water capacity: About 10 inches
Hazard of erosion by water: None or slight
Depth to seasonal high water table: November through June—12 inches above the surface to 18 inches below the surface; rest of year—more than 18 inches

Contrasting Inclusions

- Mudpot soils that are on adjacent alluvial flats in interplateau basins and have dominantly spikerush, dock, and Baltic rush in the potential plant community
- Swalesilver soils that are on adjacent, slightly higher lying terraces in interplateau basins and have dominantly silver sagebrush in the potential plant community

Major Uses

Livestock grazing, wildlife habitat

Major Management Factors

Wetness, permeability, frost action

Dominant Vegetation in Potential Plant Community

Spikerush, dock, Baltic rush

Livestock Grazing

General management considerations:
- This unit provides food and cover for wildlife.
- Grazing should be deferred during the period of nesting for waterfowl.
- Because the water on the surface is from snowmelt in spring, the amount and duration varies depending on the winter snowpack.
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Periodic inundation increases the amount of moisture available for plants and thus increases the production of forage.
- A high water table during the growing season restricts the rooting depth of non-water-tolerant plants.
- Grazing when the soil is wet results in compaction and puddling of the surface.
- Because of a high potential for frost action, plants are subject to winterkill and other damage.
- This soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings.

Suitable management practices:
- Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.

• Delay grazing until late in spring or summer when forage plants have achieved sufficient growth.
• If this unit is seeded, select plants that tolerate wetness and frost heaving and that provide cover for wildlife.

261A—Welch-Degarmo complex, 0 to 2 percent slopes

Composition

Welch soil and similar inclusions—60 percent
Degarmo soil and similar inclusions—30 percent
Contrasting features—10 percent

Characteristics of the Welch Soil

Position on landscape: Narrow flood plains in areas slightly lower than the Degarmo soil
Parent material: Kind—alluvium; source—andesite, basalt, tuff
Elevation: 5,800 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 9 inches—black silty clay loam
9 to 27 inches—black clay loam
27 to 62 inches—very dark brown clay loam
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Poorly drained
Permeability: Moderately slow
Available water capacity: About 10 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: November through June—12 to 18 inches; rest of year—more than 18 inches
Frequency of flooding: Frequent for brief periods from March through June

Characteristics of the Degarmo Soil

Position on landscape: Narrow flood plains on mountains in areas slightly higher than the Welch soil
Parent material: Kind—alluvium; source—andesite, basalt, tuff
Elevation: 5,800 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 11 inches—black silt loam
11 to 17 inches—black silty clay loam
17 to 28 inches—very dark gray silty clay loam
28 to 35 inches—very dark gray gravelly clay loam
35 to 42 inches—very dark gray cobbly loamy sand
42 to 60 inches—dark brown extremely gravelly loamy sand
Depth class: Very deep (more than 60 inches) to bedrock, moderately deep (24 to 35 inches) to stratified sand and gravel
Drainage class: Poorly drained
Permeability: Moderately slow over rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Slight
Depth to seasonal high water table: March through June—12 to 36 inches; rest of year—more than 36 inches
Frequency of flooding: Frequent for brief periods from March through June

Contrasting Inclusions

• Cressler soils that are in adjacent interplateau basins
• Soils that are similar to the Welch and Degarmo soils but are moderately well drained or well drained because of erosional downcutting and entrenching of stream channels

Major Uses

Wildlife habitat, livestock grazing

Major Management Factors

Welch soil—wetness, frost action
Degarmo soil—wetness, frost action, permeability

Dominant Vegetation in Potential Plant Community

Welch and Degarmo soils—tufted hairgrass

Livestock Grazing

General management considerations:
• This unit provides food and cover for wildlife.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• A high water table during the growing season restricts the rooting depth of non-water-tolerant plants.
• Because of a high potential for frost action, plants are subject to winterkill and other damage.
• Periodic flooding increases the amount of moisture available for plants and thus increases the production of forage.
• Stream channels are subject to cutting and filling during periods of flooding.
• Grazing when the soils are wet results in compaction and puddling of the surface.

• Grazing should be managed to maintain or increase the abundance of plants that help to stabilize streambanks, reduce erosion, and moderate water temperatures.
• The Welch soil generally is not suited to growing trees and shrubs for windbreaks and environmental plantings.
• Trees and shrubs for windbreaks and environmental plantings on the Degarmo soil should be tolerant of droughtiness late in summer and early in fall.

Suitable management practices:
• Allow the soil to drain adequately before grazing to prevent damage to the soil and plants.
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Maintain adequate plant cover in fall to protect the soil from erosion during periods of flooding in spring.
• Fence along riparian areas to minimize streambank erosion and to protect the quality and quantity of the water.
• If this unit is seeded, select plants that tolerate wetness and frost heaving and that provide cover for wildlife.

262E—Westbutte extremely stony loam, 5 to 30 percent slopes

Composition

Westbutte soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Westbutte Soil

Position on landscape: Hills, mountains
Parent material: Kind—colluvium; source—tuff, basalt
Elevation: 5,200 to 6,000 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark grayish brown extremely stony loam
7 to 16 inches—very dark grayish brown very stony loam
16 to 24 inches—dark brown very stony loam
24 to 33 inches—dark brown very cobbly loam
33 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate or severe

Contrasting Inclusions

• Rock outcrop
• Lambring soils that are on north-facing mountainsides and have dominantly low sagebrush in the potential plant community
• Ninemile soils that are on tablelands and have dominantly low sagebrush in the potential plant community
• Felcher, Fitzwater, and Riddleranch soils that are on south-facing slopes and have dominantly Wyoming big sagebrush in the potential plant community
• Soils that have slopes of more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Available water capacity, stones on the surface, depth to bedrock, water erosion

Dominant Vegetation in Potential Plant Community

Idaho fescue, Thurber needlegrass, mountain big sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Livestock herd and graze in the less stony areas of this unit.
• The low available water capacity limits forage production and seedling survival.
• The extremely stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The depth to bedrock and content of rock fragments throughout the soil restrict rooting depth.

Suitable management practices:
• Delay grazing until the soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

263F—Westbutte-Ninemile complex, 30 to 50 percent slopes

Composition

Westbutte soil and similar inclusions—50 percent
Ninemile soil and similar inclusions—40 percent
Contrasting inclusions—10 percent

Characteristics of the Westbutte Soil

Position on landscape: North-facing mountainsides
Parent material: Kind—colluvium, loess; source—tuff, basalt
Elevation: 5,300 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark grayish brown extremely stony loam
7 to 16 inches—very dark grayish brown very stony loam
16 to 24 inches—dark brown very stony loam
24 to 33 inches—dark brown very cobbly loam
33 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Severe

Characteristics of the Ninemile Soil

Position on landscape: North-facing hillsides and mountainsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,300 to 6,500 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 3 inches—dark brown very cobbly loam
3 to 7 inches—dark brown clay
7 to 17 inches—dark brown gravelly clay
17 inches—tuff that has coatings of silica and calcium carbonate in fractures
Depth class: Shallow (10 to 20 inches) to bedrock, very shallow (3 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Very slow
Available water capacity: About 2 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between the depths of 3 and 17 inches

Contrasting Inclusions

- Lambring soils that are on north-facing hillsides and mountainsides
- Felcher soils that are at the lower elevations on south-facing mountainsides and have dominantly Wyoming big sagebrush in the potential plant community
- Riddleranch and Fitzwater soils that are on south-facing mountainsides
- Soils that have slopes of less than 30 percent or more than 50 percent

Major Use

Livestock grazing

Major Management Factors

Westbutte soil—slope, water erosion, available water capacity, stones on the surface, depth to bedrock
Ninemile soil—slope, water erosion, depth to bedrock, depth to the claypan, permeability, available water capacity, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Westbutte soil—Idaho fescue, mountain big sagebrush, bluebunch wheatgrass, basin wildrye
Ninemile soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- Livestock prefer to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
- Livestock herd and graze in the less stony areas of this unit.
- The surface layer of the Ninemile soil is saturated following snowmelt.
- The low available water capacity limits forage production and seedling survival.
- Pedestaled plants and an erosion pavement on the Ninemile soil are the result of past erosion.
- The bedrock and rock fragments throughout the Westbutte soil restrict rooting depth.
- The claypan and bedrock in the Ninemile soil restrict rooting depth.
- Crusting of the surface layer of the Ninemile soil reduces infiltration and restricts seedling emergence and survival.

• The shallow depth of the Ninemile soil limits placement of fenceposts.
• The subsoil of the Ninemile soil expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.
• Slope and the extremely stony surface layer of the Westbutte soil restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Ninemile soil is firm and the preferred forage plants have achieved sufficient growth to withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If the Westbutte soil is seeded, select plants that tolerate droughtiness and a cool growing season.
• If the Ninemile soil is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.

264G—Westbutte-Rock outcrop complex, 30 to 70 percent north slopes

Composition

Westbutte soil and similar inclusions—65 percent
Rock outcrop—20 percent
Contrasting inclusions—15 percent

Characteristics of the Westbutte Soil

Position on landscape: North-facing hillsides and mountainsides associated with escarpments
Parent material: Kind—colluvium, loess; source—tuff, basalt
Elevation: 5,200 to 5,900 feet
Climatic factors:
Mean annual precipitation—12 to 16 inches
Mean annual air temperature—43 to 45 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 7 inches—very dark grayish brown extremely stony loam
7 to 16 inches—very dark grayish brown very stony loam
16 to 24 inches—dark brown very stony loam
24 to 33 inches—dark brown very cobbly loam
33 inches—tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Severe or very severe

Characteristics of the Rock Outcrop

Position on landscape: Escarpments, hillsides, mountainsides
Kind of rock: Basalt, tuff

Contrasting Inclusions

• Lambring soils that are on mountainsides and have dominantly low sagebrush in the potential plant community
• Ninemile soils that are on tablelands and have dominantly low sagebrush in the potential plant community
• Felcher, Riddleranch, and Fitzwater soils that are on south-facing slopes and have dominantly Wyoming big sagebrush in the potential plant community
• Pearlwise soils that are at the higher elevations
• Soils that are similar to the Westbutte soil but have bedrock at a depth of less than 20 inches
• Soils that have slopes of less than 30 percent

Major Use

Livestock grazing

Major Management Factors

Available water capacity, stones on the surface, slope, water erosion, depth to bedrock, Rock outcrop

Dominant Vegetation in Potential Plant Community

Westbutte soil—Idaho fescue, bluebunch wheatgrass, mountain big sagebrush, basin wildrye

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.
• Livestock tend to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of this unit.
• The low available water capacity limits forage production and seedling survival.
• The extremely stony surface layer, areas of Rock outcrop, and steepness of slope restrict the operation

of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The depth to bedrock and rock fragments throughout the soil restrict rooting depth.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness and a cool growing season.

265C—Westside complex, 2 to 15 percent slopes

Composition

Westside soil and similar inclusions—50 percent
Westside soil, thin surface, and similar inclusions—50 percent

Characteristics of the Westside Soils

Position on landscape: Lake terraces on tablelands
Parent material: Kind—loess over alluvium; source—basalt, tuff
Elevation: 5,000 to 5,300 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—70 to 90 days
Typical profile of the Westside soil:
0 to 3 inches—dark brown very gravelly silt loam
3 to 8 inches—dark brown cobbly silt loam
8 to 14 inches—dark brown cobbly clay
14 to 22 inches—dark brown cobbly silty clay loam
22 to 29 inches—brown very stony clay loam
29 to 60 inches—light yellowish brown extremely cobbly loam
Typical profile of the Westside soil, thin surface:
0 to 5 inches—dark brown very cobbly silt loam
5 to 12 inches—dark brown cobbly clay
12 to 30 inches—dark brown cobbly silty clay loam
30 to 35 inches—brown very stony clay loam
35 to 60 inches—light yellowish brown extremely cobbly loam
Depth class: Westside soil—very deep (more than 60 inches) to bedrock, very shallow or shallow (8 to 15 inches) to the claypan; Westside soil, thin surface—very deep (more than 60 inches) to bedrock, very shallow (3 to 8 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 4 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 8 and 22 inches
Sodicity: Between depths of 29 and 60 inches—slightly sodic
Carbonates: Between depths of 29 and 60 inches—violently effervescent

Major Use

Livestock grazing

Major Management Factors

Permeability, depth to the claypan

Dominant Vegetation in Potential Plant Community

Westside soil—winterfat, Indian ricegrass, fourwing saltbush
Westside soil, thin surface—Indian ricegrass, basin big sagebrush, Thurber needlegrass, Wyoming big sagebrush, needleandthread

Livestock Grazing

General management considerations:
• This unit provides habitat for antelope in winter.
• The claypan restricts rooting depth and water movement.
• Cold soil temperatures and a short growing season limit the period of plant growth.
• Crusting of the soil surface reduces infiltration.
• The shallow or very shallow depth to the clayey layer restricts permeability and causes very brief periods of ponding or saturation of the surface layer during snowmelt.
• The clayey subsoil expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.

Suitable management practices:
• Minimize erosion of the surface layer to maintain the potential of the soil to produce forage.
• Delay grazing until the surface layer is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
• If this unit is seeded, select plants that tolerate droughtiness in summer.

266E—Wildhill very stony loam, 2 to 30 percent slopes

Composition

Wildhill soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Wildhill Soil

Position on landscape: Bedrock-controlled lake terraces
Parent material: Kind—alluvium; source—basalt
Elevation: 4,500 to 5,000 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 6 inches—brown very stony loam
6 to 19 inches—brown extremely stony loam
19 to 26 inches—brown extremely gravelly loam
26 inches—basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of water erosion: Moderate or severe
Carbonates: Between depths of 6 and 19 inches—slightly effervescent; between depths of 19 and 26 inches—strongly effervescent

Contrasting Inclusions

- McNye soils that are on adjacent bedrock-controlled lake terraces and have dominantly Thurber needlegrass, needleandthread, and Wyoming big sagebrush in the potential plant community
- Rock outcrop
- Soils that are similar to the Wildhill soil but have bedrock at a depth of less than 20 inches or more than 40 inches
- Soils that have slopes of more than 30 percent

Major Use

Livestock grazing

Major Management Factors

Available water capacity, stones on the surface, rock fragments throughout the soil, depth to bedrock, water erosion

Dominant Vegetation in Potential Plant Community

Shadscale, bud sagebrush, Indian ricegrass, bottlebrush squirreltail

Livestock Grazing

General management considerations:
- The depth to bedrock limits construction of water impoundments and restricts rooting depth.
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The rock fragments on and in the soil restrict the placement of fenceposts.
- Livestock herd and graze in the less stony areas of this unit.
- The very stony surface layer restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- This unit is suited to grazing in winter.

Suitable management practices:
- Minimize erosion of the surface layer to maintain the potential of the soil to produce forage.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
- If this unit is seeded, select plants that tolerate droughtiness.

267F—Wildhill very stony loam, 30 to 50 percent south slopes

Composition

Wildhill soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Wildhill Soil

Position on landscape: South-facing slopes of bedrock-controlled lake terraces
Parent material: Kind—alluvium; source—basalt
Elevation: 4,500 to 5,000 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days

Typical profile:
0 to 6 inches—brown very stony loam
6 to 19 inches—brown extremely stony loam
19 to 26 inches—brown extremely gravelly loam
26 inches—basalt

Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 3 inches
Hazard of water erosion: Severe
Carbonates: Between depths of 6 and 19 inches—slightly effervescent; between depths of 19 and 26 inches—strongly effervescent

Contrasting Inclusions

- McNye soils that are on adjacent bedrock-controlled lake terraces and have dominantly Thurber needlegrass and Wyoming big sagebrush in the potential plant community
- Rock outcrop
- Soils that are similar to the Wildhill soil but have bedrock at a depth of less than 20 inches or more than 40 inches
- Soils that have slopes of less than 30 percent

Major Use

Livestock grazing

Major Management Factors

Slope, water erosion, available water capacity, stones on the surface, rock fragments throughout the soil, depth to bedrock

Dominant Vegetation in Potential Plant Community

Shadscale, Indian ricegrass, bottlebrush squirreltail

Livestock Grazing

General management considerations:
- The depth to bedrock restricts rooting depth.
- The rock fragments on and in the soil restrict the placement of fenceposts.
- The low precipitation and low available water capacity limit forage production and seedling survival.
- The growing season on the south-facing slopes begins earlier in spring and available moisture is a limitation earlier in summer on these slopes than on the north-facing slopes.
- Livestock tend to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
- Livestock herd and graze in the less stony areas of this unit.
- The very stony surface layer and the steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
- This unit is suited to grazing in winter.

Suitable management practices:
- Minimize erosion of the surface layer to maintain the potential of the soil to produce forage.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, and accumulating litter on the surface.
- If this unit is seeded, select plants that tolerate droughtiness.

268C—Winterim very gravelly loam, 0 to 15 percent slopes

Composition

Winterim soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Winterim Soil

Position on landscape: Mountainsides and plateaus
Parent material: Kind—residuum, colluvium; source—basalt, tuff
Elevation: 5,200 to 6,200 feet
Climatic factors:
Mean annual precipitation—20 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days

Typical profile:
1 inch to 0—ponderosa pine needles
0 to 5 inches—black very gravelly loam
5 to 12 inches—dark brown gravelly clay loam
12 to 45 inches—dark reddish brown very gravelly clay
45 inches—weathered basalt

Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 21 and 45 inches

Contrasting Inclusions

- Booth soils that are on adjacent benches, hillsides, and foot slopes and have low sagebrush in the potential plant community
- Rogger and Woodchopper soils that are at the higher elevations on adjacent mountainsides and have dominantly white fir in the potential plant community

• Royst soils that are on adjacent hillsides
• Soils that have slopes of more than 15 percent

Major Uses

Woodland, livestock grazing

Major Management Factors

Permeability, rock fragments, shrink-swell potential

Dominant Vegetation in Potential Plant Community

Ponderosa pine, squawcarpet, antelope bitterbrush, wooly wyethia

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling and a cool growing season.

Woodland

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
• The clayey subsoil restricts permeability.
• Wet, unsurfaced roads and skid trails are slippery and sticky.
• The rock fragments can make tree planting difficult.

Suitable management practices:
• To minimize compaction and erosion, use designated skid trails and low-pressure ground equipment and avoid logging in spring when the soil is wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the soil surface.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.

269E—Winterim very gravelly loam, 15 to 40 percent north slopes

Composition

Winterim soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Winterim Soil

Position on landscape: Mountainsides
Parent material: Kind—residuum, colluvium; source—basalt, tuff
Elevation: 5,200 to 6,200 feet
Climatic factors:
Mean annual precipitation—20 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 5 inches—black very gravelly loam
5 to 12 inches—dark brown gravelly clay loam
12 to 45 inches—dark reddish brown very gravelly clay
45 inches—weathered basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 21 and 45 inches

Contrasting Inclusions

• Booth soils that on adjacent benches, hillsides, and foot slopes and have low sagebrush in the potential plant community
• Rogger and Woodchopper soils that are at the higher elevations on adjacent mountainsides and have dominantly white fir in the potential plant community
• Royst soils that are on adjacent hillsides
• Soils that have slopes of less than 15 percent or more than 40 percent

Major Uses

Woodland, livestock grazing

Major Management Factors

Slope, water erosion, shrink-swell potential, permeability, rock fragments

Dominant Vegetation in Potential Plant Community

Ponderosa pine, squawcarpet, antelope bitterbrush, wooly wyethia

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The growing season on the north-facing slopes begins later in spring and moisture is available until later in summer on these slopes than on the south-facing slopes.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling and a cool growing season.

Woodland

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
• The clayey subsoil restricts permeability.
• Wet, unsurfaced roads and skid trails are slippery and sticky.
• The rock fragments can make tree planting difficult.
• Cuts and fills slough when wet.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
• To minimize compaction and erosion, use designated skid trails and low-pressure ground equipment and avoid logging in spring when the soil is wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the soil surface.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

269G—Winterim very gravelly loam, 40 to 60 percent north slopes

Composition

Winterim soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Winterim Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,000 to 6,200 feet
Climatic factors:
Mean annual precipitation—20 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 5 inches—black very gravelly loam
5 to 12 inches—dark brown gravelly clay loam
12 to 45 inches—dark reddish brown very gravelly clay
45 inches—weathered basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 21 and 45 inches

Contrasting Inclusions

• Royst and Nuss soils that are on adjacent hillsides
• Mound soils that are at the higher elevations on adjacent mountainsides and have dominantly white fir in the potential plant community
• Rock outcrop
• Soils that have slopes of more than 60 percent or less than 40 percent

Major Use

Woodland

Major Management Factors

Slope, water erosion, permeability, rock fragments

Dominant Vegetation in Potential Plant Community

Ponderosa pine, squawcarpet, antelope bitterbrush, wooly wyethia

Woodland

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
- The clayey subsoil restricts permeability.
- Wet, unsurfaced roads are slippery and sticky.
- The rock fragments can make tree planting difficult.
- Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
- Cuts and fills slough when wet.
- Cutbanks are difficult to vegetate because of the clayey subsoil.
- To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
- To minimize soil displacement, use cable yarding systems.
- To minimize compaction and erosion, avoid logging in spring when the soil is wet.
- Leave slash material on the soil surface to minimize sheet and rill erosion.
- Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
- Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
- Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the soil surface.

270E—Winterim very gravelly loam, 15 to 40 percent south slopes

Composition

Winterim soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Winterim Soil

Position on landscape: Mountainsides
Parent material: Kind—residuum, colluvium; source—basalt, tuff
Elevation: 5,700 to 6,500 feet
Climatic factors:
Mean annual precipitation—20 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 5 inches—black very gravelly loam
5 to 12 inches—dark brown gravelly clay loam
12 to 45 inches—dark reddish brown very gravelly clay
45 inches—weathered basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 21 and 45 inches

Contrasting Inclusions

- Booth soils that are on adjacent benches, hillsides, and foot slopes and have low sagebrush in the potential plant community
- Rogger and Woodchopper soils that are at the higher elevations on adjacent mountainsides and have dominantly white fir in the potential plant community
- Royst soils that are on adjacent hillsides
- Soils that have slopes of less than 15 percent or more than 40 percent

Major Uses

Woodland, livestock grazing

Major Management Factors

Slope, water erosion, shrink-swell potential, permeability, rock fragments

Dominant Vegetation in Potential Plant Community

Ponderosa pine, squawcarpet, antelope bitterbrush, wooly wyethia

Livestock Grazing

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The growing season on the south-facing slopes begins earlier in spring than on the north-facing slopes. Available moisture is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Minimize the risk of erosion by preserving the

existing plant cover, seeding, accumulating litter on the surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate shrinking and swelling and a cool growing season.

Woodland

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
• The clayey subsoil restricts permeability.
• Wet, unsurfaced roads and skid trails are slippery and sticky.
• The soils on south-facing slopes are more droughty than those on north-facing slopes.
• Artificial or natural shade increases seeding survival.
• The rock fragments can make tree planting difficult.
• Cuts and fills slough when wet.
• To protect the quality and quantity of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
• Because this unit is on south-facing slopes, larger than normal planting stock, a higher planting rate, shade cards, or additional plantings may be needed.

Suitable management practices:
• To minimize compaction and erosion, use designated skid trails and low-pressure ground equipment and avoid logging in spring when the soil is wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the soil surface.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

270G—Winterim very gravelly loam, 40 to 60 percent south slopes

Composition

Winterim soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Winterim Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,700 to 6,500 feet
Climatic factors:
Mean annual precipitation—20 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 5 inches—black very gravelly loam
5 to 12 inches—dark brown gravelly clay loam
12 to 45 inches—dark reddish brown very gravelly clay
45 inches—weathered basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 21 and 45 inches

Contrasting Inclusions

• Booth soils that are on adjacent benches, hillsides, and foot slopes and have low sagebrush or mountain big sagebrush in the potential plant community
• Royst and Nuss soils that are on adjacent hillsides
• Mound soils that are at the higher elevations on adjacent mountainsides and have dominantly white fir in the potential plant community
• Rock outcrop
• Soils that have slopes of less than 40 percent or more than 60 percent

Major Use

Woodland

Major Management Factors

Slope, water erosion, permeability, rock fragments

Dominant Vegetation in Potential Plant Community

Ponderosa pine, squawcarpet, antelope bitterbrush, wooly wyethia

Woodland

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
- The clayey subsoil restricts permeability.
- Wet, unsurfaced roads are slippery and sticky.
- The soils on south-facing slopes are more droughty than those on north-facing slopes.
- Artificial or natural shade increases seedling survival.
- The rock fragments can make tree planting difficult.
- Cuts and fills slough when wet.
- Cutbanks are difficult to vegetate because the soil is clayey.
- Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
- To protect the quality and quantity of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- Because this unit is on south-facing slopes, larger than normal planting stock, a higher planting rate, shade cards, or additional plantings may be needed.

Suitable management practices:
- To minimize soil displacement, use cable yarding systems.
- To minimize compaction and erosion, avoid logging in spring when the soil is wet.
- Leave slash on the soil surface to minimize sheet and rill erosion.
- Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
- Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
- Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the soil surface.

271E—Winterim very gravelly loam, slump, 2 to 30 percent slopes

Composition

Winterim soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Winterim Soil

Position on landscape: Slump benches on mountains
Parent material: Kind—colluvium, residuum; source—tuff
Elevation: 4,300 to 4,700 feet
Climatic factors:
Mean annual precipitation—20 to 22 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 5 inches—black very gravelly loam
5 to 12 inches—dark brown gravelly clay loam
12 to 45 inches—dark reddish brown very gravelly clay
45 to 60 inches—weathered basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 21 and 45 inches

Contrasting Inclusions

- Royst soils that are on adjacent hillsides
- Nuss soils that are on adjacent hillsides and have dominantly mountain big sagebrush and Idaho fescue in the potential plant community
- Mound soils that are at the higher elevations on adjacent mountainsides and have dominantly white fir in the potential plant community
- Rock outcrop
- Soils that have slopes of more than 30 percent
- Soils that have a very stony loam surface layer

Major Use

Woodland

Major Management Factors

Rock fragments, water erosion, permeability

Dominant Vegetation in Potential Plant Community

Ponderosa pine, squawcarpet, antelope bitterbrush, wooly wyethia

Woodland

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
• The clayey subsoil restricts permeability.
• Wet, unsurfaced roads and skid trails are slippery and sticky.
• This soil slumps because of the highly fractured and faulted tuffaceous bedrock.
• The uneven slopes and hummocky topography restrict the operation of equipment.
• The rock fragments can make tree planting difficult.
• Cuts and fills slough when wet.

Suitable management practices:
• To minimize compaction and erosion, use designated skid trails and low-pressure ground equipment and avoid logging in spring when the soil is wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the soil surface.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

272C—Winterim-Booth complex, 0 to 15 percent slopes

Composition

Winterim soil and similar inclusions—60 percent
Booth soil and similar inclusions—30 percent
Contrasting inclusions—10 percent

Characteristics of the Winterim Soil

Position on landscape: Plateaus and mountainsides
Parent material: Kind—colluvium, residuum; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—18 to 22 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 5 inches—black very gravelly loam
5 to 12 inches—dark brown gravelly clay loam
12 to 45 inches—dark reddish brown very gravelly clay
45 inches—weathered basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 21 and 45 inches

Characteristics of the Booth Soil

Position on landscape: Foot slopes and benches on hills and mountains
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 20 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown, partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Moderate
Shrink-swell potential: High between depths of 4 and 24 inches

Contrasting Inclusions

• Merlin soils that are on tablelands and are near the Booth soil
• Rogger and Woodchopper soils that are on plateaus and mountains and have dominantly white fir in the potential plant community

- Royst soils that are on hills and have sparse ponderosa pine in the potential plant community
- Bullump soils that are on mountains and have dominantly mountain big sagebrush in the potential plant community
- Nuss soils that are on hills and have dominantly mountain big sagebrush and curlleaf mountainmahogany in the potential plant community
- Soils that have slopes of more than 15 percent
- Soils that are similar to the Booth soil but have bedrock at a depth of 40 inches or more

Major Uses

Winterim soil—livestock grazing, woodland
Booth soil—livestock grazing

Major Management Factors

Winterim soil—permeability, rock fragments, shrink-swell potential
Booth soil—depth to the claypan, permeability, depth to bedrock, shrink-swell potential, available water capacity, stones on the surface, water erosion

Dominant Vegetation in Potential Plant Community

Winterim soil—ponderosa pine, squawcarpet, antelope bitterbrush, wooly wyethia
Booth soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

Winterim and Booth soils

General management considerations:
- Cold soil temperatures and a short growing season limit the period of plant growth.
- The bedrock and claypan in the Booth soil restrict rooting depth.
- The surface layer of the Booth soil is saturated following snowmelt.
- Pedestaled plants and an erosion pavement on the Booth soil are the result of past erosion.
- The clayey layer expands when wet and contracts when dry, which can rip and tear plant roots and damage structures.
- The very stony surface layer of the Booth soil restricts the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
- Delay grazing until late in spring when forage plants have achieved sufficient growth.
- Delay grazing until the Booth soil is firm and the preferred forage plants can withstand grazing pressure.
- Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the soil surface, and maintaining adequate plant cover.
- If the Booth soil is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.
- Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

Woodland

Winterim soil

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
- The clayey subsoil restricts permeability.
- Wet, unsurfaced roads and skid trails are slippery and sticky.
- Cuts and fills slough when wet.
- The bedrock is of good quality for use as base and grade material for road construction.
- The rock fragments can make tree planting difficult.

Suitable management practices:
- To minimize compaction and erosion, use designated skid trails and low-pressure ground equipment and avoid logging in spring when the soil is wet.
- To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
- Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the soil surface.

273E—Winterim-Booth complex, 15 to 40 percent north slopes

Composition

Winterim soil and similar inclusions—50 percent
Booth soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Winterim Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—18 to 22 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 5 inches—black very gravelly loam
5 to 12 inches—dark brown gravelly clay loam
12 to 45 inches—dark reddish brown very gravelly clay
45 inches—weathered basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 12 and 45 inches

Characteristics of the Booth Soil

Position on landscape: Foot slopes and benches on mountains and hills
Parent material: Kind—colluvium; source—basalt, tuff
Elevation: 5,000 to 6,500 feet
Climatic factors:
Mean annual precipitation—14 to 20 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
0 to 4 inches—very dark brown very stony loam
4 to 12 inches—very dark brown clay
12 to 24 inches—dark brown clay
24 to 26 inches—olive brown, partially weathered tuff
26 inches—unweathered tuff
Depth class: Moderately deep (20 to 40 inches) to bedrock, very shallow (1 to 7 inches) to the claypan
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 3 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 4 and 24 inches

Contrasting Inclusions

- Royst soils that are on hills and that have sparse ponderosa pine in the potential plant community
- Nuss that are on hills and have mountain big sagebrush and curlleaf mountainmahogany in the potential plant community
- Mound that are at the higher elevation on mountainsides and have dominantly white fir in the potential plant community
- Rock outcrop
- Bullump soils that are on the lower part of slopes and have mountain big sagebrush in the potential plant community
- Soils that have slopes of less than 15 percent or more than 40 percent
- Soils on south-facing slopes

Major Uses

Winterim soil—livestock grazing, woodland
Booth soil—livestock grazing (fig. 22)

Figure 22.—Area of Winterim-Booth complex, 15 to 40 percent north slopes. The Winterim soil is used for timber production and livestock grazing, and the Booth soil is used for livestock grazing.

Major Management Factors

Winterim soil—slope, water erosion, shrink-swell potential, permeability, rock fragments
Booth soil—depth to the claypan, permeability, depth to bedrock, water erosion, stones on the surface, slope, shrink-swell potential, available water capacity

Dominant Vegetation in Potential Plant Community

Winterim soil—ponderosa pine, squawcarpet, antelope bitterbrush, wooly wyethia
Booth soil—Idaho fescue, low sagebrush, bluebunch wheatgrass

Livestock Grazing

Winterim and Booth soils

General management considerations:

• Cold soil temperatures and a short growing season limit the period of plant growth.
• The surface layer of the Booth soil is saturated following snowmelt.
• Livestock prefer to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
• Livestock herd and graze in the less stony areas of this unit.
• The bedrock and claypan in the Booth soil restrict rooting depth.
• Pedestaled plants and an erosion pavement on the Booth soil are the result of past erosion.
• The clayey layer expands when wet and contract when dry, which can rip and tear plant roots.
• The very stony surface layer and slope of the Booth soil restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Delay grazing until the Booth soil is firm and the preferred forage plants can withstand grazing pressure.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the soil surface, and maintaining adequate plant cover.
• If the Booth soil is seeded, select plants that tolerate droughtiness, shrinking and swelling, and a cool growing season.
• Improve areas that are heavily infested with undesirable shrubs by railing, chaining, beating, or applying chemicals.

Woodland

Winterim soil

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50
Estimated yield (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
• The clayey subsoil restricts permeability.
• Wet, unsurfaced roads and skid trails are slippery.
• The rock fragments can make tree planting difficult.
• Cuts and fills slough when wet.
• To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
• To minimize compaction and erosion, use designated skid trails and low-pressure ground equipment and avoid logging in spring when the soil is wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the soil surface.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

274F—Winterim association, slump, 30 to 50 percent slopes

Composition

Winterim soil, north-facing, and similar inclusions—55 percent
Winterim soil, south-facing, and similar inclusions—30 percent
Contrasting inclusions—15 percent

Characteristics of the Winterim Soils

Position on landscape: North- and south-facing mountainsides
Parent material: Kind—colluvium, residuum; source—tuff, basalt
Elevation: 5,000 to 6,200 feet
Climatic factors:
Mean annual precipitation—20 to 22 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 5 inches—black very gravelly loam
5 to 12 inches—dark brown gravelly clay loam
12 to 45 inches—dark reddish brown very gravelly clay
45 inches—weathered basalt
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Slow
Available water capacity: About 5 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 12 and 45 inches

Contrasting Inclusions

- Royst soils that are on hills and have sparse ponderosa pine in the potential plant community
- Nuss soils that are on hills and have mountain big sagebrush and curlleaf mountainmahogany in the potential plant community
- Mound soils that are at the higher elevations on mountainsides and have dominantly white fir in the potential plant community
- Rock outcrop
- Soils that have slopes of more than 50 percent or less than 30 percent
- Soils that have a very stony loam surface layer

Major Uses

Woodland, livestock grazing

Major Management Factors

Slope, water erosion, shrink-swell potential, permeability, rock fragments

Dominant Vegetation in Potential Plant Community

Ponderosa pine, squawcarpet, antelope bitterbrush, wooly wyethia

Woodland

Estimated growth at culmination of mean annual increment: 50 cubic feet per acre per year for ponderosa pine at age 50

Estimated yield (Scribner rule): 150 board feet per acre per year for ponderosa pine at age 190

General management considerations:
- The clayey subsoil restricts permeability.
- Wet, unsurfaced roads and skid trails are slippery and sticky.
- This unit slumps because of the highly fractured and faulted tuffaceous bedrock.
- The soils on south-facing slopes are more droughty than those on north-facing slopes.
- The rock fragments can make tree planting difficult.
- Artificial or natural shade can increase seedling survival on the south-facing slopes.
- Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
- Cuts and fills slough when wet.
- Cutbanks are difficult to vegetate because of the clayey subsoil.
- To protect the quantity and quality of the water, a buffer zone should be maintained around riparian areas and disturbance of these areas should be minimized.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- Because the soils on south-facing slopes are more droughty, larger than normal planting stock, a higher planting rate, shade cards, or additional plantings may be needed.

Suitable management practices:
- To minimize soil displacement, use cable yarding systems.
- To minimize compaction and erosion, avoid logging in spring when the soils are wet.
- Leave slash on the soil surface to minimize sheet and rill erosion.
- Avoid constructing roads at midslope. Locate roads on ridgetops or in saddles to minimize cuts and fills.
- Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
- Restrict vehicle access to periods when the soil is dry or frozen to prevent puddling and rutting of the soil surface.

275E—Woodchopper-Polander complex, 15 to 40 percent south slopes

Composition

Woodchopper soil and similar inclusions—60 percent
Polander soil and similar inclusions—30 percent
Contrasting features—10 percent

Characteristics of the Woodchopper Soil

Position on landscape: Plateaus, mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
3 inches to 0—ponderosa pine and white fir needles
0 to 14 inches—dark reddish brown gravelly loam
14 to 25 inches—dark reddish brown cobbly clay loam
25 to 49 inches—dark reddish brown clay
49 to 60 inches—reddish brown gravelly clay
Depth class: Very deep (more than 60 inches) to bedrock

Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 7 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 25 and 60 inches

Characteristics of the Polander Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Mound, Rogger, and Twelvemile soils that are on adjacent mountainsides
• Winterim that are at the lower elevations on adjacent mountainsides
• Soils that have slopes of less than 15 percent or more than 40 percent
• Soils on north-facing slopes
• Soils that have a stony or very stony surface layer

Major Use

Woodland

Major Management Factors

Woodchopper soil—permeability, slope, water erosion
Polander soil—water erosion, slope

Dominant Vegetation in Potential Plant Community

Woodchopper and Polander soils—white fir, ponderosa pine, common snowberry, heartleaf arnica, wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: Woodchopper and Polander soils—55 cubic feet per acre per year for ponderosa pine at age 50 and 77 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): Woodchopper and Polander soils—172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
• Wet, unsurfaced roads and skid trails on the Woodchopper soil are slippery and sticky, and those on the Polander soil are soft.
• The clayey subsoil in the Woodchopper soil restricts permeability.
• Cuts and fills on the Woodchopper soil slough when wet, and those on the Polander soil are stable.
• To protect the quality and quantity of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
• The growing season begins earlier on the south-facing slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• Because this unit is on south-facing slopes, larger than normal planting stock, a higher planting rate, shade cards, or additional plantings may be needed.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
• To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soils are wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Restrict vehicle access of the Woodchopper soil to periods when the soil is dry or frozen to prevent puddling and rutting.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.

276C—Woodchopper-Rogger complex, 0 to 15 percent slopes

Composition

Woodchopper soil and similar inclusions—60 percent
Rogger soil and similar inclusions—30 percent
Contrasting inclusions—10 percent

Characteristics of the Woodchopper Soil

Position on landscape: Plateaus, mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
3 inches to 0—ponderosa pine and white fir needles
0 to 14 inches—dark reddish brown gravelly loam
14 to 25 inches—dark reddish brown cobbly clay loam
25 to 49 inches—dark reddish brown clay
49 to 60 inches—reddish brown gravelly clay
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 7 inches
Hazard of erosion by water: Slight or moderate
Shrink-swell potential: High between depths of 25 and 60 inches

Characteristics of the Rogger Soil

Position on landscape: Plateaus, mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—ponderosa pine and white fir needles
0 to 5 inches—very dark brown very gravelly fine sandy loam
5 to 12 inches—very dark grayish brown very gravelly fine sandy loam
12 to 21 inches—dark yellowish brown gravelly fine sandy loam
21 to 36 inches—dark yellowish brown very cobbly loam
36 inches—weathered basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Slight or moderate

Contrasting Inclusions

- Winterim soils that are at the lower elevations on adjacent mountainsides
- Soils that have a stony or very stony surface layer
- Soils that have slopes of more than 15 percent

Major Use

Woodland

Major Management Factors

Woodchopper soil—permeability
Rogger soil—available water capacity, depth to bedrock, rock fragments

Dominant Vegetation in Potential Plant Community

Woodchopper and Rogger soils—white fir, ponderosa pine, common snowberry, heartleaf arnica, wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: Woodchopper soil—55 cubic feet per acre per year for ponderosa pine at age 50 and 77 cubic feet per acre per year for white fir at age 70; Rogger soil—69 cubic feet per acre per year for ponderosa pine at age 40 and 91 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): Woodchopper soil—172 board feet per acre per year for ponderosa pine at age 160; Rogger soil—225 board feet per acre per year for ponderosa pine at age 150

General management considerations:
- The clayey subsoil of the Woodchopper soil restricts permeability.
- Wet, unsurfaced roads and skid trails on the

Woodchopper soil are slippery and sticky, and those on the Rogger soil are firm.
• The rock fragments in the Rogger soil make tree planting difficult.
• The bedrock in the Rogger soil restricts rooting depth.
• Because the Rogger soil is droughty, larger than normal planting stock, a higher planting rate, or additional plantings may be needed.

Suitable management practices:
• To minimize compaction, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soils are wet.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
• Reduce the risk of erosion and minimize displacement of the Woodchopper soil by limiting vehicle access to periods when the soil is dry or frozen.

277E—Woodchopper-Rogger complex, 15 to 40 percent south slopes

Composition

Woodchopper soil and similar inclusions—60 percent
Rogger soil and similar inclusions—30 percent
Contrasting inclusions—10 percent

Characteristics of the Woodchopper Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
3 inches to 0—ponderosa pine and white fir needles
0 to 14 inches—dark reddish brown gravelly loam
14 to 25 inches—dark reddish brown cobbly clay loam
25 to 49 inches—dark reddish brown clay
49 to 60 inches—reddish brown gravelly clay
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately slow
Available water capacity: About 7 inches
Hazard of erosion by water: Severe
Shrink-swell potential: High between depths of 25 and 60 inches

Characteristics of the Rogger Soil

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—28 to 32 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
2 inches to 0—ponderosa pine and white fir needles
0 to 5 inches—very dark brown very gravelly fine sandy loam
5 to 12 inches—very dark brown very gravelly fine sandy loam
12 to 21 inches—dark yellowish brown very gravelly fine sandy loam
21 to 36 inches—dark yellowish brown very cobbly loam
36 inches—weathered basalt
Depth class: Moderately deep (20 to 40 inches) to bedrock
Drainage class: Well drained
Permeability: Moderate
Available water capacity: About 3 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Winterim soils that are at the lower elevations on adjacent mountainsides
• Soils that have slopes of less than 15 percent or more than 40 percent
• Soils that have a stony or very stony surface layer

Major Use

Woodland

Major Management Factors

Woodchopper soil—water erosion, slope, permeability
Rogger soil—water erosion, slope, available water capacity, depth to bedrock, rock fragments

Dominant Vegetation in Potential Plant Community

Woodchopper and Rogger soils—white fir, ponderosa pine, common snowberry, heartleaf arnica, wheeler bluegrass

Woodland

Estimated growth at culmination of mean annual increment: Woodchopper soil—55 cubic feet per acre per year for ponderosa pine at age 50 and 77 cubic feet per acre per year for white fir at age 70; Rogger soil—69 cubic feet per acre per year for ponderosa pine at age 40 and 91 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): Woodchopper soil—172 board feet per acre per year for ponderosa pine at age 160; Rogger soil—225 board feet per acre per year for ponderosa pine at age 150

General management considerations:
- Wet, unsurfaced roads and skid trails on the Woodchopper soil are slippery and sticky, and those on the Rogger soil are firm.
- The clayey subsoil of the Woodchopper soil restricts permeability.
- The rock fragments in the Rogger soil make tree planting difficult.
- The growing season begins earlier on the south-facing slopes than on the north-facing slopes. Droughtiness is a limitation earlier in the growing season on south-facing slopes than on north-facing slopes.
- The bedrock in the Rogger soil restricts rooting depth.
- Cuts and fills on the Woodchopper soil slough when wet, and those on the Rogger soil ravel when dry.
- To protect the quality and quantity of the water, a buffer zone should be maintained around riparian areas. Management of these areas should be designed to minimize disturbance. Trees should not be felled into or skidded through riparian areas.
- Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.
- Because the Rogger soil is droughty and the soils in this unit are on south-facing slopes, larger than normal planting stock, a higher planting rate, shade cards, or additional plantings may be needed.

Suitable management practices:
- To minimize compaction, displacement, and erosion, use designated skid trails and low-pressure ground equipment, log in areas that are covered with a minimum of 12 inches of snow or that have a frozen surface layer, and avoid logging in spring when the soils are wet.
- To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
- Minimize mechanical piling of slash. Heavy equipment causes soil compaction and disturbance and exposes the soil. Maintain slash on the soil surface to reduce sheet and rill erosion.
- Reduce the risk of erosion on skid trails and temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
- Restrict vehicle access on the Woodchopper soil to periods when the soil is dry or frozen to prevent puddling and rutting.

278G—Xerolls-Rock outcrop complex, cool, 40 to 60 percent north slopes

Composition

Xerolls and similar inclusions—60 percent
Rock outcrop—30 percent
Contrasting inclusions—10 percent

Characteristics of the Xerolls

Position on landscape: North-facing mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,000 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 38 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March
Reference profile:
0 to 4 inches—dark brown extremely stony loam
4 to 11 inches—dark brown extremely cobbly loam
11 to 27 inches—dark yellowish brown extremely cobbly loam
27 inches—basalt
Depth class: Shallow to very deep (10 to 70 inches) to bedrock
Drainage class: Somewhat excessively drained and well drained
Permeability: Moderately slow to moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Characteristics of the Rock Outcrop

Position on landscape: Escarpments
Kind of rock: Basalt

Contrasting Inclusions

• Booth soils that are on adjacent mountainsides and benches and have low sagebrush in the potential plant community
• Rogger soils that are on adjacent mountainsides and support dominantly ponderosa pine and white fir
• Winterim soils that are on adjacent mountainsides and support dominantly ponderosa pine
• Soils on south-facing slopes
• Soils that have slopes of less than 40 percent
• Rubble land

Major Uses

Watershed, livestock grazing

Major Management Factors

Water erosion; slope; Rock outcrop; depth to bedrock, rock fragments, and available water capacity in some areas

Dominant Vegetation in Potential Plant Community

Xerolls—Idaho fescue, curlleaf mountainmahogany, common snowberry, mountain big sagebrush

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The growing season of the soils on north-facing slopes begins later in spring and moisture is available until later in summer in these soils than in the soils on south-facing slopes.
• Livestock prefer to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
• Uniform distribution of livestock is difficult because of the slope and the lack of permanent water developments.
• The areas of shallow, droughty soils in this unit produce forage that is available for livestock grazing earlier in the year and for a shorter period of time than the adjacent areas of deeper soils.
• Livestock tend to herd and graze in the less stony areas of this unit.
• The depth to bedrock in some areas restricts rooting depth and placement of fenceposts.
• The low available water capacity in some areas limits forage production and seedling survival.
• The extremely stony surface layer, areas of Rock outcrop, and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until summer when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the soil surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a short, cool growing season.

279G—Xerolls-Rock outcrop complex, cool, 40 to 60 percent south slopes

Composition

Xerolls and similar inclusions—60 percent
Rock outcrop—30 percent
Contrasting inclusions—10 percent

Characteristics of the Xerolls

Position on landscape: South-facing mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,000 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 38 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March
Reference profile:
0 to 4 inches—dark brown extremely stony loam
4 to 11 inches—dark brown extremely cobbly loam
11 to 27 inches—dark yellowish brown extremely cobbly loam
27 inches—basalt
Depth class: Shallow to very deep (10 to 70 inches) to bedrock
Drainage class: Somewhat excessively drained and well drained
Permeability: Moderately rapid to moderately slow
Available water capacity: About 4 inches
Hazard of erosion by water: Severe

Characteristics of the Rock Outcrop

Position on landscape: Escarpments
Kind of rock: Basalt

Contrasting Inclusions

• Booth soils that are on adjacent mountainsides and

benches and have low sagebrush in the potential plant community
• Rogger soils that are on adjacent mountainsides and support dominantly ponderosa pine and white fir
• Winterim soils that are on adjacent mountainsides and support dominantly ponderosa pine
• Soils on north-facing slopes
• Soils that have slopes of less than 40 percent
• Rubble land

Major Uses

Watershed, livestock grazing

Major Management Factors

Water erosion; slope; Rock outcrop; depth to bedrock, rock fragments, and available water capacity in some areas

Dominant Vegetation in Potential Plant Community

Xerolls—bluebunch wheatgrass, mountain big sagebrush

Livestock Grazing

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The growing season on the south-facing slopes begins earlier in spring than on the north-facing slopes. Available moisture is a limitation earlier in the growing season on the south-facing slopes than on the north-facing slopes.
• Livestock prefer to graze in the easily accessible areas on ridgetops and in valleys before they graze in the less accessible areas on side slopes.
• Uniform distribution of livestock is difficult because of the slope and the lack of permanent water developments.
• The areas of shallow, droughty soils in this unit produce forage available for livestock grazing earlier in the year and for a shorter period of time than the adjacent areas of deeper soils.
• Livestock tend to herd and graze in the less stony areas of this unit.
• The depth to bedrock in some areas restricts rooting depth and placement of fenceposts.
• The low available water capacity in some areas limits forage production and seedling survival.
• The extremely stony surface layer, areas of Rock outcrop, and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The shallow depth in some areas limits placement of fenceposts and makes special design of fences necessary.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the soil surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a short, cool growing season.

280G—Xerolls-Rock outcrop complex, warm, 30 to 75 percent south slopes

Composition

Xerolls and similar inclusions—45 percent
Rock outcrop—40 percent
Contrasting inclusions—15 percent

Characteristics of the Xerolls

Position on landscape: Hillsides, mountainsides
Parent material: Kind—colluvium, residuum; source—basalt
Elevation: 4,600 to 5,800 feet
Climatic factors:
Mean annual precipitation—10 to 12 inches
Mean annual air temperature—45 to 48 degrees F
Frost-free period—70 to 110 days
Reference profile:
0 to 3 inches—dark brown very stony loam
3 to 10 inches—dark brown very cobbly loam
10 to 25 inches—dark yellowish brown very cobbly loam
25 inches—basalt
Depth class: Shallow to very deep (10 to 70 inches) to bedrock
Drainage class: Moderately well drained and well drained
Permeability: Moderate and moderately rapid
Available water capacity: About 2 inches
Hazard of erosion by water: Severe and very severe

Characteristics of the Rock Outcrop

Position on landscape: Escarpments
Kind of rock: Basalt

Contrasting Inclusions

• Lambring soils that are on adjacent, north-facing slopes and have dominantly Idaho fescue, mountain big sagebrush, or low sagebrush in the potential plant community

• Riddleranch soils that are on adjacent mountainsides and have dominantly Idaho fescue and Wyoming big sagebrush in the potential plant community
• Soils that have slopes of less than 30 percent
• Rubble land

Major Uses

Watershed, livestock grazing

Major Management Factors

Slope; water erosion; Rock outcrop; depth to bedrock, rock fragments, and available water capacity in some areas

Dominant Vegetation in Potential Plant Community

Xerolls—Sandberg bluegrass, low sagebrush.

Livestock Grazing

General management considerations:
• Livestock tend to graze in easily accessible areas on ridgetops and in valleys before they graze in less accessible areas on side slopes.
• Livestock tend to herd and graze in the less stony areas of this unit.
• The depth to bedrock in some areas restricts the rooting depth and placement of fenceposts.
• The low available water capacity in some areas limits forage production and seedling survival.
• The very stony surface layer, areas of Rock outcrop, and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.
• The growing season begins earlier in spring on the south-facing slopes than on the north-facing slopes, but droughtiness is a limitation earlier in summer on the south-facing slopes.

Suitable management practices:
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the soil surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate droughtiness.

281G—Xerolls-Rock outcrop-Polander complex, 30 to 80 percent south slopes

Composition

Xerolls and similar inclusions—45 percent
Rock outcrop—20 percent
Polander soil and similar inclusions—20 percent
Contrasting inclusions—15 percent

Characteristics of the Xerolls

Position on landscape: Mountainsides
Parent material: Kind—colluvium, residuum; source—andesite, basalt, tuff
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 38 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March
Reference profile:
0 to 4 inches—dark brown extremely stony loam
4 to 11 inches—dark brown extremely cobbly loam
11 to 27 inches—dark yellowish brown extremely cobbly loam
27 inches—basalt
Depth class: Shallow to very deep (10 to 70 inches) to bedrock
Drainage class: Somewhat excessively drained and well drained
Permeability: Moderately slow to moderately rapid
Available water capacity: About 4 inches
Hazard of erosion by water: Severe and very severe

Characteristics of the Rock Outcrop

Position on landscape: Mountainsides, escarpments
Kind of rock: Tuff, basalt

Characteristics of the Polander Soil

Position on landscape: Mountainsides that have slopes of 30 to 60 percent
Parent material: Kind—colluvium, residuum; source—pyroclastic rock
Elevation: 5,500 to 7,200 feet
Climatic factors:
Mean annual precipitation—18 to 38 inches
Mean annual air temperature—45 to 47 degrees F
Frost-free period—50 to 70 days
Period of snowpack: More than 12 inches—December through March; more than 48 inches—January and February
Typical profile:
1 inch to 0—ponderosa pine needles
0 to 14 inches—very dark grayish brown sandy loam
14 to 38 inches—dark grayish brown sandy loam
38 to 50 inches—dark grayish brown cobbly loam
50 inches—highly weathered tuff
Depth class: Deep (40 to 60 inches) to bedrock
Drainage class: Well drained
Permeability: Moderately rapid
Available water capacity: About 6 inches
Hazard of erosion by water: Severe

Contrasting Inclusions

• Mound, Rogger, and Twelvemile soils that are on adjacent mountainsides
• Soils on north-facing slopes
• Soils that have slopes of less than 30 percent or more than 80 percent
• Rubble land

Major Uses

Xerolls—watershed, livestock grazing
Polander soil—watershed, woodland

Major Management Factors

Xerolls—water erosion; slope; Rock outcrop; depth to bedrock, rock fragments, and available water capacity in some areas
Polander soil—slope, water erosion, Rock outcrop

Dominant Vegetation in Potential Plant Community

Xerolls—bluebunch wheatgrass, mountain big sagebrush.
Polander soil—white fir, ponderosa pine, common snowberry, heartleaf arnica, wheeler bluegrass

Livestock Grazing

Xerolls

General management considerations:
• Cold soil temperatures and a short growing season limit the period of plant growth.
• The growing season begins earlier in spring on the south-facing slopes than on the north-facing slopes, but droughtiness is a limitation earlier in summer on the south-facing slopes.
• The trees on the Polander soil provide shade and shelter for livestock.
• Livestock prefer to graze the easily accessible areas on ridgetops and in valleys before they graze the less accessible areas on side slopes.
• Uniform distribution of livestock is difficult because of the slope and the lack of permanent water developments.
• The areas of shallow, droughty soils in this unit produce forage available for livestock grazing earlier in the year and for a shorter period of time than the adjacent areas of deeper soils.
• Livestock tend to herd and graze in the less stony areas of this unit.
• The depth to bedrock in some areas restricts rooting depth and placement of fenceposts.
• The low available water capacity in some areas limits forage production and seedling survival.
• The extremely stony surface layer, areas of Rock outcrop, and steepness of slope restrict the operation of ground seeding equipment. Other methods such as broadcast seeding should be used.

Suitable management practices:
• Delay grazing until late in spring when forage plants have achieved sufficient growth.
• Minimize the risk of erosion by preserving the existing plant cover, seeding, accumulating litter on the soil surface, and maintaining adequate plant cover.
• If this unit is seeded, select plants that tolerate a short, cool growing season.

Woodland

Polander soil

Estimated growth at culmination of mean annual increment: 55 cubic feet per acre per year for ponderosa pine at age 50; 57 cubic feet per acre per year for white fir at age 70
Estimated yield (Scribner rule): 172 board feet per acre per year for ponderosa pine at age 160

General management considerations:
• The soils on south-facing slopes are more droughty than those on north-facing slopes.
• Artificial or natural shade increases seedling survival.
• Wet, unsurfaced roads are soft.
• Dry, unsurfaced roads are dusty.
• Cuts and fills are stable.
• The areas of Rock outcrop force yarding and skidding paths to converge, which increases the risks of compaction and erosion.
• Roads located at midslope are difficult to maintain and require large cuts and fills that remove land from production.
• Cuts and fills should have a ratio of more than 2 to 1 to allow for long-term establishment of plants.

Suitable management practices:
• To minimize soil displacement, use cable yarding systems.
• To minimize compaction, adjust yarding operations to the content of moisture, organic matter, and rock fragments in the surface layer.
• Leave slash on the soil to minimize sheet and rill erosion.
• Reduce the risk of erosion on temporary roads by seeding, installing water bars, scarifying the soil surface, or accumulating slash on the soil surface.
• Use shade cards to increase seedling survival.

282B—Zorravista fine sand, 0 to 5 percent slopes

Composition

Zorravista soil and similar inclusions—85 percent
Contrasting inclusions—15 percent

Characteristics of the Zorravista Soil

Position on landscape: Semistabilized dunes and sand sheets on lake terraces
Parent material: Kind—eolian sand; source—basalt, tuff, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark brown fine sand
4 to 60 inches—dark brown loamy fine sand and fine sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Excessively drained
Permeability: Very rapid
Available water capacity: About 3 inches
Hazard of erosion: By water—slight; by wind—very severe

Contrasting Inclusions

- Mesman soils that are on adjacent lake terraces and have basin big sagebrush and black greasewood in the potential plant community
- McConnel soils that are on adjacent perched deltas and lake terraces and have dominantly Wyoming big sagebrush in the potential plant community
- Hinton soils that are on adjacent lake terraces and have dominantly Wyoming big sagebrush in the potential plant community
- Soils that have slopes of more than 5 percent

Major Uses

Livestock grazing, cropland

Major Management Factors

Permeability, wind erosion, available water capacity

Dominant Vegetation in Potential Plant Community

Indian ricegrass, fourwing saltbush, needleandthread

Livestock Grazing

General management considerations:
- The low precipitation and low available water capacity limit forage production and seedling survival.
- This unit is subject to wind erosion if the vegetation is removed or degraded.
- A potential for seepage limits construction of water impoundments.
- This soil is suited to grazing in winter.
- Range seeding controls blowing and drifting sand.

Suitable management practices:
- Minimize the risk of wind erosion by preserving the existing plant cover, seeding, and accumulating plant litter on the surface.
- If this unit is seeded, select plants that tolerate droughtiness.

Cropland

General management considerations:
- Because of the limited precipitation and low available water capacity, continuous cropping is not practical unless the soil is irrigated.
- Because of the rapid water intake rate and the very rapid permeability, this soil is best suited to sprinkler irrigation.
- Because the soil is droughty and has very rapid permeability, irrigation water should be applied frequently for short periods.
- Wind erosion is a concern on this soil because of the fine sand surface layer.
- Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
- Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
- Because this soil is subject to blowing, a plant cover should be maintained.
- The seedling mortality rate may be severe because of the very low available water capacity.

Suitable management practices:
- Irrigate during the dry period in summer.
- Irrigate at a rate that ensures optimum production but does not increase deep percolation.
- Apply sufficient irrigation water to wet the root zone but not so much that it leaches plant nutrients below the root zone.
- Reduce the risk of wind erosion by planting crops in narrow strips at right angles to the prevailing wind,

maintaining crop residue on the surface, maintaining a plant cover, and keeping the soil surface rough.

283B—Zorravista-Hinton complex, 0 to 8 percent slopes

Composition

Zorravista soil and similar inclusions—50 percent
Hinton soil and similar inclusions—35 percent
Contrasting inclusions—15 percent

Characteristics of the Zorravista Soil

Position on landscape: Semistabilized dunes and sand sheets on lake terraces that have slopes of 2 to 8 percent
Parent material: Kind—eolian sand; source—basalt, tuff, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 4 inches—dark brown fine sand
4 to 60 inches—dark brown loamy fine sand and fine sand
Depth class: Very deep (more than 60 inches) to bedrock
Drainage class: Excessively drained
Permeability: Very rapid
Available water capacity: About 3 inches
Hazard of erosion: By water—slight; by wind—very severe

Characteristics of the Hinton Soil

Position on landscape: Lake terraces that have slopes of 0 to 5 percent
Parent material: Kind—stratified lacustrine beach sediment and eolian deposits; source—tuff, basalt, volcanic ash
Elevation: 4,200 to 4,800 feet
Climatic factors:
Mean annual precipitation—8 to 10 inches
Mean annual air temperature—47 to 50 degrees F
Frost-free period—90 to 110 days
Typical profile:
0 to 1 inch—very dark grayish brown gravelly loamy sand
1 inch to 12 inches—dark brown loamy sand
12 to 18 inches—dark brown gravelly loam
18 to 24 inches—dark gray extremely gravelly sand
24 to 28 inches—brown sand
28 to 40 inches—brown extremely gravelly sand
40 to 43 inches—brown gravelly sand
43 to 60 inches—brown extremely gravelly sand
Depth class: Very deep (more than 60 inches) to bedrock, shallow (10 to 20 inches) to the firm brittle layer
Drainage class: Well drained
Permeability: Upper 12 inches—rapid; between depths of 12 and 18 inches—moderately slow
Available water capacity: About 1 inch
Hazard of erosion: By water—slight; by wind—severe

Contrasting Inclusions

• Mesman soils that are on adjacent lake terraces and have dominantly basin big sagebrush and black greasewood in the potential plant community
• McConnel soils that are on adjacent perched deltas and lake terraces and have dominantly Wyoming big sagebrush in the potential plant community

Major Use

Livestock grazing

Major Management Factors

Zorravista soil—permeability, wind erosion, available water capacity
Hinton soil—permeability, wind erosion, available water capacity, firm brittle layer

Dominant Vegetation in Potential Plant Community

Zorravista soil—Indian ricegrass, fourwing saltbush, needleandthread
Hinton soil—Indian ricegrass, basin big sagebrush, Thurber needlegrass, Wyoming big sagebrush, needleandthread

Livestock Grazing

General management considerations:
• The low precipitation and low available water capacity limit forage production and seedling survival.
• The firm brittle layer in the Hinton soil restricts rooting depth and water movement.
• A potential for seepage limits construction of water impoundments.
• The soils in this unit are subject to wind erosion if the vegetation is removed or degraded.
• Because of the high corrosivity to uncoated steel, protection from corrosion or use of noncorrosive

material, such as concrete, aluminum, galvanized steel, or plastics, is needed for structures or pipelines.
• This unit is suited to grazing in winter.
• Range seeding controls blowing and drifting sand.
• Trees and shrubs for windbreaks and environmental plantings should be tolerant of droughtiness.
• Because the soils in this unit are subject to blowing, a plant cover should be maintained.
• The seedling mortality rate may be severe because of the very low available water capacity.

Suitable management practices:
• Minimize the risk of wind erosion by preserving the existing plant cover, seeding, and accumulating plant litter on the surface.
• If this unit is seeded, select plants that tolerate droughtiness.

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 uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The estimated yields of the main crops and pasture plants are listed for each soil, the system of land capability classification used by the Natural Resources Conservation Service is explained, and prime farmland is described.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading “Detailed Soil Map Units.” Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Nonirrigated Cropland

About 10,000 acres of the survey area is used for nonirrigated crops, mainly small grain. A hazard of water erosion and droughtiness are the primary concerns in managing nonirrigated cropland. Resource management systems should be specific to each soil, crop grown, and climatic condition to keep soil and moisture losses to a minimum. Management strategies for a particular farm may include a combination of practices. Because droughtiness is a major limitation to the production of nonirrigated crops, conservation and efficient use of the available moisture is important.

Gully, sheet, and rill erosion are serious concerns in this survey area. These types of erosion result in loss of valuable topsoil, sedimentation, loss of soil productivity, poor water quality, and damage to property.

If the surface layer is lost through erosion, much of the available plant nutrients and organic matter are lost, which affects soil structure, water infiltration, and soil tilth. The severity of the erosion determines how much productivity is lost. Many years are needed to replace a small portion of the soil surface even under the best soil-building conditions. Soils that have steeper slopes, particularly those that have slopes of more than 25 percent, are highly susceptible to water erosion. Planting permanent vegetation helps to minimize water erosion and rehabilitate severely eroded areas.

Soils that freeze are very susceptible to erosion. The water intake rate may be reduced significantly when a soil is frozen, and excessive runoff occurs during periods of freezing and thawing. When the surface of the soil thaws, it becomes supersaturated. The resulting mix of soil and water flows downslope, causing severe gully erosion. Drews soils that have slopes of more than 10 percent are particularly subject to runoff when they are frozen.

Resource management systems that reduce soil erosion from runoff and that conserve soil moisture include both cultural and structural practices. Cultural practices consist of conservation cropping systems and conservation tillage systems, including minimum tillage and no-till farming, and use of chemical fallow and crop residue. Structural practices include the construction of terraces, diversions, and grassed waterways. Farming on the contour and across the slope and stripcropping also reduce erosion and conserve soil moisture.

Residue Management and Tillage Systems. Organic matter provided by crop residue is an important source of nitrogen, phosphorus, and sulfur. It also increases the water intake rate and available water capacity, reduces surface crusting, promotes good soil structure and tilth, and reduces erosion. Research shows that organic matter content gradually decreases in soils that are under a small grain and fallow cropping system for many years, even in areas where straw is incorporated. Use of conservation cropping systems that include additions of straw, however, helps to slow this decline. The organic matter content can be maintained by regularly adding manure. Growing green manure crops or planting severely eroded areas to permanent vegetation hastens rehabilitation.

Conservation tillage systems are important in maintaining good soil tilth. Keeping the surface rough and cloddy can reduce runoff. Excessive tillage results in loss of soil moisture, and it pulverizes soil aggregates and destroys soil structure. Overworking the soil in spring and summer before seeding results in crusting of the surface, which reduces infiltration, produces a powdery soil surface that is subject to wind erosion, impairs seedling emergence, and causes excessive runoff and erosion.

Most of the soils in this survey area that are used for nonirrigated crops are loam or silt loam. When wet, these soils are particularly susceptible to compaction by farm machinery and other vehicles and by livestock. Compaction results in reduced permeability and infiltration and restricted root penetration. As water movement in the soils is impeded, runoff increases and erosion occurs. Minimizing tillage operations and restricting traffic by equipment and livestock when the soils are wet reduces compaction. Subsoiling or deep chiseling when the soils are dry fractures the compacted layers.

Proper management of crop residue includes leaving as much plant material on the soil surface throughout the year as needed to control erosion. Residue on the surface reduces erosion and filters out the sediment from runoff. Decomposing residue returns some organic matter to the soil, which helps to improve soil structure and the water infiltration rate. Residue management also is effective in reducing the risk of wind erosion.

Removal of residue by grazing, mechanical chopping, tilling, or burning generally is neither desirable nor economically feasible. Moldboard plowing inverts the soil surface and leaves little residue on the surface. Disking or chiseling buries some of the crop residue, which accelerates the decomposition of the buried portion, and retains adequate residue on the surface.

The trend in areas of nonirrigated crops is toward minimum tillage or no-till farming. No-till farming consists of planting crops in untilled soil by opening a narrow band of sufficient width and depth for proper seed coverage. No other seedbed preparation is done. Use of herbicides to kill weeds and grasses during the fallow year, commonly called chemical fallow, makes most cultivation unnecessary.

Structural Practices. Terraces and diversions are used to reduce the effective length of slopes and thereby reduce runoff, sedimentation, and erosion. They are best suited to soils that have uniform, regular slopes. In areas that have slopes of more than 12 percent, terraces usually are effective in reducing gully erosion.

Level or gradient terraces are used in areas of nonirrigated cropland. Level terraces generally are most effective in areas of deep soils that receive a moderate amount of precipitation, such as those of the Harriman series. Gradient terraces generally are constructed in areas of moderately deep soils that receive a high amount of precipitation, such as those of the Drewsgap series.

Grassed waterways reduce erosion and sedimentation in areas of concentrated waterflow. Natural or constructed waterways are suitable where there is a nonerosive outlet. Maintaining a plant cover keeps the soil in place and makes it more resistant to water erosion. A plant cover also acts as a filter, reducing the amount of sediment carried by runoff.

Stripcropping, or alternating fields of crops and fallow, reduces the risks of wind and water erosion. On soils that are gravelly loamy sand, such as those of the Fordney series, including alternate strips of vegetation or crop residue retards the movement of soil particles by wind. These strips should be oriented at right angles to the prevailing wind. Stripcropping also reduces water erosion and sedimentation in areas of high precipitation. Stripcropping is best suited to soils that have uniform slopes, where strips can be on the contour or across the slope.

Tillage and seeding can be done in conjunction with stripcropping. The ridges left by tillage and planting operations retard the flow of water downslope. These practices are best suited to soils that have uniform slopes.

Cropping Systems. The primary cropping system used on the nonirrigated cropland in the area is small grain and fallow, and it includes mainly winter wheat and spring barley. The nonirrigated cropland is fallowed, or kept free of vegetation, for one cropping season to control weeds and to store moisture and nutrients for the crops to be grown the following season.

Summer fallowing is a primary factor contributing to the risk of water erosion in areas where prolonged rains, freezing temperatures, or intense summer thunderstorms occur. In areas where moisture is sufficient, annual cropping may be more desirable.

Annual precipitation is sufficient to fill to field capacity the profile of the moderately deep soils, such are those of the Drewsgap series. These soils are suited to annual cropping. Deep soils, such as those of the Drews series, may be cropped two or three years in a row followed by one year of fallow during periods of higher than normal precipitation. Fallow can be used for weed control during years when precipitation is exceptionally low. Soils on flood plains where precipitation is supplemented by subsurface water, such as those of the Lakeview series, commonly are used for permanent pastures of grass or grass-legume mixtures.

For high yields and good-quality crops, fertilization is needed on all of the soils in the area. Fertilizers are used to replace or supplement the natural supply of nutrients in the soil, including elements such as nitrogen, phosphorus, and sulfur. The amount and kind of fertilizer used should be based on the results of soil tests and the needs of the crop grown. The local office of the Cooperative Extension Service can help to determine the proper kind and amount of fertilizer to apply.

Irrigated Cropland

About 150,000 acres of the survey area is irrigable or potentially irrigable land. Nearly 11,000 acres was converted to irrigated land with the construction of Drews and Cottonwood Reservoirs, and nearly 14,000 acres of wetland in the Warner Valley was converted to irrigated cropland in the late 1950’s.

Many areas are surface irrigated with water from runoff in spring. Runoff from snowmelt generally is not available during the peak period of use. Poor-quality water from wells and runoff from flood irrigation is detrimental to plants in some areas. Some of the water from wells in the Warner and Chewaucan Valleys has a high level of boron, sulfur, or salts.

Wind erosion is a concern in the Chewaucan and Warner Valleys and in the Valley Falls area. Practices are needed to minimize wind erosion in areas of cropland. The critical period for wind erosion is late in winter through early in summer. Plant cover and plant residue should be maintained on the soil surface during this period. Alfalfa and grass-legume pasture should be included in the rotation to increase the content of organic matter in the soil and to protect the soil from wind erosion. Tillage should be delayed until after the critical period for wind erosion. Zorravista fine sand and Mesman fine sandy loam are particularly subject to wind erosion.

Conservation tillage leaves plant residue on the soil surface. Tillage implements that leave residue on the surface include sweeps, chisels, and others that do not invert and pulverize the soil. Tillage operations should be conducted at right angles to the prevailing wind, which generally is from the southwest.

A wide variety of irrigation methods are used in this area, including center-pivot systems, wheel- and hand-moved sprinklers, border and furrow flooding, and wild flooding. Sprinkler systems are most common. Low-pressure center-pivot systems are becoming more popular because of the lower energy costs. Some sprinkler systems have been converted to flood systems because of increasing energy costs.

Center-pivot and drip irrigation systems are particularly well adapted to sandy soils, such as those of the Zorravista series, that have very rapid permeability and a high water intake rate. The frequency, duration, and amount of water applied can be controlled easily with these irrigation systems.

Soils on terraces in Goose Lake Valley are irrigated with center-pivot, wheel- and hand-moved sprinkler, border, and furrow systems. These soils have a loam surface layer and commonly a subsoil that has slow permeability. Light, frequent applications of irrigation water are needed to minimize runoff and erosion.

Soils on flood plains in nearly level stream bottoms are not subject to severe runoff; however, water management is still important. Overirrigation leaches plant nutrients, results in a high water table, and in some areas causes a buildup of salts on the soil surface.

Crops grown in the survey area include alfalfa (fig. 23), grass, small grain, and mint. A frost-free period of less than 110 days limits the kinds of crops that can be grown.

Figure 23.—Irrigated alfalfa in an area of Lakeview loam in foreground; Drews loam on undulating lake terrace in background.

Tillage and the planting and harvesting of field crops is restricted significantly on soils that have a water table near the surface. These soils are used almost exclusively for pasture and hay. As the large lakes of the last ice age dried up, salts were concentrated and deposited in the soils on alluvial flats and low lake terraces. These soils may have a high water table or a high content of salts and sodium, or both. Reclaiming the soils by removing the salts and sodium can be expensive.

The Lakeview, Goose Lake, Pit, and Ozamis soils have a seasonal high water table. Drainage can be improved by surface or subsurface drainage systems. Surface systems include open ditches, impoundments, and land shaping to eliminate depressions. Subsurface systems include tile and mole drains. Drainage water must be pumped if outlets are not available.

Wetness, salts, and sodium adversely affect plant growth. Soils that are high in content of salts are saline. Salts limit the amount of water available to plants and reduce seedling survival. Soils that have excess sodium (pH of more than 8.5) are sodic. These soils have an imbalance of nutrients and a root environment that is toxic to most plants. Crusting caused by the dispersion of sodium reduces the water intake rate and limits seedling emergence and survival. Soils that have a high content of salts and excess sodium are saline-sodic. Stockdrive, Thunderegg, and Icene soils are examples of soils that have saline and sodic properties.

Saline soils can be reclaimed by leaching the salts below the root zone. A cemented pan in some soils restricts the downward movement of water; therefore, the pan should be ripped to allow for the leaching of salts. Water that has a low content of salts and sodium should be used for leaching. Leaching can also remove toxic boron and chloride from the root zone. Drainage is needed to prevent salts from moving upward into the root zone.

Leaching of saline-sodic soils without the addition of soil amendments removes the salts but not the sodium. Leaching alone creates a sodic soil characterized by the dispersion of soil particles, reduced infiltration, and poor tilth. Soil amendments such as gypsum provide calcium, which chemically replaces sodium. The sodium then can be removed by applying water. Other practices that assist in reclamation include adding organic material, applying chemical fertilizers such as ammonium nitrate and ammonium sulfate or other acid-producing fertilizers, and planting salt- or sodium-tolerant crops to improve the physical condition of the soil. Salt-tolerant crops include barley, Canada wildrye, crested wheatgrass, birdsfoot trefoil, tall fescue, meadow foxtail, and tall wheatgrass. Saline-sodic soils cannot be reclaimed rapidly. Soil tests are needed to determine the proper quantities of amendments.

If the soils are drained and excess salts are removed, the choice of crops suitable for planting is increased. Drainage allows for better irrigation water management and earlier accessibility to fields. A wider variety of crops can be grown under irrigation, but more specialized fertilizer is also needed. The kinds and amount of fertilizer should be based on soil tests, the needs of the crop grown, and expected yields.

Native grass meadows and pastures provide important forage for livestock and wildlife habitat.

Proper management practices are needed to maintain and improve the productivity of these native grass pastures and hay meadows. Pastures should be kept in good condition, as measured by the quantity of plants present that are high in the ecological succession. Planned grazing systems, fertilizer, fences, irrigation, and other management practices can have a significant effect on yields. Deferring grazing and mowing until after grasses are mature helps to maintain the abundance of the desired species. To stimulate regrowth, pastures commonly are irrigated after haying operations. Grazing the hay stubble after mowing also is common, but the pasture should be irrigated first. Grazing of fields that are being irrigated or are wet causes compaction of the soils.

High-quality forage species can be sustained if the season and degree of use are properly managed. The length of the periods of grazing and the timing of grazing during the growing season are important considerations. Grazing early in the growing season is feasible if the plants can set seed after the livestock are removed. Sufficient soil moisture and length of growing season are needed for plants to regrow and set seed. Allowing plants to reach maturity maintains the abundance of the desirable species. Pastures that are in poor condition as a result of past use can be improved by changing the duration and intensity of grazing.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system ***(36)***, soils are generally grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The capability class and subclass of each map unit in this survey area are shown in table 5.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation’s short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation’s prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forest land, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slope ranges mainly from 0 to 5 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 152,000 acres, or nearly 8.5 percent of the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available.

A recent trend in land use in some parts of the survey area has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed at the end of this section. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading “Detailed Soil Map Units.”

The map units that meet the requirements for prime farmland if irrigated are:

40B Calimus silt loam, 0 to 5 percent slopes
51A Crump muck, 0 to 1 percent slopes (where drained)
52A Crump silty clay loam, drained, 0 to 1 percent slopes
54A Crump-Ozamis complex, drained, 0 to 1 percent slopes
64B Deter loam, 0 to 5 percent slopes

65B Deter loam, low precipitation, 0 to 5 percent slopes
69B Donica gravelly loam, 0 to 5 percent slopes
73B Drews loam, 0 to 5 percent slopes
76B Drewsgap loam, 0 to 5 percent slopes
95B Fordney gravelly loamy sand, 0 to 5 percent slopes
95C Fordney gravelly loamy sand, 5 to 15 percent slopes
97A Goose Lake silt loam, 0 to 1 percent slopes (where drained)
109B Harriman loam, 0 to 5 percent slopes
124A Lakeview loam, 0 to 2 percent slopes
125A Lakeview silty clay loam, 0 to 2 percent slopes
127A Lakeview silty clay loam, low precipitation, 0 to 2 percent slopes
153A McConnel very gravelly sandy loam, 0 to 2 percent slopes
153C McConnel very gravelly sandy loam, 2 to 15 percent slopes
182A Norad silt loam, 0 to 2 percent slopes
191A Ozamis loam, 0 to 1 percent slopes (where drained)
192A Ozamis silty clay loam, 0 to 1 percent slopes (where drained)
243B Salisbury loam, 0 to 5 percent slopes
246A Spangenburg complex, 0 to 2 percent slopes
253A Tulana mucky silty clay loam, drained, 0 to 1 percent slopes
282B Zorravista fine sand, 0 to 5 percent slopes
283B Zorravista-Hinton complex, 0 to 8 percent slopes

Rangeland

Dave Franzen, range conservationist, Natural Resources Conservation Service, prepared this section.

Nearly 60 percent of the survey area is rangeland. The vegetation on this land helps to control erosion, conserve water, and maintain watersheds; provides habitat for wildlife; and provides year-round forage for wildlife and livestock. The rangeland also offers scenic and recreational value.

Importance and Uses

The survey area has been used for domestic livestock grazing since the late 1800's. Migrant sheep operators once moved large flocks across the area. As the grazing season progressed from winter to summer, flocks gradually were moved from the basins to the higher elevations. These large sheep operations have been replaced by large cattle operations. Although the number of livestock has declined over the years, livestock grazing remains vital to the economy of the area.

Rangeland watersheds provide for the capture, storage, and safe release of water through springs and riparian systems, which helps to maintain the quality and quantity of water for fish. The rangeland also provides habitat for many game and nongame mammals and birds, including some threatened and endangered species.

Rangeland provides opportunities for wildlife viewing, photography, landscape painting, hang gliding, hiking, rockhounding, and sightseeing.

The vegetation on the rangeland maintains and provides a gene pool for natural maintenance, selection, and propagation of adapted species in their native habitats. These habitats and the associated vegetation are used as seed sources for the development of improved plant material. Historically, edible whole plants or parts of plants were crucial to the survival of Native Americans. The interest in native plants for edible and medicinal purposes has been revived in recent years.

Broad Vegetative Groupings

Grazing and browsing by livestock and wildlife occur in a wide variety of environments in the survey area. The vegetative cover types in the area and their relationship to the general soil map units are discussed in the following paragraphs.

The dominant vegetation on the soils in general soil map units 1, 2, 3, 7, and 8 consists of grasses and sedges. The plant communities in these areas are influenced by ponding, flooding, or a high water table during part of the year. Hardstem bulrush and cattail are on the wettest soils. The majority of the soils in these units support native meadow vegetation, including tufted hairgrass, which is dominant, and Nevada bluegrass, redtop, sedges, and rushes. These soils produce the highest abundance of plants and forage in the survey area. The meadows are used as hayland and for grazing. Haying operations normally take place in midsummer. Grazing should be deferred until after the haying operations are complete. The shallow open water areas are used extensively as breeding areas for waterfowl.

The dominant vegetation on the soils in general soil map units 4, 5, and 6 consists of salt-tolerant grasses and shrubs; however, significant areas of these units do not support vegetation. These soils are ponded annually and are saline or sodic. They support a wide variety of plant communities. Inland saltgrass, alkali sacaton, basin wildrye, and black greasewood are dominant, but basin big sagebrush and alkali bluegrass also are present.

These salt-tolerant plant communities have very little value as forage for wildlife and livestock because of the low productivity and relative unpalatability of most species. In spring these areas provide habitat for migrating waterfowl. Because these areas are in warm basins, they are used in winter as holding areas for livestock.

The dominant vegetation on the soils in general soil map units 9, 10, 11, 12, 13, and 14 consists of perennial grasses and shrubs. In areas where slopes are nearly level to gently rolling and irrigation water is available, irrigated crops typically are grown. In uncultivated areas, precipitation and temperature strongly influence the type of plant communities and their management. In the 8- to 12-inch precipitation zone, Wyoming big sagebrush, low sagebrush, Thurber needlegrass, Sandberg bluegrass, and bluebunch wheatgrass are dominant. Areas in this zone are best suited to grazing by livestock in spring and fall. They also are important as winter range for elk and mule deer. The southern exposures at the lower elevations are critical for wintering mule deer and elk because these exposures remain relatively free of snow and the vegetation greens up earlier in spring in these areas than in areas under other associated plant communities.

Mountain big sagebrush, low sagebrush, antelope bitterbrush, and Idaho fescue are dominant in the 12- to 18-inch precipitation zone. Areas in this zone are best suited to grazing by livestock late in spring and in summer and fall. Big game species also use these areas during these periods. These areas are not suitable as range for big game animals in winter because they usually are covered with snow from late in fall through spring.

The dominant vegetation on the soils in general soil map units 15, 16, 17, 18, and 19 is similar to that of general soil map units 9 through 14 except the soils in units 15 through 19 also support western juniper. Because of the high elevation and short growing season, the vegetation on units 17 and 18 is best suited to livestock grazing late in summer and in fall when the snow has melted and the grasses have matured. Western juniper is present in the climax vegetative type on the ridgetops and escarpments. This species is intolerant of fires, but fires occur very infrequently in these areas because of the lack of understory vegetation capable of supplying fuel. As a result of grazing pressure and aggressive fire control during the last few decades, juniper has invaded plant communities downslope. This invasion is occurring in varying degrees on all of the soils in units 15 through 19.

The dominant vegetation on the soils in general soil map units 20, 21, 22, and 23 consists of coniferous trees, shrubs, and perennial grasses. These soils are at the highest elevations and receive the highest amount of precipitation of any in the survey area. Elevation ranges from about 5,000 to 8,400 feet. Precipitation ranges from about 18 to 38 inches. Most of the precipitation falls as snow. The principal forest cover types on these soils are interior ponderosa pine, white fir, and whitebark pine.

The interior ponderosa pine forest cover type is at the lower elevations. This type is associated with general soil map unit 20. The vegetation is dominantly ponderosa pine in the overstory, mountain big sagebrush and antelope bitterbrush in the midstory, and Idaho fescue in the understory. The areas are relatively open. Because sunlight reaches the forest floor, the understory vegetation is palatable for both livestock and wildlife. Because of the short growing season and the period of snow cover, livestock grazing is best suited to periods late in summer and in fall.

As elevation and precipitation increase, the white fir forest cover type becomes dominant. This cover type is associated with general soil map units 21, 22, and 23. The vegetation is dominantly white fir and ponderosa pine in the overstory, snowbrush manzanita in the midstory, and squawcarpet and Wheeler bluegrass in the understory.

Above an elevation of about 7,000 feet, the whitebark pine forest cover type is dominant. This type is associated with general soil map unit 23. The vegetation is dominantly lodgepole pine, western white pine, white fir, and whitebark pine in the overstory; pinemat manzanita in the midstory; and Wheeler bluegrass and longstolon sedge in the understory. Forage production for livestock and wildlife generally is low because the canopy is closed and the understory is shaded. After timber is harvested, however, forage production increases substantially. It slowly declines again as the forest reestablishes itself and the canopy closes. Because of the short growing season and the period of snow cover, livestock grazing is best suited to periods early in fall.

Grazing Management

The key to proper livestock grazing management is use of a system designed with consideration of plant and animal requirements, topography, and management objectives. Grazing systems include rotating pastures, controlling the time and length of the grazing period, and resting or deferring grazing during periods of critical plant growth. Other practices such as fencing, salting, constructing water developments, controlling weeds and brush, thinning, and seeding are used to facilitate the grazing system, to improve livestock distribution, or to increase forage production.

An important objective of grazing management should be the maintenance or improvement of the soil, water, and vegetation. The objective may not be to improve the range condition or site potential because of economic considerations or other considerations. However, management is needed to achieve an acceptable level of cover and forage production consistent with the limitations of the vegetative site. Areas should be managed to conserve water, improve water quality, and reduce erosion.

Limitations for Use as Rangeland

Because of specific characteristics, some areas are unsuited or less suited to particular grazing practices. Important limitations are given in the section “Detailed Soil Map Units.” Some of the characteristics that could affect grazing management are discussed briefly in the following paragraphs.

Aspect is the direction in which a slope faces. North-facing slopes generally are more productive, but development of plants is slower because of the cool temperatures. Livestock and wildlife prefer these slopes in summer. The vegetation stays green until late in summer because of the cool, moist conditions. South-facing slopes generally have the opposite characteristics of north-facing slopes. Because they are warmer and drier, they are poorly suited to livestock grazing in summer. These slopes are very important to big game in winter because less snow accumulates in these areas and they are the first to green up in spring. Southeast- and west-facing slopes have characteristics similar to those of the south-facing slopes.

Droughtiness is a result of low annual precipitation or low available water capacity. It reduces the production of forage and limits the choice of species suitable for seeding. Soil characteristics such as coarse texture, shallow depth, and a high content of rock fragments restrict the available water capacity.

Cold temperatures limit the length of the growing season. Below-normal daily temperatures during the growing season delay plant growth.

A ***high water table*** is present seasonally in some soils and year-round in others. Wetness, even if the root zone is saturated only briefly, has a major impact on plant community composition and production. This is especially true if a soil is ponded or has a water table at or near the surface. If these soils are grazed during wet periods, they are subject to compaction and displacement and the plant crown is subject to damage. If these soils are seeded, mechanical site preparation is difficult because of the limited period when equipment can be used. The species selected for seeding should be tolerant of wetness.

Livestock water developments are needed in most of the grazed areas in the survey area (fig. 24).

Figure 24.—Stock ponds in forested mountains provide water for livestock and wildlife in fall.

Construction of stock ponds is not feasible in many locations, and proper construction material is not available in some areas. Unless material for sealing a pond is brought in from outside the area, ponds can be constructed only in areas where the soil material naturally is slowly permeable and can be compacted and sealed properly. Soils that are coarse textured, have a high content of rock fragments, or are shallow to bedrock are subject to excessive seepage and are poorly suited to use as ponds. Unreliable runoff also limits the feasibility of many areas for use as ponds. This is particularly true in the lower precipitation zones (those that receive less than 10 inches annually). Even in the higher precipitation zones, the coarse textured, excessively drained soils seldom receive sufficient moisture from runoff to make pond development feasible.

Steepness of slope affects livestock use and the feasibility of applying certain management practices. Areas that have slopes of 30 percent or less are preferred by livestock. Areas that have slopes of more than 50 percent receive very little use even if the forage in these areas is abundant. Limited use of the steep slopes normally is anticipated, and stocking rates are adjusted accordingly. Mechanical seeding with ground equipment generally is impractical in areas that have slopes of more than 35 percent.

Stones and cobbles on the soil surface can affect grazing management and the potential for revegetation. Livestock generally avoid areas that have a large amount of stones and cobbles on the surface. The amount of stones on the surface also affects the feasibility of mechanical seedbed preparation and seeding.

Loss of site potential is a management concern on some soils in the survey area. Some of the soils in the area have lost a significant amount of the surface layer and are identified as eroded or as having a thin surface layer. Loss of the surface layer can cause major changes in the composition of the plant community. For example, in areas of Booth complex, 2 to 15 percent slopes, big sagebrush has been replaced by low sagebrush. Low sagebrush is better able to adjust to changes in the soil moisture and nutrient content. In areas of Floke complex, 2 to 15 percent slopes, bluebunch wheatgrass has been replaced by Sandberg bluegrass. These irreversible changes in the plant community as a result of soil erosion are most evident in soils that have a claypan, which restricts plant growth. Loss of total production ranges from 25 to 50 percent, depending on the degree of soil erosion.

Rock outcrop and escarpments are throughout the survey area. Typically, they are on steep, south- and west-facing slopes. They generally formed as a result of geologic faults or are exposed areas of sedimentary or igneous rock. The areas of Rock outcrop and the escarpments are as much as several hundred feet long and are 10 to several hundred feet high. They are well expressed along Abert Rim and Hart Mountain. They act as physical barriers to all domestic livestock and to some wildlife. Some species of wildlife, such as chukar partridge and bighorn sheep, prefer habitat associated with escarpments and Rock outcrop.

The ***surface texture*** also affects use of a soil as rangeland. Soils that have a sandy surface layer are subject to a severe hazard of wind erosion. These areas should be grazed only when the soils are moist and the risk of wind erosion is reduced, generally late in fall to early in spring. Soils that have a silty surface layer are subject to crusting and are sticky when wet. Crusting of the surface reduces infiltration and seedling emergence. Soils that have a clayey surface layer have a slow or very slow infiltration rate and are very sticky and very plastic when wet. The soil surface becomes rutted and compacted if these soils are grazed or traversed by equipment when wet.

Characteristic Plant Communities

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for each soil, the vegetative site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. An explanation of the column headings in the table follows.

A ***vegetative site*** is a distinctive kind of site that produces a characteristic natural plant community that differs from natural plant communities on other vegetative sites in kind, amount, and proportion of plants. The relationship between soils and vegetation was ascertained during this survey; thus, vegetative sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of plants. Soil reaction, salt content, climate, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually in a well managed potential natural plant community. It includes vegetation that may or may not be palatable to grazing animals. It includes the current year’s growth of leaves, twigs, and fruits of woody plants that are as much as 4.5 feet tall. 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.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under ***composition***, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The percent composition has been determined either by the production of air-dry weight or by the abundance of individual species. If pounds per acre of air-dry weight is given in table 6, the percent composition has been determined by air-dry weight. If this is absent, the percent composition has been determined by abundance. The amount of vegetation that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range and forest management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present vegetative site condition. Site condition is determined by comparing the present plant community with the potential natural plant community on a particular site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

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, control of undesirable 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.

Woodland Management and Productivity

By Russell R. Hatz, forester, Natural Resources Conservation Service, and David L. Wenzel, soil scientist, Forest Service.

The survey area is one of the primary producers of timber in south-central Oregon. The best timber-growing sites generally are in areas of soils that are derived from basalt and are at middle elevations. The higher elevations generally are too cold in summer to produce large quantities of timber, and the lower elevations are too dry. The productivity of a site may be highly variable because of specific environmental and microsite characteristics.

About 8 percent of the survey area is classified as commercial forest land. About 20 percent of this land is owned by the forest industry, 20 percent is owned by ranchers and other private landowners, and 60 percent is publicly owned. The publicly owned land is managed by the Forest Service and is in the Lakeview Federal Sustained Yield Unit. To help maintain the economic stability of participating communities, the Forest Service is required to sell all timber harvested from land in this unit to buyers who will process the timber in the towns of Lakeview and Paisley.

Lakeview is recognized as the center of the forest products industry in Lake County. The county has several large sawmills and wood products manufacturing plants. Easy access to rail transportation facilitates the export of finished lumber, logs, and wood chips. The Forest Service, Oregon State Department of Forestry, and local fire districts provide protection from fire.

Most of the forest land in the survey area has slopes of 0 to 40 percent. Only a small part of the forest land has slopes of more than 40 percent. Because the forest land is in the rainshadow of the Cascade Mountains, it is characterized by drought-tolerant tree species such as western juniper and ponderosa pine, although abundant stands of white fir are at the higher elevations. Ponderosa pine, white fir, and lodgepole pine are the dominant timber species. Three principal forest cover types, including interior ponderosa pine, white fir, and whitebark pine types, are recognized in the survey area. Forest type codes are given for the forested soils under “Vegetative sites” in table 6. These codes were taken from the plant association guide for Fremont National Forest ***(33)***.

The interior ponderosa pine forest cover type is primarily at the low to middle elevations below and adjacent to mixed conifer zones. The soils are moderately deep to very deep and are well drained. Ponderosa pine, western juniper, mountain big sagebrush, wax currant, antelope bitterbrush, snowbrush manzanita, Ross sedge, bottlebrush squirreltail, and Idaho fescue are associated with this forest type.

The white fir forest cover type generally is at the middle to high elevations in areas that are cool and moist. This type is associated with a wide range of soils, landforms, and slopes. The vegetation consists of ponderosa pine, white fir, lodgepole pine, western white pine, snowbrush manzanita, wax currant, squawcarpet, Ross sedge, lupine, and bottlebrush squirreltail.

The whitebark pine forest cover type is primarily on high-elevation rhyolite eruptive centers. The soils are gravelly and coarse textured. The vegetation consists of whitebark pine, lodgepole pine, white fir, western white pine, pinemat manzanita, wax currant, lupine, longstolon sedge, Wheeler bluegrass, and grouse huckleberry.

Repeated fires in the forested areas once resulted in the establishment of stands of ponderosa pine and lodgepole pine. Following a half century of fire control, many such stands are changing to the white fir forest type. Controlled fires and silvicultural treatments are being used to maintain early seral species in many managed stands.

The majority of the woodland in the survey area provides forage for livestock and wildlife. The amount of forage available under many stands of timber is low, and the palatability ranges from low to high. If properly managed, the interior ponderosa pine forest type includes high-quality bunchgrass.

Timber management can also improve the distribution of livestock and the production of forage for livestock. Harvesting timber creates openings that serve as transitory range. Until planted tree seedlings are large enough to shade the undergrowth (15 to 20 years), this temporary range contributes significantly to the amount of forage available for livestock. Transitory range also makes it possible to move livestock away from traditional areas of concentration, such as riparian areas, and into areas that have received little, if any, use by livestock.

The forested areas in the survey area are affected by many diseases and insects that can damage individual stands of trees. The amount of damage varies from year to year.

The Modoc budworm ***(choristoneura viridis)*** is abundant in the Warner Mountains. Outbreaks occur sporadically as the populations build and then collapse. Damage is limited to the true firs and generally only results in a slight reduction in growth. The fir engraver ***(Scolytus tralis)*** is a native bark beetle that primarily attacks true firs. Outbreaks occur at irregular intervals and generally follow periods of drought or defoliation, which lower the resistance of the trees. This insect can cause a severe rate of tree mortality. The fir tree borer ***(Semanotus litigiosus)*** attacks trees that died recently or are dying and degrades the lumber. The mountain pine beetle ***(Dendroctonus ponderosae)***, western pine beetle ***(Dendroctonus brevicomis)***, pine engraver ***(Ips pini)***, and red turpentine beetle ***(Dendroctonus pseudotsugae)*** are the most common of the bark beetles that annually kill some ponderosa pine and lodgepole pine and periodically kill large numbers of trees.

Fomes rootrot ***(Fomes anosa)*** and brown stringy rot ***(Echinodontium tinctorium)*** are examples of the many kinds of fungi that attack live white fir trees. Fire wounds are the most common entry points for fungi. Young, thriving, uninjured fir trees generally are free from rot, but old, overmature trees frequently are badly decayed. Twig dieback ***(Cytospora abietis)*** is a fungus that causes cankering and dieback of true firs. It can reach epidemic proportions if the trees are predisposed to attack because of adverse conditions such as drought or beetle infestation. Other diseases also are present and at any given time may cause serious damage to individual stands of trees. Rootrot established in the center of trees may limit the growth and potential yield of stands and affect local management.

The information in soil surveys is important to woodland managers as they seek ways to increase the productivity of woodland. Some soils respond better to fertilization, some are susceptible to landslides and erosion after roadbuilding and harvesting, and others require special management for harvesting and reforestation.

Table 7 summarizes the forestry information given in the section “Detailed Soil Map Units” and serves as a quick reference for woodland interpretations. The site index, if available, is given in the table.

The ***potential productivity*** of ***common trees*** on a soil is expressed as a ***site index***. Site index is determined by taking height and age measurements on selected trees within stands of a given species. The procedure is given in the site index publications for ponderosa pine ***(16)*** and white fir ***(30)***. The site index applies to fully stocked, even-aged stands. The highest yields can be expected from soils that have the highest site indexes. Site index values can be converted into estimated yields at various ages by carefully using the appropriate yield tables.

Species preferred for wood production are selected for reforestation or are allowed to regenerate naturally. Commercial value, topographic position, survival and growth potential, and natural plant community relationships are some of the factors that can influence the choice of adapted trees suitable for reforestation.

As indicated in table 7, the woodland soils in this survey area have been rated for a number of factors to be considered in woodland management. A rating of ***slight***, ***moderate***, or ***severe*** indicates the degree of the major soil limitations. If a soil has a rating of moderate or severe, additional information is given in the detailed soil map units.

The ***hazard of sheet and rill erosion*** ratings refer to the probability of excessive erosion occurring as a result of operations that leave the soil exposed. Forest land that is damaged by fire or overgrazing is also subject to erosion. A rating of ***slight*** indicates that no particular erosion-control measures are needed under ordinary conditions; ***moderate*** that some erosion-control measures are needed, and ***severe*** that extra measures are needed to control erosion during silvicultural activities. These ratings are determined by considering the topography, erodibility of a soil, and local climate. Ratings of moderate or severe may indicate the need for modified road construction, special harvesting systems, and alternative site preparation techniques.

The ***hazard of cut and fill erosion*** ratings refer to the probability that damage may occur as a result of erosion on road cuts and fills. Cuts and fills should be seeded. A rating of ***slight*** indicates that no other erosion-control measures are needed under ordinary conditions; ***moderate*** that additional erosion-control measures, such as use of mulch and sediment traps, are needed under certain conditions; and ***severe*** that additional erosion-control measures are needed under most conditions.

The texture of the surface and subsurface layers and the angle and length of the slope contribute to the risk of cut and fill erosion. The risk of erosion is most severe in areas that have longer cuts and fills and in areas of more highly erodible soils.

The ***equipment limitation*** ratings refer to the limits on the use of wheeled or tracked, ground-based equipment because of the characteristics of the soil or the topography. A rating of ***slight*** indicates that use of equipment normally is not limited to a particular kind of equipment or time of year; ***moderate*** that there is a short seasonal limitation or a need for some modification in management or equipment; and ***severe*** that there is a seasonal limitation or a need for special equipment or management or that use of equipment is hazardous.

Use of equipment is limited mainly by the steepness of slope, soil wetness, and susceptibility to soil compaction. As slope gradient and length increase, it becomes more difficult to use wheeled equipment. Tracked equipment should be used in the steeper areas, and cable yarding systems should be used in the steepest areas. Soil wetness, especially in areas of fine-textured soils, can severely limit the use of equipment and make harvesting practical only during the dry period in summer.

The ***soil compaction*** ratings refer to the probability that damage will occur to the soil structure as a result of repeated equipment use during periods when the soil is wet or moist. Compaction should always be a consideration during silvicultural activities. Even in areas that have a ***slight*** rating, use of designated skid trails and protection of the layer of duff are needed. A ***moderate*** rating indicates the potential need for extra precautions, such as use of cable yarding systems instead of ground skidding equipment and seasonal restrictions on equipment use. A ***severe*** rating indicates the need for extreme caution and possibly some restorative measures, such as ripping or disking, after harvesting.

Soil characteristics considered in the compaction ratings are the thickness of the layer of duff, content of coarse fragments, texture, and plasticity. Soil compaction decreases air spaces in the soil; thus, air and water movement are reduced, which restricts root growth and increases the risk of surface erosion.

The ***soil displacement*** ratings refer to gouging, scraping, or pushing soil from its natural position by mechanical means. It is most often associated with mechanical slash disposal, tractor yarding operations, and site preparation. A ***slight*** rating indicates that equipment use is not restricted and that special precautions generally are not needed; ***moderate*** that specialized equipment, such as a brush rake, is needed; and ***severe*** that extreme caution should be used in tractor yarding operations and in mechanical slash disposal and site preparation.

Soil characteristics considered in the soil displacement ratings are the thickness of the layer of duff and the surface layer, slope, content of coarse fragments, and texture. Removing or mixing the layer of duff and exposing the mineral soil are needed for natural regeneration of many species; however, if the soil displacement is excessive, plant recovery rates may be impaired. Prolonged exposure of the soil may result in an increased risk of erosion and further deterioration of the site.

The ***seedling mortality*** ratings refer to the probability of death of tree seedlings as a result of the characteristics of the soil or topography. Plant competition and damage by animals are not considered in this rating. The ratings apply to healthy, dormant seedlings from good stock that are properly planted during a period of sufficient moisture. ***Slight*** indicates that no problem is expected under normal conditions; ***moderate*** that some problems can be expected and that extra precautions are needed; and ***severe*** that the potential mortality rate is high and that extra precautions are essential for successful reforestation.

Wetness, droughtiness, and topographic conditions contribute to the seedling mortality rate. To offset these concerns, larger than normal planting stock, special site preparation, surface drainage, or additional plantings may be needed.

The ***windthrow*** ratings refer to the ability of the soil to support the development of tree roots and to hold trees firmly. A rating of ***slight*** indicates that trees normally are not blown down by the wind; ***moderate*** that an occasional tree may be blown down during periods of soil wetness and moderate or strong winds; and ***severe*** that many trees may be blown down during periods when the soil is wet and winds are moderate or strong.

Restricted rooting depth because of a high water table, underlying bedrock, or an impervious layer and poor anchoring of roots because of loose soil material contribute to the risk of windthrow. Moderate or severe ratings indicate the need for care in thinning forest stands, periodic salvage of windblown trees, and adequate roads and trails to support salvage operations.

The ***plant competition*** ratings refer to the likelihood of invasion by undesirable plants when openings are made in the tree canopy. A ***slight*** rating indicates that unwanted plants are not likely to retard the development of natural or planted seedlings; ***moderate*** that competition will retard natural or planted reforestation; and ***severe*** that competition can be expected to prevent natural or planted reforestation.

Plant competition is a concern in areas where the climatic conditions and soil characteristics are favorable for plant growth. In many areas the key to predicting plant competition problems is the quantity and proximity of seed sources of undesirable plants or the quantity of unwanted brush rootstock that will resprout after harvesting. Moderate and severe ratings indicate the need for careful and thorough site preparation and the potential need for mechanical or chemical treatment to retard the growth of competing vegetation.

The ***fire damage*** ratings refer to the probability that a fire of moderate fireline intensity (116 to 520 btus/sec/ft) will have a negative impact on the characteristics of the soil. A rating of ***slight*** indicates that negative impacts to the soil characteristics are not expected; ***moderate*** that negative impacts, such as poor infiltration and excessive erosion, may occur and that extra caution is advised in planning prescribed fires; and ***severe*** that negative impacts are likely to occur and that extreme caution is advised in planning prescribed fires.

The soil characteristics considered in determining the ability of a soil to resist fire damage are the thickness of the layer of duff, the content of organic matter, and the texture. To offset potential damage, winter burning, alternative lighting techniques, monitoring of the fuel and the content of moisture, yarding of unmerchantable material, elimination of prescribed fires, or erosion-control measures may be needed after burning.

Watersheds

Soils affect the cycle of water by capturing, storing, and releasing moisture. Differences in the kind and amount of vegetation produced in a watershed area are closely related to the kinds of soil. Effective management is based on the relationship among the soils, vegetation, and water.

The cycle of water affects the production and maintenance of all resources. Water transports nutrients from the soil to the roots of plants and allows the nutrients to move throughout the plants. The amount of water in a soil largely determines the forage or timber species that will grow on a given site. Changes in annual precipitation can increase or decrease the annual growth of plants, including that of trees for use as commercial timber. Water is critical to all wildlife, and thus it influences the distribution and abundance of wildlife populations. As well as supplying drinking water for wildlife, the streams, ponds, and springs support lush riparian habitat that provides food, cover, and nesting areas for wildlife.

Most of the water used to irrigate crops originates in the higher upland areas. The amount of water available in the survey area is influenced by the elevation, rate of evapotranspiration, precipitation, and soils. Generally, the annual demand for water exceeds the available supply. The available water supply, including that of Goose Lake Valley, Warner Valley, and Chewaucan Marsh, is overappropriated in most years.

Watersheds are composed of aquatic, riparian, and upland terrestrial ecosystems. Riparian areas are wetland ecosystems that have a high water table because of proximity to areas that have an aquatic ecosystem or subsurface water. Riparian ecosystems generally occur as an ecotone between aquatic and upland ecosystems, but they have distinct vegetative and soil characteristics. Riparian areas are uniquely characterized by high diversity, density, and productivity of species. Riparian, aquatic, and upland terrestrial ecosystems interact continuously through exchanges of energy, nutrients, and species. The Degarmo-Welch complex, 0 to 2 percent slopes, detailed soil map unit and the Welch-Degarmo general soil map unit are examples of riparian areas.

Riparian areas represent only a small part of the total acreage of the survey area, but their ecological value is very high. The vegetation in riparian areas provides shade and traps sediment before it reaches stream channels, thus helping to maintain a supply of cool, clean water. Healthy riparian areas store water for release late in the growing season and provide water when the supply is low in other areas. Because many riparian areas are narrow, most are not delineated on the maps for this survey area because of the scale used.

Riparian areas provide many types of recreational opportunities, including fishing, hunting, bird watching, nature viewing, boating, hiking, and camping.

On a per acre basis, the forage produced in the riparian areas is several times that produced on the adjacent uplands, and it is used by domestic livestock and wildlife. Because riparian areas provide water and succulent forage and have gentle topography, livestock tend to concentrate in these areas.

The use and management of the resources in the riparian areas, such as timber harvesting or grazing, directly affect the quality of the water associated with streams and the habitat provided by the riparian vegetation. When livestock concentrate along stream bottom lands, they browse heavily on streamside vegetation and trample streambanks. Because the roots of this streamside vegetation help to stabilize channels and the shrubs and trees shade and cool the water in streams, extensive loss of streamside vegetation increases the risk of channel erosion and increases stream sedimentation and turbidity. Severe channel downcutting can lower the water table adjacent to the stream, which causes changes in production and composition of the plant community. Streambank water storage capabilities can also be reduced, resulting in less water being released for use late in the growing season. The reduction of shade provided by streamside shrubs and trees results in higher water temperatures late in summer.

Generally, the quality of the water is good at elevations above 5,500 feet and good to moderate below this elevation. Basalt is the major parent rock in areas above 5,500 feet, and watersheds in material derived from basalt are resistant to erosion. The soils in the Woodchopper-Rogger general soil map unit are examples of those on stable slopes of forested mountains. The streams at or above 5,500 feet are primarily first- and second-order drainageways. The watersheds below 5,500 feet developed in multilayered pyroclastic material, which is more susceptible to erosion. The soils in the Booth-Bullump-Nuss general soil map unit are examples of those that have developed in this material. The relatively high water temperatures in these areas (above 64 degrees F) are undesirable for cold-water fisheries. Several of the streams at the lower elevations are subject to high temperatures in July and August because of insufficient streamflow late in the growing season; wide, shallow channel configurations; and inadequate streamside shade. The Chewaucan River is an example. This river has the potential to support a high-quality fishery, but it is far below its potential because of the present condition of the riparian vegetation.

The condition of most other riparian areas in this survey area is stable or improving. Recent restoration efforts, including construction of structural improvements and implementation of grazing systems designed to promote recovery of these areas, have significantly improved the physical, biological, and ecological condition of a number of riparian areas. Practices include constructing loose rock checkdams, shaving banks, fencing, reveting streambanks with juniper, and constructing log or rock structures instream. Changes in management practices and grazing systems have improved the condition of many riparian areas. It will take many decades, however, to return some of the riparian areas in this survey area to the desired ecological condition.

The degree of damage to watersheds depends on several physical and biological factors. In managed areas that include bare ground and roads, the most significant factors include the hazard of soil erosion, the steepness of slope, and the rate of runoff or the occurrence of storms.

Most precipitation falls as snow from November through March, and most of the runoff from snowmelt occurs in April and May and early in June. Most likely to cause damage are high-intensity thunderstorms in summer and periods of rainfall in winter when a snowpack is present. Intense thunderstorms in summer can cause localized erosion and sedimentation. Rain on snow can cause similar results, but the effects usually are more widespread and are greater in stream channel systems.

Windbreaks and Environmental Plantings

Wind can be a serious environmental and economic problem. It can cause erosion, crop damage, safety hazards, and energy loss. Field windbreaks, farmstead windbreaks, and environmental plantings are effective in reducing the problems associated with uncontrolled wind.

Field windbreaks protect crops, reduce wind erosion, control snow deposition, and provide cover for wildlife. These windbreaks are narrow plantings made at right angles to the prevailing wind at specific intervals across a field. Many environmental changes occur on the leeward side of a windbreak. Windspeed is reduced, transpiration by plants is reduced, humidity is increased, evaporation is reduced, and soil moisture is increased. Yields can be increased significantly if crops are protected by properly designed and maintained field windbreaks.

Farmstead windbreaks protect livestock and structures, reduce heating expenses, and control snow deposition. They also add beauty, protect gardens, and provide habitat for wildlife. Several rows of low- and high-growing shrubs and trees provide the most protection.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. They can also be used to furnish habitat for wildlife. The plants, mostly evergreen shrubs and trees, are closely spaced.

For windbreaks and environmental plantings to be effective, the tree or shrub species selected must be adapted to the soil. Selecting the proper trees or shrubs for each soil is key to a successful planting. Table 8 lists the tree and shrub species suitable for use as windbreaks and environmental plantings on specific soils. The table shows the height that the trees and shrubs are expected to reach in 20 years. This information can be used as a guide in planning windbreaks and environmental plantings. Additional information can be obtained from the local office of the Natural Resources Conservation Service.

Wildlife Habitat

The survey area supports a wide variety of wildlife species. The large, closed lake basins support much of the wetland in eastern Oregon. These areas of wetland are an important component of the waterfowl migrating route called the Pacific Flyway System. Habitat for wetland wildlife consists of open water areas surrounded by shallow-water marshes. Plants important for cover include cattails and bulrushes. These areas of wetland provide critical habitat for large numbers of waterfowl during migration in spring and fall. The dominant soils in the marshes are those of the Crump series.

The various types of habitat for upland wildlife are associated with the different landscapes and the soils and plant communities that they support. These landscapes include basins, tablelands, and shrub-covered or forested mountains.

The basins are important wintering areas for big game and other upland wildlife. The diverse land uses, including cropland, pasture, hayland, and rangeland, provide diverse habitat. The soils on the alluvial flats and low terraces typically have water on the surface or a high water table. The Degarmo, Cressler, Mudpot, and Welch soils are associated with the meadows and stream corridors at the higher elevations. The Lakeview, Goose Lake, Ozamis, Reese, Alvodest, Stockdrive, Mesman, and Tandy soils are associated with the meadows and stream corridors at the lower elevations. The riparian areas associated with these soils are used heavily by wildlife and need to be considered in the development of conservation and resource management plans. Streambank vegetation provides shade and moderates water temperatures, which are critical for many species of fish. This vegetation also helps to prevent streambank erosion and provides cover for wildlife. Livestock concentrate in the meadows and along riparian areas because of the availability of water. Unless proper grazing management is used, the habitat in these riparian areas and meadows can deteriorate rapidly. Fencing and rotation grazing help to maintain the habitat and forage for both livestock and wildlife.

The tablelands in the survey area can be divided into three habitat types. These types are determined by the plant communities, generally by the dominant kind of sagebrush in an area. The kinds of sagebrush include Wyoming big sagebrush, low sagebrush, and mountain big sagebrush.

Wyoming big sagebrush communities provide important wintering areas for antelope. The Brace, Old Camp, Ratto, and Raz soils are on tablelands that support Wyoming big sagebrush. Although Wyoming big sagebrush provides important forage for antelope, black sagebrush, low sagebrush, and silver sagebrush are preferred at certain times of the year. Grasses and forbs are preferred for grazing early in spring, forbs late in spring and in summer, forbs and shrubs in fall, and shrubs in winter. The dominant forbs preferred by antelope include globemallow, small burnet, and Lewis flax. Antelope fawning and rearing occurs dominantly in areas of low sagebrush along the foot slopes of Warner and Hart Mountains and in Goose Lake Valley. Soils of the Anawalt, Carryback, Fertaline, Floke, Freznik, Hart, and Ninemile series are in these areas.

Low sagebrush communities provide important habitat for sage grouse. The grassy areas are the main strutting grounds for sage grouse, and the forbs are used as forage in spring and summer. Chemical spraying to control sagebrush also kills these forbs. Mechanical removal of sagebrush or prescribed burning allows the forbs and grasses to recover and can improve the habitat for brooding. The low sagebrush communities that are in good condition support large populations of sage grouse, vesper sparrow, and western meadowlark. As the condition of the communities degrades, populations of horned lark and Brewer’s sparrow increase.

Mountain big sagebrush communities and the associated curlleaf mountainmahogany provide important winter forage for mule deer. The Bullump, Drews, Newlands, and Nuss soils are examples of those that support mountain big sagebrush or curlleaf mountainmahogany. In areas where fire has been controlled, antelope bitterbrush is also an important forage species for mule deer and antelope. Mule deer fawning and rearing occurs dominantly in the mountain big sagebrush communities along the foot slopes of mountains.

Shrub-covered mountains and escarpments provide habitat for mule deer, elk, chukar, and raptors. The vegetation on Hart Mountain also provides habitat for bighorn sheep. The dominant soils associated with these areas include those of the Bullump, Lambring, Harcany, Eglirim, Fitzwater, Westbutte, and Royst series. The areas of Rubble land and Rock outcrop on these mountains are used by chukar in summer and fall and provide cover and nesting sites for golden eagle, red-tailed hawk, prairie falcon, great horned owl, long-eared owl, and common barn owls. Bighorn sheep use the habitat on escarpments extensively throughout the year. The north-facing slopes provide forage in summer, and the south-facing slopes provide forage in winter and spring. Mule deer and elk use the western juniper on the lower escarpments and mountainsides as cover and for forage in winter.

The forested mountains and hills provide habitat for a variety of species in spring, summer, and fall. Because of the cold temperatures and the depth of the snowpack, many species migrate to lower elevations in winter. The dominant soils on the forested mountains and hills include those of the Royst, Winterim, Woodchopper, Polander, Hallihan, Mound, Rogger, and Longjohn series. The soils at the lower elevations that support dominantly interior ponderosa pine forest cover type provide forage for mule deer and elk. Antelope bitterbrush and bunchgrasses thrive in the open understory in these areas.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the “Soil Properties” section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

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

Building Site Development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered ***slight*** if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; ***moderate*** if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and ***severe*** if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and ***small commercial buildings*** are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Sanitary Facilities

Table 10 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered ***slight*** if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; ***moderate*** if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and ***severe*** if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

The table also shows the suitability of the soils for use as daily cover for landfill. A rating of ***good*** indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; ***fair*** indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and ***poor*** indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

The table gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in the table are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated ***good, fair,*** or ***poor*** as a source of roadfill and topsoil. They are rated as a ***probable*** or ***improbable*** source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated ***good*** contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated ***fair*** are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated ***poor*** have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and ***gravel*** are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the table, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated ***good*** have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated ***fair*** are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated ***poor*** are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered ***slight*** if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; ***moderate*** if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and ***severe*** if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading “Taxonomic Units and Their Morphology.”

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. “Loam,” for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, “gravelly.” Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system ***(4, 29)*** and the system adopted by the American Association of State Highway and Transportation Officials ***(3, 29)***.

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, CL-ML.

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.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and ***plasticity index*** (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^{1}/_{3}$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

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 considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. 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, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

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

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on the basis of measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are ***low***, a change of less than 3 percent; ***moderate***, 3 to 6 percent; ***high***, more than 6 percent; and ***very high***, greater than 9 percent.

Erosion factor K 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 percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.64. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T 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.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 15 gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist 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 (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a 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.

If a soil is assigned to two hydrologic groups in the table, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

The table gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. ***None*** means that flooding is not probable; ***rare*** that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); ***occasional*** that it occurs, on the average, once or less in 2 years (the chance of flooding is 5 to 50 percent in any year); and ***frequent*** that it occurs, on the average, more than once in 2 years (the chance of flooding is more than 50 percent in any year). ***Common*** is used when the occasional and frequent classes are grouped for certain purposes. Duration is expressed as ***very brief*** if less than 2 days, ***brief*** if 2 to 7 days, ***long*** if 7 days to 1 month, and ***very long*** if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on observations of the water table at selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. Indicated in the table are the depth to the seasonal high water table; the kind of water table—that is, perched, apparent, or artesian; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in the table.

An ***apparent*** water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A ***perched*** water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone. An ***artesian*** water table is under hydrostatic head, generally below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil, which is referred to as ponding. “More than 6.0” indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Table 16 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

A ***cemented pan*** is a cemented or indurated subsurface layer within a depth of 5 feet. Such a pan causes difficulty in excavation. Pans are classified as thin or thick. A thin pan is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A thick pan is more than 3 inches thick if continuously indurated or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as ***low, moderate,*** or ***high,*** is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as ***low, moderate,*** or ***high***. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories ***(38)***. 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. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven 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 ***sol***. An example is Inceptisol.

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 Aquept (***Aqu***, meaning water, plus ***ept***, from Inceptisol).

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; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquepts (***Hapl***, meaning minimal horizonation, plus ***aquept***, the suborder of the Inceptisols that has a aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; 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 taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective ***Typic*** identifies the subgroup that typifies the great group. An example is Typic Haplaquepts.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, montmorillonitic, nonacid, frigid Typic Haplaquepts.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Taxonomic Units and Their Morphology

In this section, each taxonomic unit recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each unit. A pedon, a small three-dimensional area of soil, that is typical of the unit in the survey area is described. The detailed description of each soil horizon follows standards in the “Soil Survey Manual” ***(35)***. Many of the technical terms used in the descriptions are defined in “Soil Taxonomy” ***(38)***. Unless otherwise indicated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the unit.

The map units of each taxonomic unit are described in the section “Detailed Soil Map Units.”

Als Series

The Als series consists of very deep, excessively drained soils that formed in eolian sand over lacustrine sediment. Als soils are on sand dunes on lake terraces and valley floors. Slopes are 1 to 15 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Als fine sand in an area of Als-Mesman complex, 0 to 15 percent slopes, in an area of rangeland; in the SE1/4SW1/4NE1/4 of sec. 4, T. 36 S., R. 24 E.

A—0 to 15 inches; very dark grayish brown (10YR 3/2) fine sand, pale brown (10YR 6/3) dry; weak very fine granular structure; loose, nonsticky and nonplastic; many fine, medium, and coarse roots; many fine irregular pores; moderately alkaline; gradual wavy boundary.

C1—15 to 45 inches; very dark grayish brown (10YR 3/2) fine sand, pale brown (10YR 6/3) dry; single grain; soft, very friable, nonsticky and nonplastic; common very fine roots; many fine irregular pores; moderately alkaline; gradual wavy boundary.

2C2—45 to 65 inches; dark brown (10YR 3/3) fine sandy loam, pale brown (10YR 6/3) dry; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; moderately alkaline.

The particle-size control section is 0 to 5 percent clay and more than 70 percent sand. Depth to the 2C horizon, where present, is 40 to 60 inches or more.

The A and C horizons have value of 2 or 3 when moist and 5 or 6 when dry, and they have chroma of 2 or 3 when moist or dry. The A horizon has granular structure or is single grain.

The 2C horizon, where present, is fine sandy loam or sandy clay loam and is 15 to 30 percent clay. This horizon is present only in areas of deeper sand dunes.

Alvodest Series

The Alvodest series consists of very deep, moderately well drained soils that formed in lacustrine sediment. Alvodest soils are on alluvial flats in lake basins. Slopes are 0 to 1 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees.

Typical pedon of Alvodest silt loam in an area Alvodest-Playas complex, 0 to 1 percent slopes (fig. 25), in an area of rangeland; in the SW1/4SE1/4SE1/4 of sec. 30, R. 25 E., T. 38 S.

Figure 25.—Profile of Alvodest silt loam in an area of Alvodest-Playas complex, 0 to 1 percent slopes. Black greasewood is on the wind-deposited hummocks. The first arrow indicates the base of the hummock, the second arrow indicates the top of the clayey B horizon, and the third arrow indicates the top of the C horizon.

Aknz1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; strong medium and fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many fine and medium roots; violently effervescent; carbonates are disseminated; very strongly alkaline; clear smooth boundary.

Aknz2—2 to 14 inches; dark brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; slightly effervescent; carbonates are disseminated; very strongly alkaline; abrupt smooth boundary.

Bknz1—14 to 25 inches; dark grayish brown (10YR 4/2) silty clay, grayish brown (10YR 5/2) dry; moderate medium prismatic structure; extremely hard, very firm, sticky and very plastic; few coarse roots and common fine and medium roots; common distinct stress surfaces; violently effervescent; carbonates are disseminated; very strongly alkaline; clear smooth boundary.

Bknz2—25 to 32 inches; dark brown (10YR 4/3) and very dark grayish brown (10YR 3/2) silty clay loam, light gray (10YR 7/2) and grayish brown (10YR 5/2) dry; weak medium prismatic structure; hard, firm, very sticky and very plastic; common medium and fine roots; violently effervescent; carbonates are disseminated; very strongly alkaline; gradual smooth boundary.

Cknz—32 to 60 inches; dark brown (10YR 3/3) and very dark gray (10YR 5/3) loam, light gray (10YR 7/2) and white (10YR 8/2) dry; massive; extremely hard, very firm, sticky and plastic; few fine and medium roots; strong medium angular blocks of fractured consolidated lacustrine sediment; violently effervescent; carbonates are disseminated; very strongly alkaline.

Depth to bedrock is more than 60 inches. These soils are ponded and have a high water table late in winter and in spring.

The A horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 2 or 3 when moist or dry. Electrical conductivity is more than 16 millimhos per centimeter, and the sodium adsorption ratio is 800 to 1,000.

The B horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 or 3 when moist. Electrical conductivity is more than 16 millimhos per centimeter, and the sodium adsorption ratio is 70 to 700. The B horizon is clay, silty clay, or silty clay loam. It is 35 to 60 percent clay.

The C horizon has value of 3 to 5 when moist and 6 to 8 when dry, and it has chroma of 2 or 3 when moist or dry. It is loam, silty clay, or silty clay loam. Electrical conductivity is more than 16 millimhos per centimeter, and the sodium adsorption ratio is 13 or more.

Anawalt Series

The Anawalt series consists of shallow, well drained soils that formed in colluvium and residuum derived from tuff, basalt, andesite, and rhyolite. Anawalt soils are on tablelands and mountains. Slopes are 2 to 30 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 43 degrees F.

Typical pedon of Anawalt loam, 2 to 8 percent slopes, in an area of rangeland; about 1 mile northwest of the Hart Mountain National Antelope Refuge Headquarters; in the SW$^1/_4$NE$^1/_4$ of sec. 9, T. 35 S., R. 26 E.

A1—0 to 4 inches; very dark brown (10YR 2/2) loam, light grayish brown (10YR 6/2) dry; weak thin platy structure parting to weak very fine granular; soft, very friable, slightly sticky and nonplastic; 10 percent gravel; common very fine roots; many very fine vesicular pores; neutral; gradual smooth boundary.

A2—4 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to weak very fine granular; slightly hard, friable, slightly sticky and slightly plastic; 14 percent gravel; common very fine roots; few very fine tubular pores; neutral; abrupt smooth boundary.

2Bt—9 to 17 inches; dark brown (7.5YR 3/3) clay, yellowish brown (10YR 5/4) dry and dark brown (7.5YR 3/4) crushed; moderate fine angular blocky structure; very hard, very firm, very sticky and very plastic; 5 percent gravel and 5 percent cobbles; common very fine roots; few very fine tubular pores; many cutans on peds; few faint clay films in pores; neutral; abrupt smooth boundary.

2R—17 inches; tuff; coatings of silica and calcium carbonate in fractures.

Thickness of the solum and depth to bedrock are 12 to 20 inches. Rock fragment content is 5 to 35 percent. The profile is neutral to moderately alkaline.

The A horizon has value of 2 to 3 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry.

An E, AB, or BA horizon is present in some pedons. It has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 1 to 3 when moist or dry.

The 2Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is clay, cobbly clay, or cobbly clay loam and is 35 to 60 percent clay.

The 2R horizon is fractured and has free carbonates or opal on the lower side of rock fragments.

Argixerolls

Argixerolls consist of shallow to very deep, well drained soils that formed in residuum and colluvium derived from tuff. These soils are on hills and foot slopes. Slopes are 15 to 30 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 47 degrees F.

Reference pedon of Argixerolls in an area of Argixerolls-Badland complex, 15 to 30 percent slopes in an area of rangeland; about 3 miles west of Summer Lake Hot Springs, on Highway 31; in the NE1/4NW1/4 of sec. 9, T. 33 S., R. 17 E.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine irregular pores; mildly alkaline; clear smooth boundary.

A2—5 to 12 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine roots; many fine irregular pores; mildly alkaline; clear wavy boundary.

Bt1—12 to 25 inches; olive brown (2.5Y 4/4) clay loam, light yellowish brown (2.5Y 6/4) dry; moderate medium subangular blocky structure; hard, firm, slightly sticky and plastic; few fine and medium roots; common fine tubular pores; common distinct clay films on faces of peds; mildly alkaline; clear wavy boundary.

Bt2—25 to 38 inches; olive brown (2.5Y 4/4) clay, light yellowish brown (2.5Y 6/4)) dry; strong coarse subangular blocky structure; very hard, very firm, sticky and plastic; few fine roots; few fine tubular pores; common distinct clay films on faces of peds and in pores; mildly alkaline; gradual wavy boundary.

Cr—38 inches; light olive brown, highly weathered tuff.

The mollic epipedon is 7 to 15 inches thick. The profile is neutral or mildly alkaline throughout. Depth to soft bedrock is 10 to 60 inches or more. The profile has hue of 10YR or 2.5Y.

Berdugo Series

The Berdugo series consists of very deep, well drained soils that formed in lacustrine sediment derived from tuff and basalt. Berdugo soils are on lake terraces. Slopes are 0 to 2 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 46 degrees F.

Typical pedon of Berdugo fine sandy loam in an area of Spangenburg-Berdugo complex, 0 to 2 percent slopes, in an area of rangeland; in the NE1/4NE1/4SW1/4 of sec. 15, T. 41 S., R. 27 E.

A1—0 to 3 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 4/3) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; mildly alkaline; abrupt smooth boundary.

A2—3 to 5 inches; dark brown (10YR 3/3) fine sandy loam, light brownish gray (10YR 6/2) dry; strong thick platy structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine roots; many very fine discontinuous random vesicular pores; moderately alkaline; abrupt smooth boundary.

2Bt1—5 to 10 inches; brown (10YR 4/3) clay, light brown (10YR 5/3) dry; strong very fine angular blocky structure; slightly hard, friable, sticky and plastic; many fine roots and common coarse roots; many distinct clay films on faces of peds; moderately alkaline; abrupt wavy boundary.

2Bt2—10 to 19 inches; brown (10YR 4/3) silty clay loam, brown (10YR 5/3) dry; strong fine prismatic structure; extremely hard, firm, sticky and plastic; few fine and coarse roots; common distinct clay films on faces of peds; moderately alkaline; abrupt wavy boundary.

3Bk1—19 to 39 inches; very dark grayish brown (10YR 3/2) clay loam, light gray (2.5Y 7/2) dry; massive; slightly hard, very friable, sticky and slightly plastic; few very fine roots; violently effervescent; carbonates are segregated in common fine irregularly shaped seams and filaments; strongly alkaline; clear wavy boundary.

4Bk2—39 to 50 inches; olive brown (2.5Y 4/4) very fine sandy loam, white (2.5Y 8/2) dry; common fine distinct brown (7.5YR 4/4) relict mottles; massive; soft, very friable, nonsticky and nonplastic; slightly effervescent; carbonates are disseminated; strongly alkaline; gradual wavy boundary.

4C—50 to 60 inches; olive brown (2.5Y 4/4) loamy sand, white (2.5Y 8/2) dry; many medium distinct brown (7.5YR 4/4) relict mottles; massive; soft, very friable, nonsticky and nonplastic; moderately alkaline.

The particle-size control section averages 35 to 45 percent clay. Depth to bedrock or to an indurated pan is more than 60 inches. Some strata below the argillic horizon are firm and brittle. Depth to the stratified C horizon is 20 to 50 inches.

The A horizon is mildly alkaline or moderately alkaline.

The 2Bt horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry. It is silty clay loam, silty clay, or clay. The horizon is mildly alkaline or moderately alkaline.

The 3Bk horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 or 3 when moist or dry. It is clay loam, loam, or very fine sandy loam. The horizon is moderately alkaline or strongly alkaline.

The 4C horizon has value of 7 or 8 when dry and 4 or 5 when moist, and it has chroma of 2 to 4 when moist or dry. It is stratified loamy sand, gravelly sandy loam, and extremely gravelly sand.

Bicondoa Series

The Bicondoa series consists of very deep, poorly drained soils that formed in alluvium derived from tuff and basalt. Bicondoa soils are on flood plains in lake basins. Slopes are 0 to 2 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Bicondoa silty clay loam, 0 to 2 percent slopes, in a meadow on Shirk Ranch, in Guano Valley; in the NW1/4SE1/4SW1/4NW1/4 of sec. 35, T. 38 S., R. 27 E.

A1—0 to 4 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots; many very fine and fine interstitial pores; slightly effervescent; 5 percent fine gravel; moderately alkaline; abrupt smooth boundary.

A2—4 to 6 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; strongly effervescent; 20 percent fine gravel; moderately alkaline; abrupt smooth boundary.

A3—6 to 14 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; common very fine and fine interstitial pores; strongly effervescent; 10 percent fine gravel; moderately alkaline; clear wavy boundary.

C1—14 to 23 inches; dark gray (10YR 4/1) silty clay, light gray (10YR 6/1) dry; few fine faint dark grayish brown (10YR 4/2) organic stains, light brownish gray (10YR 6/2) dry; weak medium prismatic structure; hard, firm, very sticky and very plastic; few very fine and fine roots; common very fine and fine interstitial pores; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—23 to 27 inches; dark grayish brown (10YR 4/2) clay, light brownish gray (10YR 6/2) dry; massive; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; mildly alkaline; abrupt smooth boundary.

C3—27 to 32 inches; dark grayish brown (10YR 4/2) silty clay, light gray (10YR 7/1) dry; few fine distinct dark brown (10YR 3/2) organic stains, brown (10YR 5/2) dry; massive; very hard, firm, very sticky and very plastic; mildly alkaline; clear smooth boundary.

C4—32 to 60 inches; dark yellowish brown (10YR 4/4) silty clay, very pale brown (10YR 7/4) dry; few fine distinct dark grayish brown (10YR 4/2) organic stains, light brownish gray (10YR 6/2) dry; massive; hard, firm, very sticky and very plastic; mildly alkaline.

These soils are frequently flooded and have a high water table late in winter and in spring. Depth to bedrock is more than 60 inches. The profile is calcareous throughout the upper 20 inches and is slightly calcareous or noncalcareous below. The particle-size control section averages 0 to 10 percent rock fragments, mainly fine gravel, and 35 to 50 percent clay. The mollic epipedon is 10 to 20 inches thick.

The A horizon has hue of 10YR or 2.5Y, and it has chroma of 1 or 2 when moist or dry.

The C horizon is silty clay or clay with thin strata of clay loam or silty clay loam in some areas. The horizon has hue of 10YR or 2.5Y. Chroma is 1 or 2 when moist or dry to a depth of 30 inches or more, but it ranges to 4 at a depth of more than 30 inches.

Blizzard Series

The Blizzard series consists of shallow, well drained soils that formed in colluvium over residuum derived from basalt and tuff. Blizzard soils are on tablelands. Slopes are 0 to 15 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 43 degrees F.

Typical pedon of Blizzard very cobbly silty clay loam, 0 to 15 percent slopes, in an area of rangeland; along a trail in the SE1/4SW1/4 of sec. 36, T. 40 S., R. 25 E.

A—0 to 1 inch; dark brown (7.5YR 4/2) very cobbly silty clay loam, brown (7.5YR 5/2) dry; weak thin platy structure; soft, very friable, slightly sticky and slightly plastic; few very fine, fine, and coarse roots; few very fine vesicular pores; 30 percent cobbles and 15 percent gravel; mildly alkaline; clear smooth boundary.

Bt1—1 inch to 7 inches; dark brown (7.5YR 3/2) silty clay, brown (7.5YR 5/2) dry; strong medium subangular and angular blocky structure; very hard, friable, sticky and plastic; common fine roots and few coarse roots; few very fine and fine vesicular pores; common faint clay films on faces of peds; 10 percent cobbles; mildly alkaline; clear wavy boundary.

Bt2—7 to 16 inches; dark brown (7.5YR 4/2) cobbly clay, brown (7.5YR 5/2) dry; strong medium prismatic structure parting to strong medium angular blocky; extremely hard, firm, very sticky and plastic; few fine and coarse roots; few very fine tubular pores; common distinct clay films on face of peds; 20 percent cobbles; mildly alkaline; abrupt smooth boundary.

R—16 inches; fractured basalt.

The particle-size control section averages 0 to 25 percent rock fragments, mainly cobbles and gravel, and 45 to 60 percent clay. Thickness of the solum and depth to bedrock are 10 to 20 inches. The mollic epipedon is 7 to 10 inches thick, and it includes the upper part or all of the Bt horizon. The profile is neutral or mildly alkaline.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 4 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry. In some areas the horizon has value of 4 when moist and 6 when dry, but when mixed to a depth of 7 inches, the matrix color meets the criteria for a mollic epipedon. The A horizon is 10 to 25 percent gravel and 15 to 40 percent cobbles.

The Bt horizon has value of 3 or 4 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is silty clay, cobbly clay, or clay.

Some pedons have a Bk horizon below the Bt horizon.

Booth Series

The Booth series consists of moderately deep, well drained soils that formed in colluvium derived from basalt and tuff. Booth soils are on mountains and hills. Slopes are 0 to 60 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 43 degrees F.

Typical pedon of Booth very stony loam, 2 to 15 percent slopes in an area of rangeland; about 2,000 feet east and 600 feet north of the southwest corner of sec. 20, T. 36 S., R. 21 E.

A—0 to 4 inches; very dark brown (10YR 2/2) very stony loam, dark gray (10YR 4/1) dry; weak thin platy structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; 15 percent stones, 10 percent cobbles, and 15 percent gravel; many very fine pores; slightly acid; clear smooth boundary.

2Bt1—4 to 12 inches; very dark brown (10YR 2/2) clay, dark grayish brown (10YR 4/2) dry; moderate medium and coarse prismatic structure; very hard, very firm, very sticky and very plastic; common fine and medium roots; few very fine tubular pores; nearly continuous clay films on faces of peds; slightly acid; clear smooth boundary.

2Bt2—12 to 24 inches; dark brown (10YR 3/3) clay, grayish brown (10YR 5/2) dry and dark brown (10YR 4/3) rubbed; strong coarse prismatic structure; very hard, very firm, very sticky and very plastic; few fine roots; few very fine tubular pores; continuous stress cutans on faces of peds; neutral; abrupt smooth boundary.

3Cr—24 to 26 inches; olive brown (2.5Y 4/4) partially weathered tuff, light gray (2.5Y 7/2) and olive yellow (2.5Y 6/6) dry; extremely firm; clear wavy boundary.

3R—26 inches; unweathered tuff.

The mollic epipedon is 7 to 15 inches thick, and it includes the upper part of the argillic horizon. Thickness of the solum and depth to a lithic contact are 20 to 40 inches. The solum is slightly acid or neutral. An absolute clay increase of 20 percent or more is between the A and 2Bt horizons.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 5 when dry, and chroma of 1 to 3 when moist or dry. It is 5 to 20 percent gravel and 0 to 25 percent cobbles or stones, or both. The horizon is very stony loam, gravelly loam, or silty clay.

The 2Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 2 to 4 when moist and 3 to 6 when dry, and chroma of 2 to 4 when moist or dry. It is clay or silty clay. The horizon averages 45 to 60 percent clay and 0 to 10 percent rock fragments.

Boravall Series

The Boravall series consists of very deep, poorly drained soils that formed in lacustrine sediment. Boravall soils are on alluvial flats in lake basins. Slopes are 0 to 1 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Boravall silt loam, 0 to 1 percent slopes, in an area of rangeland; in the SE$^1/_4$NW$^1/_4$SW$^1/_4$ of sec. 29, R. 25 E., T. 38 S.

Aknz—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/1) dry; moderate medium platy structure; very hard, firm, sticky and plastic; many medium and coarse roots; violently effervescent; carbonates are disseminated; very strongly alkaline; gradual smooth boundary.

Bkn1—6 to 12 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine prismatic structure; hard, friable, sticky and plastic; common fine and medium roots; violently effervescent; carbonates are disseminated; very strongly alkaline; gradual smooth boundary.

Bkn2—12 to 19 inches; very dark gray (10YR 3/1) and brown (10YR 5/3) silty clay, light gray (10YR 7/1) and gray (10YR 5/1) dry; moderate fine prismatic structure; hard, friable, very sticky and very plastic; common fine and medium roots; slightly effervescent; carbonates are disseminated; very strongly alkaline; abrupt smooth boundary.

Bkn3—19 to 36 inches; very dark gray (10YR 3/1) and light yellowish brown (10YR 6/4) silty clay, light gray (10YR 7/2) and dark gray (10YR 4/1) dry; moderate medium prismatic structure; very hard, firm, sticky and plastic; common very fine and fine roots; slightly effervescent matrix; many medium concretions and soft masses of carbonates; very strongly alkaline; abrupt smooth boundary.

2Ckn—36 to 60 inches; light yellowish brown (10YR 6/4) and very dark gray (10YR 3/1) silt loam, light gray (10YR 7/2) and light brownish gray (10YR 6/2) dry; massive; very hard, firm and brittle, sticky and plastic; few fine roots; slightly effervescent; carbonates are disseminated; strongly alkaline.

Depth to bedrock is more than 60 inches. These soils are subject to rare flooding and have a high water table late in winter and in spring. The particle-size control section averages 35 to 45 percent clay. Salt efflorescence is on the surface in summer.

The A horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 1 or 2 when moist or dry. Electrical conductivity is more than 16 millimhos per centimeter, and the sodium adsorption ratio is more than 100.

The B horizon has value of 3 to 6 when moist and 5 to 7 when dry, and it has chroma of 1 to 4 when moist and 1 to 3 when dry. Electrical conductivity is 2 to 4 millimhos per centimeter, and the sodium adsorption ratio is 13 to 50.

The 2C horizon has hue of 10YR, 5Y, or 2.5Y, value of 3 to 6 when moist and 6 or 7 when dry, and chroma of 1 to 4 when moist and 1 or 2 when dry. It is silt loam or silty clay loam. Electrical conductivity is less than 2 millimhos per centimeter, and the sodium adsorption ratio is 5 to 13. The horizon is massive to strong fine and medium angular blocky. The structure is a result of consolidation, compaction, and fracturing of the sediment.

Boulder Lake Series

The Boulder Lake series consists of very deep, poorly drained soils that formed in lacustrine sediment derived from tuff and basalt. Boulder Lake soils are in closed basins and depressions, on tablelands, and on alluvial flats in lake basins. Slopes are 0 to 2 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Boulder Lake silty clay, 0 to 2 percent slopes, in an area of rangeland; on the west shore of Mound Lake, in the Hart Mountain National Antelope Refuge; in the SW$^1/_4$NE$^1/_4$SW$^1/_4$ of sec. 15, T. 37 S., R. 26 E.

A—0 to 2 inches; grayish brown (10YR 5/2) silty clay, gray (10YR 5/1) dry; moderate medium and fine angular block structure; hard, friable, sticky and plastic; few very fine roots; neutral; clear wavy boundary.

Bss1—2 to 12 inches; grayish brown (10YR 5/2) silty clay, gray (10YR 5/1) dry; strong medium and coarse prismatic structure; very hard, firm, very sticky and very plastic; many very fine roots and common medium roots; few slickensides on faces of peds; neutral; clear smooth boundary.

Bss2—12 to 24 inches; grayish brown (10YR 5/2) silty clay, grayish brown (10YR 5/2) dry; common fine distinct very dark gray (10YR 3/1) mottles, yellowish brown (10YR 5/6) dry; moderate medium prismatic structure; very hard, firm, sticky and plastic; common medium and fine roots and few very fine roots; common slickensides on faces of peds; mildly alkaline; clear smooth boundary.

Bss3—24 to 35 inches; grayish brown (10YR 5/2) silty clay, grayish brown (10YR 5/2) dry; weak medium prismatic structure parting to moderate medium angular blocky; hard, firm, slightly sticky and slightly plastic; common medium roots; few slickensides on faces of peds; mildly alkaline; clear smooth boundary.

2Bk1—35 to 42 inches; brown (10YR 5/3) silty clay loam, light brownish gray (10YR 6/2) dry; massive; hard, firm, slightly sticky and slightly plastic; strongly effervescent; lime segregated in many fine irregular seams and masses; moderately alkaline; abrupt smooth boundary.

2Bk2—42 to 60 inches; brown (10YR 5/3) silty clay loam, light brownish gray (10YR 6/2) dry; massive; very hard, firm, slightly sticky and slightly plastic; strongly effervescent; lime segregated in common fine irregular seams and filaments; moderately alkaline.

Depth to bedrock is more than 60 inches. The soils are ponded and have a high water table late in winter and in spring. The particle-size control section averages 45 to 60 percent clay. Depth to the 2Bk horizon is 30 to 50 inches. Depth to distinct or prominent mottles is 10 to 20 inches.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 2 or 3 when moist and 1 to 3 when dry. It is neutral or mildly alkaline.

The Bss horizon has hue of 10YR or 2.5Y and value of 4 or 5 when moist and 5 or 6 when dry. Chroma in most areas is 2 when moist or dry, but it is 1 when dry in the upper part in some areas. The horizon is silty clay or clay.

The 2Bk horizon has hue of 10YR or 2.5Y, value of 5 or 6 when moist or dry, and chroma of 2 or 3 when moist or dry. It is silty clay loam or clay loam and is 30 to 40 percent clay. The horizon is mildly alkaline or moderately alkaline.

Brace Series

The Brace series consists of soils that are moderately deep to a hardpan and are well drained. These soils formed in residuum and colluvium derived from basalt and tuff. Brace soils are on tablelands. Slopes are 2 to 20 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is 45 degrees F.

Typical pedon of Brace loam in an area of Brace-Coglin complex, 2 to 15 percent slopes, in an area of rangeland; in the SW1/4SE1/4NE1/4 of sec. 22, T. 33 S., R. 28 E.

A1—0 to 3 inches; dark brown (10YR 3/3) loam, light brownish gray (10YR 6/2) dry; moderate thin platy structure parting to moderate fine subangular blocky; soft, very friable, slightly sticky and nonplastic; many very fine, fine, and medium roots; 10 percent gravel; mildly alkaline; clear smooth boundary.

A2—3 to 9 inches; dark brown (10YR 3/3) cobbly loam, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine, fine, and medium roots; 20 percent cobbles and 10 percent gravel; mildly alkaline; abrupt smooth boundary.

2Bt1—9 to 15 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate fine prismatic structure parting to moderate medium subangular blocky; slightly hard, firm, sticky and slightly plastic; many very fine, fine, medium, and coarse roots; common distinct clay films on faces of peds; 10 percent gravel; moderately alkaline; clear wavy boundary.

2Bt2—15 to 19 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, firm, sticky and slightly plastic; many very fine, fine, medium, and coarse roots; common distinct clay films on faces of peds; 10 percent gravel; moderately alkaline; abrupt wavy boundary.

3Bkq—19 to 25 inches; yellowish brown (10YR 5/6) extremely gravelly loam, very pale brown (10YR 7/3) dry; massive; hard, firm and brittle, nonsticky and nonplastic; 20 percent cobbles and 50 percent gravel; violently effervescent; carbonates are disseminated; moderately alkaline; clear smooth boundary.

3Bkqm—25 to 35 inches; indurated hardpan; abrupt wavy boundary.

4R—35 inches; basalt.

Depth to the firm, brittle layer is 10 to 25 inches. Depth to the indurated hardpan is 20 to 37 inches. Depth to bedrock is 22 to 40 inches.

The A1 horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry. It is 0 to 5 percent subangular stones, 0 to 5 percent cobbles, and 5 to 10 percent gravel. The horizon is loam or loamy sand.

The A2 horizon has color similar to that of the A1 horizon. The A2 horizon is 5 to 20 percent gravel, 15 to 25 percent cobbles, and 0 to 10 percent stones.

The 2Bt horizon has value of 3 or 4 when moist and 5 when dry, and it has chroma of 3 or 4 when moist or dry. It is 5 to 15 percent gravel and 0 to 5 percent cobbles. The horizon is silty clay loam, clay loam, or loam and is 25 to 35 percent clay.

The 3Bkq horizon has value of 4 to 7 when moist and 5 to 7 when dry, and it has chroma of 3 to 6 when moist and 3 or 4 when dry. It is 40 to 75 percent rock fragments, including 30 to 50 percent gravel and 10 to 25 percent cobbles. The horizon is slightly effervescent to violently effervescent. Carbonates are segregated or disseminated.

The 3Bkqm consists of basalt and tuff fragments cemented with silica. The laminar silica-cemented cap is 1 millimeter to about 1 centimeter thick. The 3Bkqm horizon is 2 to 10 inches thick over basalt or tuff.

Buffaran Series

The Buffaran series consists of soils that are shallow to a hardpan and are well drained. These soils formed in alluvium derived from tuff, basalt, andesite, and rhyolite. Buffaran soils are on alluvial fans. Slopes are 0 to 5 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 49 degrees F.

Typical pedon of Buffaran gravelly loam, 0 to 5 percent slopes, in a seeded area of crested wheatgrass in Guano Valley; in the SW1/4NW1/4NE1/4 of sec. 4, T. 41 S., R. 27 E.

A—0 to 2 inches; brown (10YR 4/2) and dark grayish brown (10YR 4/3) gravelly loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; soft, very friable, slightly sticky and nonplastic; 2 percent cobbles and 20 percent gravel; common very fine roots; many very fine and fine discontinuous tubular pores; neutral; clear wavy boundary.

Bt1—2 to 8 inches; dark grayish brown (10YR 3/2) and dark yellowish brown (10YR 3/4) clay loam, yellowish brown (10YR 5/4) and light brownish gray (10YR 6/2) dry; moderate medium and fine subangular blocky structure; slightly hard, friable, sticky and plastic; 5 percent gravel; common very fine and fine roots; few very fine tubular pores; few faint clay films on faces of peds; mildly alkaline; clear wavy boundary.

Bt2—8 to 15 inches; dark yellowish brown (10YR 3/4 and 10YR 4/4) clay loam, light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/4) dry, weak coarse prismatic structure parting to moderate fine and very fine angular blocky; slightly hard, very firm, sticky and plastic; 5 percent gravel; common very fine and fine roots; common very fine tubular pores; many distinct clay films on faces of peds; moderately alkaline; abrupt wavy boundary.

Bkq—15 to 17 inches; dark yellowish brown (10YR 4/4) gravelly clay loam, light yellowish brown (10YR 6/4) dry; massive; hard, firm, sticky and plastic; 30 percent strongly cemented hardpan fragments; strongly effervescent; disseminated carbonates; 1 percent cobbles and 25 percent gravel; moderately alkaline; clear wavy boundary.

Bkqm—17 to 40 inches; indurated silica- and lime-cemented hardpan; massive; extremely hard, extremely firm; alternate layers of strong cementation and indurated silica laminae; violently effervescent on surface of laminae, noneffervescent throughout laminae; 1 percent cobbles and 15 percent gravel; clear wavy boundary.

Bqm—40 to 60 inches; strongly cemented hardpan consisting of many thin laminae with weakly cemented material between the laminae; 25 percent gravel; moderately alkaline.

Thickness of the solum and depth to the indurated hardpan are 14 to 20 inches. Depth to bedrock is more than 60 inches.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 or 3 when moist or dry. It is neutral or mildly alkaline.

The Bt horizon has hue of 10YR or 7.5YR, and it has chroma of 3 or 4 when moist or dry. It is clay, clay loam, or gravelly clay loam and is 35 to 45 percent clay and 5 to 30 percent gravel. The horizon is mildly alkaline or moderately alkaline.

The Bkq horizon is gravelly loam or gravelly clay loam and is 20 to 40 percent strongly cemented hardpan fragments and 15 to 30 percent gravel and cobbles.

Bullump Series

The Bullump series consists of very deep, well drained soils that formed in colluvium and residuum derived from rhyolite, tuff, and basalt. Bullump soils are on mountains and hills. Slopes are 5 to 70 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Bullump extremely gravelly loam in an area of Rogger-Bullump association, 40 to 60 percent north slopes, in an area of rangeland; in the NW1/4NW1/4NW1/4 of sec. 35, T. 37 S., R. 22 E.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) extremely gravelly loam, dark brown (10YR 3/3) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; common very fine discontinuous random vesicular pores; 5 percent stones, 15 percent cobbles, and 45 percent gravel; mildly alkaline; gradual wavy boundary.

A2—3 to 11 inches; very dark grayish brown (10YR 3/2) extremely gravelly loam, dark brown (10YR 3/3) dry; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots and few fine roots; 5 percent stones, 15 percent cobbles, and 45 percent gravel; mildly alkaline; clear wavy boundary.

Bt1—11 to 22 inches; very dark grayish brown (10YR 3/2) very gravelly clay loam, dark brown (10YR 4/3) dry; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine roots; few very fine tubular pores; 15 percent cobbles and 40 percent gravel;

common faint clay films in pores and on faces of peds; mildly alkaline; clear wavy boundary.

Bt2—22 to 42 inches; dark yellowish brown (10YR 3/4) very gravelly clay loam, yellowish brown (10YR 5/6) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine tubular pores; 55 percent gravel; few faint clay films in pores and on faces of peds; mildly alkaline; clear wavy boundary.

C—42 to 60 inches; dark yellowish brown (10YR 4/6) extremely gravelly loam, yellowish brown (10YR 5/6) dry; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; 20 percent cobbles and 45 percent gravel; mildly alkaline.

Depth to bedrock is more than 60 inches. The particle-size control section averages 25 to 35 percent clay and 35 to 55 percent rock fragments. The profile is neutral or mildly alkaline.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is extremely stony loam, extremely gravelly loam, gravelly loam, or very stony loam.

The Bt horizon has value of 3 or 4 when moist and 4 to 6 when dry, and it has chroma of 2 to 4 when moist and 3 to 6 when dry. It is very gravelly loam or very gravelly clay loam.

Calimus Series

The Calimus series consists of very deep, well drained soils that formed in alluvium derived from volcanic tuff, basalt, and diatomite. Calimus soils are on lake terraces and alluvial fans. Slopes are 0 to 5 percent. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Calimus silt loam, 0 to 5 percent slopes, in a seeded area of rangeland; about 2 miles west of Valley Falls; in the SE$^1/_4$NE$^1/_4$NE$^1/_4$ of sec. 33, T. 35 S., R. 20 E.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate thin and medium platy structure; slightly hard, friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; many fine vesicular pores; neutral; clear smooth boundary.

A2—2 to 10 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine tubular pores; neutral; clear smooth boundary.

A3—10 to 22 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; common very fine, fine, and medium roots and few coarse roots; many very fine tubular pores; neutral; abrupt wavy boundary.

Bt—22 to 30 inches; very dark gray (10YR 3/1) silt loam, light gray (10YR 6/1) dry; yellowish brown (10YR 5/4) relict mottles, dark yellowish brown (10YR 4/4) dry; moderate medium subangular structure; hard, firm, sticky and plastic; few very fine and fine roots; many fine tubular pores; few faint clay films in pores; neutral; abrupt smooth boundary.

2C1—30 to 42 inches; dark grayish brown (10YR 4/2) loamy sand, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; many very fine irregular pores; 14 percent gravel; 10 percent pumice sand; neutral; abrupt wavy boundary.

3C2—42 to 60 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; massive; hard, firm, sticky and plastic; neutral.

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 30 inches thick or more. The solum is 30 to 50 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 1 or 2 when moist or dry. It is 0 to 5 percent gravel.

The B horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 1 to 4 when moist or dry. It is loam or silt loam.

The C horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 to 4 when moist or dry. It is loam, silt loam, sandy loam, or loamy sand. The horizon is 0 to 10 percent pumice sand and 0 to 20 percent gravel.

Carryback Series

The Carryback series consists of moderately deep, well drained soils that formed in colluvium and residuum derived from basalt and tuff. Carryback soils are on tablelands. Slopes are 0 to 15 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Carryback very cobbly loam in an area of Carryback-Rock outcrop complex, 5 to 15 percent slopes, in an area of rangeland; in the SE$^1/_4$SE$^1/_4$SE$^1/_4$ of sec. 34, T. 38 S., R. 23 E.

A—0 to 2 inches; dark brown (10YR 3/3) very cobbly loam, grayish brown (10YR 5/2) dry; moderate thin platy structure; soft, very friable, slightly sticky and nonplastic; many fine and medium roots; common very fine discontinuous vesicular pores; 5 percent stones, 40 percent cobbles, and 10 percent gravel; neutral; clear wavy boundary.

AB—2 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; slightly hard, firm, sticky and slightly plastic; many fine and medium roots; 5 percent cobbles and 5 percent gravel; neutral; abrupt smooth boundary.

2Bt—8 to 15 inches; brown (7.5YR 4/4) clay, brown (7.5YR 4/4) dry; strong fine prismatic structure; very hard, firm, very sticky and plastic; common very fine and fine roots; few very fine irregular pores; 5 percent fine gravel; many distinct clay films in pores and on faces of peds; mildly alkaline; abrupt wavy boundary.

3C—15 to 22 inches; brown (7.5YR 4/4) silty clay loam, brown (7.5YR 5/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; moderately alkaline; clear smooth boundary.

3Ck1—22 to 27 inches; brown (7.5YR 4/4) silt loam, light brown (7.5YR 6/4) dry; massive; soft, very friable, slightly sticky and nonplastic; slightly effervescent; carbonates are segregated in few fine irregularly shaped seams and filaments; moderately alkaline; abrupt wavy boundary.

3Ck2—27 to 33 inches; brown (7.5YR 4/4) loam, pale brown (10YR 6/3) dry; massive; slightly hard, firm, nonsticky and nonplastic; 10 percent gravel; strongly effervescent; carbonates are segregated in many fine irregularly shaped seams and filaments; moderately alkaline; abrupt irregular boundary.

3R—33 inches; tuff; coatings of silica and calcium carbonate in fractures.

Depth to bedrock is 20 to 40 inches. The particle-size control section averages 40 to 60 percent clay. The solum has hue of 7.5YR or 10YR.

The A horizon has chroma of 2 or 3 when moist or dry. It is very cobbly loam or very stony silty clay loam. The horizon is 5 to 40 percent stones, 10 to 40 percent cobbles, and 10 to 20 percent gravel.

The AB horizon has chroma of 2 or 3 when moist or dry. It is silty clay loam or clay loam. The horizon is 0 to 5 percent stones, 0 to 10 percent cobbles, and 0 to 10 percent gravel.

The 2Bt horizon is 0 to 15 percent gravel, most of which are less than 0.25 inch in diameter, and 0 to 5 percent cobbles. It is clay or silty clay.

The 3Ck horizon has value of 5 or 6 when dry. It is 0 to 10 percent gravel, most of which is less than $^1/_4$ inch in diameter, and 0 to 5 percent cobbles. The horizon is noneffervescent to strongly effervescent. It is loam, silt loam, or silty clay loam and is 20 to 30 percent clay.

Chewaucan Series

The Chewaucan series consists of deep, well drained soils that formed in old lacustrine deposits. Chewaucan soils are on bedrock-controlled lake terraces. Slopes are 2 to 15 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Chewaucan very cobbly silty clay loam, 2 to 15 percent slopes, in an area of rangeland; in the SW$^1/_4$NE$^1/_4$NE$^1/_4$ of sec. 34, T. 35 S., R. 20 E.

A—0 to 5 inches; dark brown (10YR 3/3) very cobbly silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; hard, firm, sticky and very plastic; many very fine and fine roots and few medium and coarse roots; many very fine pores; 5 percent stones, 20 percent cobbles, 15 percent coarse gravel, and 10 percent fine gravel; moderately alkaline; gradual smooth boundary.

Bt1—5 to 10 inches; dark brown (10YR 3/3) silty clay loam, yellowish brown (10YR 5/4) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and very plastic; many very fine and fine roots and few medium and coarse roots; few very fine tubular pores; common distinct clay films on faces of peds; 5 percent stones, 5 percent cobbles, 1 percent coarse gravel, and 1 percent fine gravel; mildly alkaline; gradual smooth boundary.

Bt2—10 to 24 inches; dark yellowish brown (10YR 4/4) silty clay loam, light yellowish brown (10YR 6/4) dry; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and very plastic; common very fine and fine roots; few very fine tubular pores; common distinct clay films on faces of peds; 5 percent stones, 5 percent cobbles, 2 percent coarse gravel, and 2 percent fine gravel; mildly alkaline; abrupt smooth boundary.

Bkq—24 to 44 inches; dark yellowish brown (10YR 4/4) loam, very pale brown (10YR 7/4) dry; very hard, firm and brittle, slightly sticky and plastic; few fine roots in the upper 2 inches; strongly effervescent; lime segregated in common fine filaments or threads; 5 percent stones and 5 percent cobbles; moderately alkaline; abrupt smooth boundary.

2R—44 inches; basalt.

The mollic epipedon is 10 to 15 inches thick and includes the upper part of the Bt horizon. Depth to the firm, brittle calcareous layer is 20 to 40 inches. Depth to bedrock is 40 to 60 inches.

The A horizon has value of 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 0 to 10 percent stones, 15 to 25 percent cobbles, and 10 to 35 percent gravel. Total rock fragment content is 35 to 60 percent. The horizon commonly has weak thin platy structure in the upper 1 inch or less.

The Bt horizon has value of 5 or 6 when dry and 3 or 4 when moist, and it has chroma of 3 or 4 when moist or dry. The darker colors are in the upper part of the horizon. The Bt horizon is silty clay loam or silty clay and is 35 to 45 percent clay. Total rock fragment content ranges from 0 to 25 percent. The horizon is 0 to 10 percent stones, 0 to 15 percent cobbles, and 0 to 25 percent gravel.

The Bkq horizon is loam or clay loam and is 20 to 35 percent clay. It is extremely firm or brittle and firm when moist. Total rock fragment content ranges from 0 to 15 percent. The horizon is 0 to 10 percent stones, 0 to 10 percent cobbles, and 0 to 10 percent gravel.

Chocktoot Series

The Chocktoot series consists of very deep, well drained soils that formed in colluvium and residuum derived from andesite, basalt, tuff, and volcanic ash. Chocktoot soils are on mountains. Slopes are 15 to 60 percent. The mean annual precipitation is about 32 inches, and the mean annual air temperature is about 42 degrees F.

Typical pedon of Chocktoot very gravelly loam, 15 to 40 percent north slopes, in an area of woodland; in the NE$^1/_4$SE$^1/_4$ of sec. 15, T. 40 S., R. 21 E.

Oi—2 inches to 0; white fir needles.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) very gravelly loam, dark brown (10YR 4/3) dry; weak very fine and fine granular structure; soft, very friable, slightly sticky and nonplastic; common fine and medium roots; many fine irregular pores; 5 percent stones, 10 percent cobbles, and 35 percent gravel; neutral; gradual wavy boundary.

A2—4 to 12 inches; dark brown (10YR 3/3) very gravelly loam, brown (10YR 4/3) dry; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium roots; many fine irregular pores; 5 percent stones, 10 percent cobbles, and 35 percent gravel; slightly acid; clear wavy boundary.

Bt—12 to 36 inches; dark brown (7.5YR 3/4) very gravelly clay loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; common very fine and fine tubular pores; few faint clay films on faces of peds; 10 percent cobbles and 40 percent gravel; slightly acid; gradual wavy boundary.

C—36 to 60 inches; dark brown (7.5YR 3/4) very gravelly loam, brown (7.5YR 5/4) dry; massive; slightly hard, very friable, slightly sticky and nonplastic; few fine roots; few very fine and fine tubular pores; 50 percent gravel; slightly acid.

Depth to bedrock is more than 60 inches. The particle-size control section is 35 to 60 percent rock fragments. The mollic epipedon is 10 to 15 inches thick.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 2 or 3 when moist or dry. The bulk density is 0.85 to 1.00 grams per cubic centimeter. The horizon is 30 to 50 percent glass.

The Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 3 or 4 when moist. It is loam or clay loam and is 22 to 35 percent clay. Total rock fragment content is 35 to 60 percent, of which 0 to 10 percent is cobbles and stones and 35 to 50 percent is gravel.

The C horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. Total rock fragment content is 35 to 60 percent, of which 0 to 10 percent is cobbles and stones and 35 to 50 percent is gravel.

Coglin Series

The Coglin series consists of very deep, well drained soils that formed in colluvium and residuum derived from basalt and tuff. Coglin soils are on tablelands and fans. Slopes are 2 to 15 percent. The mean annual precipitation is about 10 inches, and the mean annual air temperature is about 46 degrees F.

Typical pedon of Coglin extremely stony loam in an area of Fertaline-Coglin complex, 2 to 15 percent slopes, in an area of rangeland; in the NE$^1/_4$NW$^1/_4$SW$^1/_4$ of sec. 31, T. 36 S., R. 23 E.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) extremely stony loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; soft, very friable, sticky and slightly plastic; many very fine and fine roots; many very fine discontinuous vesicular pores; 20 percent gravel, 15 percent cobbles, and 40 percent stones; neutral; abrupt wavy boundary.

2Bt—2 to 7 inches; dark brown (10YR 4/3) clay, dark yellowish brown (10YR 4/4) dry; strong fine prismatic structure; extremely hard, very firm, sticky and very plastic; common very fine and fine roots; few very fine discontinuous irregular pores; 10 percent fine gravel; many continuous prominent clay films in pores and on faces of peds; neutral; clear wavy boundary.

3C—7 to 16 inches; dark yellowish brown (10YR 4/4) silty clay loam, yellowish brown (10YR 5/6) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; 10 percent gravel; mildly alkaline; clear smooth boundary.

4Ck—16 to 60 inches; dark yellowish brown (10YR 4/4) silty clay loam, dark yellowish brown (10YR 4/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; 5 percent gravel; strongly effervescent; lime is segregated in common irregular filaments and seams; moderately alkaline.

Depth to soft powdery secondary lime is 10 to 30 inches. Depth to bedrock is more than 60 inches. The particle-size control section averages 35 to 50 percent clay. An absolute clay increase of 15 to 25 percent is between the A and 2Bt horizons. Thickness of the A and 2Bt horizons combined is 5 to 20 inches.

The A horizon has value of 3 or 4 when moist and 6 when dry. It is 15 to 20 percent gravel, 15 to 20 percent cobbles, and 30 to 40 percent stones. The sand fraction is mostly fine sand and very fine sand. The A horizon is 1 to 2 percent organic matter.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 4 when moist and 4 to 6 when dry, and chroma of 3 or 4 when moist and 4 when dry. It is clay or clay loam and is 5 to 15 percent fine gravel. Clay films are faint to prominent. Structure is moderate to strong prismatic parting to angular blocky. The 2Bt horizon is 1 to 2 percent organic matter.

The 3C horizon has hue of 7.5YR or 10YR, value of 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist and 4 to 6 when dry. It is 5 to 20 percent fine gravel and 0 to 10 percent cobbles and is silty clay loam or loam.

The 4Ck horizon has hue of 7.5YR or 10YR, value of 4 when moist and 4 to 6 when dry, and chroma of 4 when moist and 4 to 6 when dry. It is 5 to 20 percent fine gravel and 0 to 10 percent cobbles and is silty clay loam, silt loam, or loam. In some pedons the horizon has thin lenses of brittle material 1 to 3 inches thick. The 4Ck horizon is strongly effervescent or violently effervescent.

Corral Series

The Corral series consists of shallow, well drained soils that formed in residuum and colluvium derived from tuff. Corral soils are on dissected fans. Slopes are 2 to 15 percent. The mean annual precipitation is about 10 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Corral fine sandy loam, 2 to 15 percent slopes, in an area of rangeland; about 800 feet south of jeep trail, in the NE$^1/_4$NE$^1/_4$ of sec. 22, T. 38 S., R. 28 E.

A1—0 to 3 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; moderate medium platy structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; many very fine, common fine, and few medium vesicular pores; 10 percent gravel; mildly alkaline; clear smooth boundary.

A2—3 to 5 inches; brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots, few fine vesicular pores; 10 percent gravel; mildly alkaline; abrupt smooth boundary.

Bt—5 to 13 inches; dark yellowish brown (10YR 4/4) sandy clay loam, yellowish brown (10YR 5/4) dry; strong medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; few very fine tubular pores; common faint clay films on faces of peds; mildly alkaline; clear smooth boundary.

Crk—13 inches; yellowish brown (10YR 5/6) soft tuff, brownish yellow (10YR 6/6) dry; segregated lime in fractures.

Depth to soft bedrock and thickness of the solum are 12 to 20 inches. The particle-size control section is 0 to 15 percent rock fragments, mainly gravel, and 20 to 35 percent clay.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry.

The Bt horizon has value of 3 to 5 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. The horizon is sandy clay loam, clay loam, or loam.

Coztur Series

The Coztur series consists of shallow, well drained soils that formed in colluvium and residuum derived from basalt and tuff. Coztur soils are on tablelands. Slopes are 2 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Coztur very gravelly sandy loam, 2 to 15 percent slopes, in an area of rangeland; about 0.5 mile east of Spalding Ranch; in the SE1/4SE1/4 of sec. 34, T. 38 S., R. 28 E.

A1—0 to 2 inches; very dark grayish brown (2.5Y 3/2) very gravelly sandy loam, light brownish gray (2.5Y 6/2) dry; weak fine subangular blocky structure; loose, nonsticky and nonplastic; few very fine roots; 5 percent cobbles and 35 percent gravel; moderately alkaline; clear smooth boundary.

A2—2 to 9 inches; dark grayish brown (2.5Y 4/2) gravelly sandy loam, light brownish gray (2.5Y 6/2) dry; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots and few fine roots; common very fine tubular pores; 20 percent gravel; moderately alkaline; clear smooth boundary.

Bt—9 to 15 inches; dark yellowish brown (10YR 4/6) gravelly clay loam, brownish yellow (10YR 6/6) dry; moderate fine angular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; common distinct clay films on faces of peds; 20 percent gravel; moderately alkaline; clear smooth boundary.

R—15 inches; basalt.

Thickness of the solum and depth to bedrock are 14 to 20 inches. The profile is mildly alkaline or moderately alkaline.

The A horizon has hue of 2.5Y or 10YR, value of 3 or 4 when moist and 6 or 7 when dry, and chroma of 2 or 3 when moist or dry.

The Bt horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 to 6 when moist or dry. It is gravelly clay loam, gravelly loam, or clay loam and is 20 to 35 percent clay and 5 to 25 percent gravel.

Cressler Series

The Cressler series consists of very deep, somewhat poorly drained soils that formed in alluvium derived from basalt. Cressler soils are in upland basins. Slopes are 0 to 2 percent. The mean annual precipitation is about 24 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Cressler silty clay loam, 0 to 2 percent slopes, in a meadow; in the SE1/4NE1/4 of sec. 25, T. 39 S., R. 21 E.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; hard, friable, sticky and plastic; many very fine and fine roots; many very fine irregular pores; moderately acid; abrupt smooth boundary.

Bt1—6 to 15 inches; very dark brown (10YR 2/2) silty clay, dark gray (10YR 4/1) dry; weak fine prismatic structure parting to strong angular blocky; very hard, very firm, very sticky and very plastic; common fine roots; common very fine and fine tubular pores; common faint clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—15 to 38 inches; grayish brown (10YR 5/2) silty clay, light brownish gray (10YR 6/2) dry; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; very hard, very firm, very sticky and very plastic; few fine roots; common fine tubular pores; common distinct clay films on faces of peds and in pores; neutral; gradual wavy boundary.

BC—38 to 48 inches; brown (10YR 5/3) clay loam, light brownish gray (10YR 6/2); many fine distinct yellowish brown (10YR 5/6) mottles; massive; hard, firm, very sticky and plastic; few fine roots; common very fine and fine tubular pores; neutral; clear smooth boundary.

2C—48 to 60 inches; brown (10YR 5/3) extremely stony clay, brown (10YR 5/3) dry; many fine distinct yellowish brown (10YR 5/6) mottles; massive; hard, firm, very sticky and very plastic; few fine roots; 15 percent stones, 35 percent cobbles, and 25 percent gravel; slightly acid.

Depth to bedrock is more than 60 inches. These soils are subject to rare flooding and have a high water table late in winter and in spring. The particle-size control section averages 0 to 15 percent gravel and 35 to 50 percent clay. The mollic epipedon is 10 to 20 inches thick and includes the upper part of the subsoil. Depth to distinct or prominent mottles is 10 to 20 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 1 or 2 when moist or dry.

The B horizon has hue of 10YR or 7.5YR, value of 2 to 5 when moist and 4 or 5 when dry, and chroma or 1 or 2 when moist or dry. It is silty clay, clay, or clay loam and is 0 to 15 percent gravel.

The BC horizon has hue of 10YR or 7.5YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist or dry. It is clay loam or clay and is 0 to 15 percent gravel.

The 2C horizon, where present, has hue of 10YR or 7.5YR, value of 4 or 5 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist or dry. It is 40 to 50 percent clay. Rock fragment content is 60 to 85 percent, of which 35 to 65 percent is cobbles and stones and 15 to 30 percent is gravel.

Crump Series

The Crump series consists of very deep, very poorly drained soils that formed in decomposed organic material over silty lacustrine sediment. Crump soils are in concave areas of alluvial flats adjacent to open water areas in lake basins. Slopes are 0 to 1 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Crump muck, 0 to 1 percent slopes, in a meadow in Warner Valley; about 200 feet west and 520 feet north of the east quarter corner of sec. 34, T. 38 S., R. 24 E.

Oa—0 to 8 inches; black (10YR 2/1) muck, gray (N 5/0) dry; weak thin platy structure and moderate fine granular; very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

2C1—8 to 13 inches; black (N 2/0) silt, gray (N 6/0) dry; moderate thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; neutral; clear smooth boundary.

2C2—13 to 26 inches; very dark grayish brown (2.5Y 3/2) silt loam, light gray (2.5Y 7/1) dry; many medium faint very dark gray (2.5Y 2/2) mottles; moderate medium subangular blocky structure and moderate very fine granular; slightly hard, firm, sticky and plastic; common very fine and fine roots; many very fine and fine tubular pores; water table at a depth of 20 inches; neutral; gradual smooth boundary.

2C3—26 to 60 inches; very dark grayish brown (2.5Y 3/2) silt loam, light gray (2.5Y 7/1) dry; many medium faint very dark brown (2.5Y 2/2) mottles; moderate medium subangular blocky structure and moderate very fine granular; slightly hard, firm, sticky and plastic; few very fine roots; many very fine tubular pores; mildly alkaline.

Depth to bedrock is 60 inches or more. These soils are subject to rare flooding and have a high water table throughout the year. The histic epipedon is 8 to 14 inches thick. Rubbed fiber content is less than 10 percent. The particle-size control section averages 18 to 30 percent clay and less than 15 percent material that is coarser than very fine sand. The profile is slightly acid to mildly alkaline.

The Oa or A horizon, where present, has value of 4 or 5 when dry and chroma of 0 or 1 when moist or dry. It is muck or silty clay loam.

The 2C horizon has hue of 10YR or neutral, value of 2 to 4 when moist and 6 or 7 when dry, and chroma of 0 to 2 when moist or dry. It is silt loam or silty clay loam with strata of silt and is 10 to 30 percent clay. Layers of pumice and ash less than 2 inches thick are at a depth of 20 inches or more in some pedons.

Drained areas of these soils have a silty clay loam surface layer and are considered poorly drained. They are a taxadjunct to the Crump series because they do not have a histic epipedon.

Degarmo Series

The Degarmo series consists of very deep, poorly drained or somewhat poorly drained soils that formed in mixed alluvium. Degarmo soils are on flood plains of mountains and on tablelands. Slopes are 0 to 2 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is 45 degrees F.

Typical pedon of Degarmo silt loam in an area of Degarmo-Welch complex, 0 to 2 percent slopes, in an area of rangeland; about 500 feet northwest of Hart Mountain National Antelope Refuge Headquarters, on Rock Creek; about 1,550 feet north and 500 feet east of the southwest corner of sec. 10, T. 35 S., R. 26 E.

A1—0 to 4 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak thin platy structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; many very fine tubular pores; neutral; clear smooth boundary.

A2—4 to 11 inches; black (N 2/0) silt loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine and fine tubular pores; neutral; clear smooth boundary.

Bw1—11 to 17 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine angular blocky structure; hard, friable, sticky and plastic; many very fine roots; many very fine tubular pores; 5 percent gravel; neutral; clear smooth boundary.

Bw2—17 to 28 inches; very dark gray (2.5Y 3/1) silty clay loam, grayish brown (2.5Y 5/2) dry; many medium distinct black (N 2/0) and very dark grayish brown (2.5Y 3/2) mottles; moderate medium angular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; 10 percent gravel; moderately alkaline; gradual wavy boundary.

BC—28 to 35 inches; very dark gray (2.5Y 3/1) gravelly clay loam, gray (2.5Y 5/1) dry; weak medium subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; 15 percent gravel; moderately alkaline; gradual smooth boundary.

2C1—35 to 42 inches; very dark gray (2.5Y 3/1) cobbly loamy sand, gray (10YR 6/1) dry; massive; loose, nonsticky and nonplastic; few fine roots; many fine and medium irregular pores; 10 percent gravel and 20 percent cobbles; neutral; clear smooth boundary.

2C2—42 to 60 inches; dark brown (10YR 4/3) extremely gravelly loamy sand, pale brown (10YR 6/3) dry; massive; loose, nonsticky and nonplastic; few fine roots; many fine and medium irregular pores; 50 percent gravel and 10 percent cobbles; neutral.

These soils are subject to frequent flooding and have a high water table in spring and summer and early in fall. The solum and mollic epipedon are 24 to 35 inches thick. Depth to bedrock is more than 60 inches. The upper part of the particle-size control section averages 20 to 35 percent clay and is more than 15 percent material that is coarser than very fine sand. The lower part is 5 to 12 percent clay, more than 70 percent sand, and 15 to 70 percent coarse fragments.

The A horizon has value of 4 or 5 when dry, and it has chroma of 0 or 1 when moist or dry. The upper 4 to 10 inches is compacted in places. The horizon averages 18 to 27 percent clay and 0 to 5 percent gravel.

The Bw horizon has hue of 10YR or 2.5Y, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and 0 to 2 when dry. It is silty clay loam, clay loam, or loam and is 25 to 35 percent clay and 0 to 10 percent gravel.

The 2C horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 1 to 3 when moist or dry. It is stratified loamy sand or loamy fine sand and is 0 to 20 percent cobbles and 5 to 60 percent gravel.

Deppy Series

The Deppy series consists of soils that are shallow to a hardpan and are well drained. These soils formed in old alluvium. Deppy soils are on alluvial fans and lake basin terraces. Slopes are 5 to 50 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Deppy very cobbly loam in an area of Deppy-Tumtum complex, 5 to 15 percent slopes, in an area of rangeland; about 0.5 mile south of Black Slough Canyon; in the SW1/4SW1/4 of sec. 2, T. 36 S., R. 28 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) very cobbly loam, light brownish gray (10YR 6/2) dry; moderate thick platy structure parting to weak medium platy; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many fine and common medium vesicular pores; 20 percent stones and 30 percent cobbles; moderately alkaline; abrupt smooth boundary.

Bt—4 to 8 inches; dark grayish brown (10YR 4/2) clay loam, light brownish gray (10YR 6/2) dry; moderate fine angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common fine tubular pores; few faint clay films on faces of peds; 10 percent gravel; moderately alkaline; clear smooth boundary.

Bkq—8 to 11 inches; brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; strong fine subangular blocky structure; hard, firm and brittle, nonsticky and nonplastic; common fine roots; common fine tubular pores; 2 percent cobbles and 10 percent gravel; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Bkqm—11 to 24 inches; strongly cemented, fractured hardpan; strongly effervescent; abrupt wavy boundary.

2Ck—24 to 60 inches; dark yellowish brown (10YR 3/6) gravelly sandy loam, light yellowish brown (10YR 6/4) dry; massive; soft, very friable, nonsticky and nonplastic; common fine roots; many very fine irregular pores; violently effervescent; disseminated lime; 30 percent gravel; moderately alkaline.

The particle-size control section averages 0 to 15 percent rock fragments, mainly gravel, and 27 to 35 percent clay. Depth to the strongly cemented hardpan is 10 to 20 inches.

The A horizon has chroma of 2 or 3 when moist or dry. It is very cobbly loam or extremely stony loam.

The Bt horizon has chroma of 2 to 4 when moist and 2 or 3 when dry. It is 4 to 11 inches thick.

The 2C horizon is gravelly sandy loam or very gravelly sandy loam.

Derapter Series

The Derapter series consists of deep, well drained soils that formed in residuum and colluvium derived from basalt and tuff. Derapter soils are on mountains. Slopes are 30 to 70 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Derapter very stony sandy loam in an area of Derapter-Rock outcrop complex, 30 to 70 percent south slopes, in an area of rangeland; about 0.5 mile north of Highway 140, along Sweeny Canyon Road, above Rodgers Ranch; in the SW1/4SW1/4 of sec. 13, T. 39 S., R. 23 E.

A1—0 to 3 inches; dark brown (10YR 3/3) very stony sandy loam, brown (10YR 5/3) dry; weak fine granular structure; loose, nonsticky and nonplastic; common very fine and medium roots and many fine roots; few very fine irregular pores; 20 percent stones, 10 percent cobbles, and 10 percent gravel; neutral; clear smooth boundary.

A2—3 to 12 inches; dark brown (10YR 3/3) very stony sandy loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots and few coarse roots; many very fine and common fine irregular and tubular pores; 20 percent stones, 10 percent cobbles, and 10 percent gravel; neutral; clear wavy boundary.

Bt1—12 to 17 inches; brown (10YR 4/3) very stony sandy clay loam, pale brown (10YR 6/3) dry; moderate coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and coarse roots and common fine and medium roots; few very fine irregular and tubular pores and common fine and medium irregular and tubular pores; many distinct clay films on faces of peds; 20 percent stones, 10 percent cobbles, and 10 percent gravel; mildly alkaline; clear wavy boundary.

Bt2—17 to 23 inches; dark yellowish brown (10YR 4/6) very stony sandy clay loam, brownish yellow (10YR 6/6) dry; moderate coarse subangular blocky structure; hard, friable, sticky and plastic; few very fine roots and common fine and medium roots; few very fine irregular and tubular pores and common fine and medium irregular and tubular pores; common distinct clay films on faces of peds; 20 percent stones, 10 percent cobbles, and 10 percent gravel; moderately alkaline; gradual wavy boundary.

Btk—23 to 31 inches; yellowish brown (10YR 5/6) very stony sandy clay loam, yellow (10YR 7/6) dry; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and medium roots and many fine roots; few very fine and medium irregular and tubular pores and common fine irregular and tubular pores; common faint clay films on faces of peds; slightly effervescent; few medium rounded soft masses of segregated lime; 20 percent stones, 10 percent cobbles, and 10 percent gravel; moderately alkaline; gradual wavy boundary.

Bk—31 to 51 inches; dark yellowish brown (10YR 4/6) very gravelly sandy loam, yellow (10YR 7/6) dry; massive; soft, very friable, slightly sticky and slightly plastic; few fine and medium roots; many very fine and common fine irregular and tubular pores; strongly effervescent; common medium rounded soft masses of segregated lime; 10 percent stones, 10 percent cobbles, and 30 percent gravel; moderately alkaline; clear smooth boundary.

R—51 inches; fractured basalt.

The particle-size control section is 35 to 60 percent rock fragments, mainly cobbles and stones, and 25 to 35 percent clay. Depth to bedrock is 40 to 60 inches. Depth to secondary carbonates is 20 to 40 inches. The mollic epipedon is 10 to 15 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 10 to 25 percent gravel and 10 to 35 percent cobbles and stones.

The Bt and Btk horizons have value of 3 to 5 when moist and 6 or 7 when dry, and they have chroma of 3 to 6 when moist or dry. They are clay loam or sandy clay loam and are 5 to 20 percent gravel and 15 to 40 percent cobbles and stones. These horizons are neutral to moderately alkaline, increasing in alkalinity with increasing depth.

The Bk horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 4 to 6 when moist or dry. It is loam or sandy loam and is 20 to 50 percent gravel and 0 to 25 percent cobbles and stones. The horizon is mildly alkaline or moderately alkaline.

Deseed Series

The Deseed series consists of moderately deep, well drained soils that formed in colluvium over residuum derived from tuff and basalt. Deseed soils are on tablelands and hills. Slopes are 2 to 50 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Deseed silt loam in an area of Deseed-Freznik complex, 2 to 15 percent slopes, in an area of rangeland; about 2,000 feet east of Jack Creek Trail and 1.25 miles west of Guano Lake; in the NE1/4SW1/4 of sec. 28, T. 39 S., R. 27 E.

A—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; moderate thick platy structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many fine and common medium irregular and vesicular pores; neutral; gradual smooth boundary.

Bt1—3 to 9 inches; brown (10YR 4/3) silty clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and medium roots; many fine irregular and tubular pores; common faint clay films on faces of peds; mildly alkaline; clear smooth boundary.

2Bt2—9 to 19 inches; dark yellowish brown (10YR 4/4) clay, yellowish brown (10YR 5/4) dry; moderate coarse prismatic structure and moderate medium angular blocky structure parting to moderate fine angular blocky; hard, firm, sticky and plastic; few fine roots; common fine irregular and tubular pores; common prominent clay films on faces of peds and lining pores; 5 percent cobbles and 5 percent gravel; mildly alkaline; clear smooth boundary.

2BCt—19 to 25 inches; yellowish brown (10YR 5/4) clay loam, very pale brown (10YR 7/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine irregular and tubular pores; common distinct clay films on faces of peds; 5 percent gravel; mildly alkaline; clear irregular boundary.

2C—25 to 28 inches; very pale brown (10YR 7/3) cobbly loam, white (10YR 8/2) dry; massive; slightly hard, friable, slightly sticky and nonplastic; few fine roots; common fine irregular and tubular pores; 15 percent cobbles and 5 percent gravel; moderately alkaline; clear irregular boundary.

2R—28 inches; fractured tuff.

Thickness of the solum is 20 to 30 inches, and depth to bedrock is 20 to 40 inches.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry. It is silt loam or very cobbly loam.

The Bt1 horizon is clay loam or silty clay loam. It is neutral or mildly alkaline.

The 2Bt and 2BCt horizons have hue of 10YR or 7.5YR, value of 4 or 5 when moist and 5 to 7 when dry, and chroma of 4 to 6 when moist or dry. They are clay, clay loam, or gravelly clay and are 35 to 50 percent clay and 5 to 20 percent rock fragments. These horizons are neutral or mildly alkaline.

The 2C horizon has value of 5 to 7 when moist and 6 to 8 when dry, and it has chroma of 2 or 3 when moist or dry. It is cobbly loam or gravelly loam. The horizon is mildly alkaline or moderately alkaline.

Deter Series

The Deter series consists of very deep, well drained soils that formed in alluvium and lacustrine sediment derived from tuff, basalt, and diatomite. Deter soils are on terraces. Slopes are 0 to 15 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Deter loam, 5 to 15 percent slopes, in an area of rangeland; on the west side of Goose Lake Valley; about 2,200 feet east and 150 feet south of the northwest corner of sec. 15, T. 38 S., R. 20 E.

A1—0 to 2 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; weak thin platy structure and weak very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine tubular pores; slightly acid; clear smooth boundary.

A2—2 to 7 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; weak medium platy structure parting to weak very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; common fine roots; many fine and medium tubular pores; slightly acid; clear smooth boundary.

Bt1—7 to 19 inches; dark brown (7.5YR 3/2) clay loam, brown (7.5YR 4/2) dry; weak medium platy structure parting to weak very fine and fine granular; hard, friable, sticky and plastic; common very fine and fine roots; common fine and medium tubular pores; few distinct clay films; neutral; gradual smooth boundary.

Bt2—19 to 34 inches; dark reddish brown (5YR 3/3) clay, reddish gray (5YR 5/2) dry; moderate medium prismatic structure parting to strong fine blocky; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few fine tubular pores; many prominent clay films; neutral; gradual smooth boundary.

Bt3—34 to 46 inches; reddish brown (5YR 4/4) gravelly clay, reddish brown (5YR 5/4) dry; strong fine blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common distinct clay films; 30 percent gravel; neutral; gradual smooth boundary.

C—46 to 60 inches; dark brown (7.5YR 4/4) gravelly clay loam, light brown (7.5YR 6/4) dry; massive; very hard, very firm, very sticky and very plastic; few very fine roots; 25 percent gravel; neutral.

The mollic epipedon is 20 to 40 inches thick. Depth to bedrock is more than 60 inches.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 1 or 2 when moist or dry. It is slightly acid or neutral.

The Bt horizon has hue of 5YR to 10YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist or dry. It is clay loam, clay, or gravelly clay and averages 35 to 45 percent clay. The horizon is neutral to moderately alkaline.

The C horizon has color similar to that of the Bt horizon. It is clay loam or gravelly clay and is 27 to 40 percent clay. It is neutral to moderately alkaline.

Devada Series

The Devada series consists of shallow, well drained soils that formed in residuum derived from tuff and basalt. Devada soils are on tablelands. Slopes are 2 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Devada very cobbly loam in an area of Devada-Deseed complex, 2 to 15 percent slopes, in an area of rangeland; about 100 feet north of the Oregon-Nevada state line, west of Guano Valley; in the SE1/4SW1/4SW1/4NE1/4 of sec. 9, T. 35 S., R. 26 E.

A—0 to 3 inches; dark grayish brown (10YR 4/2) very cobbly loam, light brownish gray (10YR 6/2) dry; weak thin platy structure parting to weak very fine granular; slightly hard, friable, slightly sticky and nonplastic; many very fine and fine roots; many very fine and fine discontinuous vesicular pores; 5 percent stones, 20 percent cobbles, and 20 percent gravel; neutral; abrupt smooth boundary.

2Bt1—3 to 7 inches; dark brown (10YR 3/3) gravelly clay, brown (10YR 5/3) dry, moderate medium and fine subangular blocky structure; slightly hard, firm, very sticky and very plastic; common very fine and fine roots, few medium and fine tubular pores; many distinct clay films on faces of peds; 2 percent cobbles and 15 percent gravel; neutral; abrupt wavy boundary.

2Bt2—7 to 18 inches; dark brown (7.5YR 4/4) clay, brown (7.5YR 5/4) dry; moderate medium and coarse angular blocky structure; hard, firm, very sticky and very plastic; common very fine and fine roots; few fine tubular pores; many distinct clay films on faces of peds; 10 percent gravel; neutral; abrupt irregular boundary.

2R—18 inches; basalt; coatings of silica and calcium carbonates in fractures.

Thickness of the solum and depth to bedrock are 12 to 20 inches. Content of rock fragments is 0 to 30 percent. The mollic epipedon is 7 to 15 inches thick and includes all or part of the argillic horizon.

The A horizon has value of 2 or 3 when moist and 4 to 6 when dry, and it has chroma of 2 or 3 when moist or dry. Where the upper 7 inches is mixed, value is than 5.5 when dry.

The Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist or dry. It is clay, gravelly clay, or clay loam and averages of 40 to 60 percent clay.

The 2R horizon is fractured, and it has free carbonates or opal on the lower side of rock fragments in some pedons.

Devoy Series

The Devoy series consists of moderately deep, well drained soils that formed in colluvium over residuum derived from basalt and tuff. Devoy soils are on tablelands. Slopes are 2 to 15 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 42 degrees F.

Typical pedon of Devoy cobbly loam in an area of Devoy-Blizzard complex, 2 to 15 percent slopes, in an area of rangeland; about 1.5 miles south of Barry Cabin and 500 feet east of jeep trail in the NW1/4SE1/4 of sec. 13, T. 41 S., R. 25 E.

A1—0 to 4 inches; dark brown (10YR 3/3) cobbly loam, brown (10YR 4/3) dry; moderate medium platy structure; slightly hard, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine vesicular pores; 25 percent cobbles and 5 percent gravel; neutral; gradual smooth boundary.

A2—4 to 10 inches; dark brown (10YR 3/3) cobbly loam, brown (10YR 4/3) dry; moderate medium platy structure; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; few very fine tubular pores; 20 percent cobbles and 5 percent gravel; neutral; clear smooth boundary.

Bt1—10 to 17 inches; dark brown (7.5YR 3/4) very cobbly clay loam, brown (7.5YR 4/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and slightly plastic; few very fine roots; few very fine tubular pores; common distinct clay films on faces of peds; 20 percent cobbles and 15 percent gravel; mildly alkaline; clear smooth boundary.

Bt2—17 to 30 inches; dark brown (7.5YR 3/4) very cobbly clay, brown (7.5YR 4/4) dry; moderate medium angular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; common prominent clay films on faces of peds; 30 percent cobbles and 20 percent gravel; mildly alkaline; abrupt smooth boundary.

R—30 inches; fractured basalt.

Thickness of the solum and depth to bedrock are 20 to 40 inches. The particle-size control section averages more than 35 percent clay.

The A horizon has value of 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 10 to 17 inches thick.

The Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 3 or 4 when moist or dry. It is clay loam or clay and is 30 to 60 percent clay and 35 to 50 percent rock fragments. The horizon is neutral or mildly alkaline.

Diaz Series

The Diaz series consists of moderately deep, well drained soils that formed in colluvium over residuum derived from tuff and basalt. Diaz soils are on tablelands. Slopes are 2 to 15 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Diaz very cobbly loam, 2 to 15 percent slopes, in an area of rangeland; about 0.25 mile east of trail in the SW1/4SE1/4 of sec. 10, T. 39 S., R. 25 E.

A—0 to 5 inches; dark brown (10YR 3/3) very cobbly loam, light brownish gray (10YR 6/2) dry; moderate medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine and fine vesicular pores; 5 percent stones, 25 percent cobbles, and 5 percent gravel; mildly alkaline; abrupt smooth boundary.

BA—5 to 9 inches; brown (10YR 4/3) loam, pale brown (10YR 6/2) dry; moderate medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine and fine irregular and tubular pores; 5 percent cobbles and 5 percent gravel; mildly alkaline; clear smooth boundary.

Bt1—9 to 14 inches; brown (10YR 4/3) clay loam, yellowish brown (10YR 5/4) dry; strong fine angular blocky structure; hard, friable, sticky and plastic; common fine roots; common very fine and fine irregular and tubular pores; many prominent clay films on faces of peds; 5 percent cobbles and 5 percent gravel; mildly alkaline; clear smooth boundary.

Bt2—14 to 17 inches; dark yellowish brown (10YR 4/4) clay loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and plastic; few fine roots; few very fine and fine irregular and tubular pores; common faint clay films on faces of peds; 5 percent cobbles and 5 percent gravel; mildly alkaline; abrupt smooth boundary.

Bk—17 to 23 inches; yellowish brown (10YR 5/6) clay loam, very pale brown (10YR 7/3) dry; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine irregular and tubular pores; moderately alkaline; slightly effervescent; abrupt smooth boundary.

R—23 inches; basalt.

The particle-size control section averages 0 to 15 percent rock fragments, mainly cobbles and gravel, and 35 to 60 percent clay. The profile is mildly alkaline or moderately alkaline. Thickness of the solum and depth to bedrock are 20 to 40 inches.

The A horizon has value of 3 or 4 when moist, and it has chroma of 2 or 3 when moist. It is neutral or mildly alkaline.

The Bt horizon has chroma of 3 or 4 when moist or dry. It is mildly alkaline or moderately alkaline. The horizon is clay loam or clay.

Donica Series

The Donica series consists of very deep, somewhat excessively drained soils that formed in gravelly alluvium derived from tuff, andesite, and basalt. Donica soils are on alluvial fans. Slopes are 0 to 15 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 46 degrees F.

Typical pedon of Donica gravelly loam, 0 to 5 percent slopes, in an area of cropland west of New Pine Creek; about 2,054 feet east and 1,565 feet south of the northwest corner of sec. 24, T. 41 S., R. 20 E.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) gravelly loam, brown (10YR 4/3) dry; weak fine granular structure and weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; 30 percent gravel; neutral; clear wavy boundary.

A—6 to 15 inches; dark brown (7.5YR 3/3) very gravelly sandy loam, brown (7.5YR 4/3) dry; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common fine roots; 40 percent gravel and 5 percent cobbles; neutral; clear wavy boundary.

BA—15 to 24 inches; dark brown (7.5YR 4/2) very gravelly sandy loam, brown (7.5YR 4/4) dry; massive; slightly hard, very friable, slightly sticky and nonplastic; common fine roots; 45 percent gravel and 5 percent cobbles; neutral; clear wavy boundary.

Bw—24 to 34 inches; dark brown (7.5YR 3/3) very gravelly loam, brown (7.5YR 4/4) dry; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; 35 percent gravel and 5 percent cobbles; neutral; clear wavy boundary.

C—34 to 61 inches; dark brown (7.5YR 3/3) extremely gravelly sandy loam, brown (7.5YR 4/4) dry;

massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots in the upper part; 55 percent gravel and 10 percent cobbles; neutral.

The solum is 22 to 40 inches thick. The mollic epipedon is 10 to 20 inches thick. The particle-size control section, where mixed, is dominantly sandy loam and is 50 to 80 percent rock fragments, mainly gravel. The profile has hue of 10YR or 7.5YR.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 15 to 35 percent gravel.

The B horizon has value of 3 or 4 when moist and 4 to 6 when dry, and it has chroma of 2 or 3 when moist and 2 to 4 when dry. It is loam or sandy loam and is 35 to 60 percent rock fragments, mainly gravel.

The C horizon has value of 3 to 6 when moist and 4 to 8 when dry, and it has chroma of 0 to 4 when moist or dry.

The Donica soils in this survey area are a taxadjunct to the Donica series because they have a zeric soil moisture regime.

Drakesflat Series

The Drakesflat series consists of moderately deep, well drained soils that formed in colluvium and residuum derived from basalt and tuff. Drakesflat soils are on tablelands. Slopes are 2 to 30 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 46 degrees F.

Typical pedon of Drakesflat loam, 2 to 15 percent slopes, in an area of rangeland; in the NW$^1/_4$SW$^1/_4$NW$^1/_4$ of sec. 5, T. 37 S., R. 23 E.

A1—0 to 6 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; moderate fine and medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many fine and coarse roots; 5 percent gravel; mildly alkaline; clear smooth boundary.

A2—6 to 12 inches; very dark grayish brown (10YR 3/2) cobbly loam, dark brown (10YR 3/3) dry; strong fine and medium angular blocky structure; soft, friable, slightly sticky and nonplastic; common medium and coarse roots; 10 percent gravel and 10 percent cobbles; mildly alkaline; abrupt smooth boundary.

2Bt—12 to 23 inches; dark brown (10YR 3/3) clay loam, dark yellowish brown (10YR 3/4) dry; strong fine prismatic structure; hard, firm, sticky and slightly plastic; common fine and medium roots; 10 percent fine gravel; many distinct clay films on faces of peds; mildly alkaline; gradual wavy boundary.

2Bk—23 to 31 inches; dark brown (10YR 4/3) clay loam, brown (7.5YR 5/4) dry; massive; slightly hard, firm, slightly sticky and nonplastic; few fine roots; 5 percent fine gravel; slightly effervescent; lime is segregated in few irregular seams and filaments; moderately alkaline; abrupt irregular boundary.

3R—31 inches; tuff; coatings of silica and calcium carbonates in fractures.

Depth to bedrock is 20 to 40 inches. The mollic epipedon is 8 to 12 inches thick. Depth to soft powdery secondary lime is 15 to 30 inches. The particle-size control section is 35 to 45 percent clay.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 0 to 10 percent stones, 0 to 20 percent cobbles, and 5 to 20 percent gravel. It is neutral or mildly alkaline.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 3 to 5 when dry, and chroma of 3 or 4 when moist or dry. It is clay loam or clay and is 0 to 5 percent stones, 0 to 10 percent cobbles, and 5 to 15 percent gravel.

The 2Bk horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 3 to 5 when dry, and chroma of 3 or 4 when moist or dry. It is 0 to 5 percent stones, 0 to 15 percent cobbles, and 0 to 30 percent gravel, most of which is fine gravel. The horizon is clay loam, gravelly loam, or cobbly loam. It is slightly effervescent to strongly effervescent.

Drakespeak Series

The Drakespeak series consists of very deep, well drained soils that formed in colluvium and residuum derived from rhyolite. Drakespeak soils are on mountains. Slopes are 20 to 50 percent. The mean annual precipitation is about 32 inches, and the mean annual air temperature is about 42 degrees F.

Typical pedon of Drakespeak very gravelly coarse sandy loam, 20 to 50 percent south slopes, in an area of rangeland; in the NE$^1/_4$SE$^1/_4$ of sec. 6, T. 38 S., R. 22 E.

A1—0 to 6 inches; very dark brown (10YR 2/2) very gravelly coarse sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; 35 percent gravel; moderately acid; gradual wavy boundary.

A2—6 to 21 inches; very dark grayish brown (10YR 3/2) very gravelly coarse sandy loam, dark brown (10YR 4/3) dry, weak and moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many very fine irregular pores; 50 percent gravel; moderately acid; clear wavy boundary.

A3—21 to 26 inches; dark brown (10YR 3/3) very gravelly coarse sandy loam, yellowish brown (10YR 5/4) dry; weak fine and medium granular structure; soft, loose, nonsticky and nonplastic; common fine roots; many very fine and fine irregular pores; 45 percent gravel; moderately acid; clear wavy boundary.

Bw—26 to 37 inches; light olive brown (2.5Y 5/4) very gravelly coarse sandy loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots and few medium roots; 50 percent gravel; moderately acid; gradual wavy boundary.

C1—37 to 47 inches; dark yellowish brown (10YR 4/4) very gravelly coarse sandy loam, light yellowish brown (10YR 6/4) dry; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; 50 percent gravel; moderately acid; gradual wavy boundary.

C2—47 to 60 inches; dark brown (10YR 4/3) very gravelly coarse sandy loam, light yellowish brown (10YR 6/4) dry; massive; hard, friable, nonsticky and nonplastic; few fine roots; 5 percent cobbles and 50 percent gravel; neutral.

Depth to bedrock is more than 60 inches. The particle-size control section is 2 to 10 percent clay and averages 35 to 60 percent rock fragments, of which 0 to 10 percent is cobbles and stones and 35 to 60 percent is gravel. The umbric epipedon is 20 to 30 inches thick.

The A horizon has value and chroma of 2 or 3 when moist or dry. The horizon is moderately acid or slightly acid.

The Bw horizon has hue of 10YR or 2.5Y, value of 3 to 5 when moist and 5 to 7 when dry, and chroma of 3 or 4 when moist or dry. Total rock fragment content is 35 to 60 percent, of which 0 to 10 percent is cobbles and stones and 35 to 60 percent is gravel. The horizon is moderately acid or slightly acid.

The C horizon has value of 4 to 6 when moist or dry, and it has chroma of 3 or 4 when moist or dry. Total rock fragment content is 35 to 60 percent, of which 0 to 10 percent is cobbles and stones and 35 to 50 percent is gravel.

Drews Series

The Drews series consists of very deep, well drained soils that formed in alluvium and lacustrine sediment derived from rhyolite, tuff, and basalt. Drews soils are on lake terraces. Slopes are 0 to 30 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Drews loam, 0 to 5 percent slopes, in an area of rangeland; about 10 miles west of the town of Lakeview; about 1,400 feet north and 1,280 feet east of the southwest corner of sec. 18, T. 39 S., R. 19 E.

A—0 to 6 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; weak very thin platy structure parting to weak very fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; 5 percent gravel; slightly acid; gradual wavy boundary.

AB—6 to 11 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; 5 percent gravel; slightly acid; clear wavy boundary.

Bt1—11 to 16 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; few faint clay films on peds and in pores; 10 percent gravel; slightly acid; clear wavy boundary.

Bt2—16 to 27 inches; dark brown (10YR 3/3) gravelly clay loam, brown (10YR 5/3) dry; weak medium prismatic structure parting to moderate medium and fine angular blocky; hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; common distinct clay films on peds and common faint clay films in pores; 25 percent gravel; neutral; gradual smooth boundary.

BC—27 to 36 inches; dark brown (10YR 3/3) gravelly clay loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; 30 percent gravel; neutral; gradual smooth boundary.

C—36 to 60 inches; dark yellowish brown (10YR 3/4) very gravelly loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; 40 percent gravel; neutral.

Depth to bedrock is more than 60 inches. The solum is 30 to 50 inches thick. The mollic epipedon is 20 to 40 inches thick.

The A and AB horizons have value of 2 or 3 when moist and 3 or 4 when dry, and they have chroma of 1 or 2 when moist or dry. The horizons are loam or cobbly loam and are 5 to 35 percent rock fragments.

The Bt and BC horizons have hue of 10YR or 7.5YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 2 or 3 when moist or dry. They are 27 to 35 percent clay and 5 to 35 percent gravel.

The C horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. The horizon is 20 to 27 percent clay and 5 to 50 percent gravel. It is slightly acid or neutral.

Drewsgap Series

The Drewsgap series consists of soils that are moderately deep to a hardpan and are well drained. These soils formed in lacustrine deposits and alluvium. Drewsgap soils are on lake terraces. Slopes are 0 to 15 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Drewsgap loam, 0 to 5 percent slopes, in an area of cropland; on the west side of Goose Lake Valley; in the NE1/4NW1/4 of sec. 24, T. 39 S., R. 19 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine pores; slightly acid; abrupt smooth boundary.

A—8 to 14 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; few very fine tubular pores; slightly acid; clear smooth boundary.

Bt—14 to 30 inches; dark brown (10YR 3/3) sandy clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; few very fine tubular pores; common faint clay films on faces of peds and in pores; slightly acid; clear smooth boundary.

C—30 to 34 inches; dark grayish brown (2.5Y 4/2) sandy loam, grayish brown (10YR 5/2) dry; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine pores; slightly acid; abrupt smooth boundary.

2Cqm—34 to 49 inches; olive brown (2.5Y 4/3) duripan; massive; extremely hard, very firm; strongly cemented and indurated in upper part; mildly alkaline; gradual smooth boundary.

2C— 49 to 61 inches; strong brown (7.5YR 5/8) and dark brown (7.5YR 4/4) very gravelly loam, light brown (7.5YR 6/4) and pinkish white (7.5YR 8/2) dry; massive; 50 percent gravel and 5 percent cobbles; slightly acid.

The mollic epipedon is 10 to 20 inches thick. Depth to the hardpan is 20 to 40 inches, and depth to bedrock is more than 60 inches.

The Ap and A horizons have hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 1 or 2 when moist or dry. They are 0 to 20 percent gravel.

The Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist, and chroma of 2 to 4 when moist or dry. It is sandy clay loam or clay loam and is 25 to 35 percent clay and 0 to 25 percent gravel.

The upper part of the 2Cqm horizon is indurated with 1- to 2-millimeter-thick laminar bands or is strongly cemented and indurated. The lower part is weakly cemented in some pedons and is as much as 25 percent gravel.

The 2C horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 4 or 5 when dry and 6 to 8 when moist, and chroma of 2 to 8 when moist or dry. It is very gravelly loam or very gravelly sandy loam and is 25 to 55 percent gravel and 0 to 10 percent cobbles.

Eglirim Series

The Eglirim series consists of very deep, well drained soils that formed in colluvium derived from basalt and tuff. Eglirim soils are on fans. Slopes are 2 to 50 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Eglirim very stony loam, 2 to 30 percent slopes, in an area of rangeland; in the SW1/4SE1/4SE1/4 of sec. 35, T. 29 S., R. 16 E.

A1—0 to 4 inches; very dark brown (10YR 2/2) very stony loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; 5 percent boulders, 30 percent stones, 5 percent cobbles, and 5 percent gravel; moderately alkaline; clear wavy boundary.

A2—4 to 16 inches; very dark brown (10YR 2/2) very stony loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; 5 percent boulders, 10 percent stones, 10 percent cobbles, and 10 percent gravel; moderately alkaline; clear irregular boundary.

2Bt1—16 to 29 inches; dark yellowish brown (10YR 3/4) extremely stony clay, dark yellowish brown (10YR 4/4) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few fine tubular pores; many faint clay films on faces of peds and in pores; 5 percent boulders, 40 percent stones, 15 percent cobbles, and 25 percent gravel; moderately alkaline; gradual wavy boundary.

2Bt2—29 to 37 inches; dark yellowish brown (10YR 3/4) extremely stony clay, dark yellowish brown (10YR 4/4) dry; moderate fine subangular blocky structure; hard, firm, sticky and slightly plastic; few fine roots; few fine tubular pores; many faint clay films on faces of peds and in pores; 5 percent boulders, 40 percent stones, 15 percent cobbles, and 25 percent gravel; moderately alkaline; gradual wavy boundary.

3C—37 to 60 inches; dark yellowish brown (10YR 3/4) extremely stony loam, yellowish brown (10YR 5/4) dry; massive; soft, very friable, slightly sticky and nonplastic; few fine roots; few fine tubular pores; 5 percent boulders, 45 percent stones, 15 percent cobbles, and 25 percent gravel; moderately alkaline.

Depth to bedrock is more than 60 inches. The solum is 20 to 40 inches thick. The mollic epipedon is 10 to 20 inches thick. The particle-size control section averages 35 to 50 percent clay and is 50 to 90 percent rock fragments.

The A horizon is 5 to 15 percent gravel, 5 to 15 percent cobbles, and 15 to 40 percent stones.

The 2Bt horizon has value of 4 or 5 when dry. It is very stony clay, extremely stony clay, or extremely stony clay loam. It is 30 to 50 percent clay and 50 to 90 percent rock fragments. The horizon is 15 to 35 percent gravel, 10 to 30 percent cobbles, and 25 to 50 percent stones and boulders.

The 3C horizon has value of 5 or 6 when dry. It is 15 to 27 percent clay and 60 to 90 percent rock fragments. Size and content of rock fragments are similar to those of the 2Bt horizon.

Erakatak Series

The Erakatak series consists of moderately deep, well drained soils that formed in colluvium and residuum derived from igneous rock. Erakatak soils are on hills and tablelands. Slopes are 2 to 30 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 43 degrees F.

Typical pedon of Erakatak cobbly loam in an area of Erakatak-Carryback complex, 15 to 30 percent slopes, in an area of rangeland; on Greaser Ridge; about 1.5 miles north of Blizzard Gap; 0.5 mile west of jeep trail in the SE1/4NE1/4 of sec. 9, T. 40 S., R. 26 E.

A—0 to 8 inches; dark brown (10YR 3/3) cobbly loam, brown (10YR 5/3) dry; weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots, common medium roots, and few coarse roots; many very fine and fine irregular and tubular pores and common medium and coarse irregular and tubular pores; 15 percent cobbles and 15 percent gravel; neutral; clear smooth boundary.

Bt1—8 to 18 inches; dark brown (10YR 3/3) very cobbly clay loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine roots and common fine, medium, and coarse roots; many very fine and fine irregular and tubular pores and common medium and coarse irregular and tubular pores; common faint clay films on faces of peds; 20 percent cobbles and 30 percent gravel; mildly alkaline; clear smooth boundary.

Bt2—18 to 30 inches; dark yellowish brown (10YR 4/4) very cobbly clay, brownish yellow (10YR 6/6) dry; weak medium subangular blocky structure; slightly hard, firm, sticky and plastic; common very fine roots, many fine and medium roots, and few coarse roots; few very fine and coarse irregular and tubular pores and common fine and medium irregular and tubular pores; few faint clay films on faces of peds; 35 percent cobbles and 20 percent gravel; mildly alkaline; abrupt irregular boundary.

R—30 inches; basalt.

The mollic epipedon is 7 to 18 inches thick. Thickness of the solum and depth to bedrock are 20 to 40 inches.

The A horizon has value of 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The Bt horizon is very cobbly clay loam and very cobbly clay. It has value of 3 or 4 when moist and 4 to 6 when dry, and it has chroma of 3 to 6 when moist or dry. The darker colors are in the upper part. The horizon is neutral or mildly alkaline.

Felcher Series

The Felcher series consists of moderately deep, well drained soils that formed in colluvium derived from basalt and tuff. Felcher soils are on mountains. Slopes are 5 to 70 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Felcher very stony clay loam in an area of Felcher-Rock outcrop, 30 to 70 percent south slopes, in an area of rangeland; about 0.5 mile west of Robinson Lake; in the SW1/4SW1/4 of sec. 14, T. 38 S., R. 25 E.

A—0 to 4 inches; brown (10YR 4/3) very stony clay loam, pale brown (10YR 6/3) dry; weak medium platy structure; soft, very friable, slightly sticky and nonplastic; few very fine roots; few very fine vesicular pores; 20 percent stones, 25 percent cobbles, and 10 percent gravel; mildly alkaline; gradual smooth boundary.

Bw—4 to 24 inches; dark grayish brown (10YR 4/2) very cobbly loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; few fine roots; few fine vesicular pores; 25 percent cobbles and 15 percent gravel; mildly alkaline; clear smooth boundary.

R—24 inches; basalt

The particle-size control section averages 35 to 55 percent rock fragments, mainly cobbles and gravel, and 20 to 35 percent clay. Thickness of the solum and depth to bedrock are 20 to 40 inches. The profile is neutral or mildly alkaline.

The A horizon is 3 to 10 inches thick. It has value of 3 to 4 when moist. It is very stony clay loam or very cobbly clay loam.

The Bw horizon is 10 to 25 inches thick. It has value of 3 or 4 when moist, and it has chroma of 2 to 4 when moist and 3 or 4 when dry. It is very cobbly clay loam, very gravelly clay loam, or very cobbly loam.

Fertaline Series

The Fertaline series consists of soils that are moderately deep to a hardpan and are well drained. These soils formed in colluvium and residuum derived from basalt and tuff. Fertaline soils are on tablelands. Slopes are 2 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Fertaline gravelly loam, 2 to 15 percent slopes, in an area of rangeland; in the SW1/4SE1/4NE1/4 of sec. 15, T. 37 S., R. 23 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine and medium roots; many very fine and fine vesicular pores; 20 percent gravel; neutral; clear smooth boundary.

A2—4 to 11 inches; very dark grayish brown (10YR 3/2) gravelly loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many medium and coarse roots; many very fine irregular pores; 30 percent gravel; neutral; abrupt smooth boundary.

2Bt—11 to 16 inches; dark yellowish brown (10YR 4/4) gravelly clay, dark yellowish brown (10YR 4/4) dry; strong fine prismatic structure; hard, very firm, sticky and plastic; few fine and medium roots; many very fine irregular pores; common distinct clay films on peds and in pores; 20 percent gravel; neutral; clear smooth boundary.

2Btk—16 to 21 inches; dark yellowish brown (10YR 4/4) gravelly clay loam, dark yellowish brown (10YR 4/6) dry; massive; slightly hard, firm, slightly sticky and nonplastic; few very fine roots; 30 percent gravel; slightly effervescent; mildly alkaline; gradual wavy boundary.

2Bkqm—21 inches; indurated extremely gravelly hardpan; strongly effervescent.

Depth to the indurated hardpan is 20 to 30 inches, and depth to bedrock is more than 60 inches. The particle-size control section is 40 to 60 percent clay and 0 to 30 percent rock fragments, mainly gravel.

The A horizon has value 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry. Where mixed, the upper 7 inches has value of more than 5.5 when dry. The horizon is neutral or mildly alkaline.

The 2B horizon has value of 4 or 5 when moist and 4 to 6 when dry, and it has chroma of 3 to 5 when moist or dry. The upper part is clay or gravelly clay and is 40 to 60 percent clay. It is neutral or mildly alkaline. The lower part is clay, clay loam, or gravelly clay loam and is 35 to 50 percent clay. It is mildly alkaline or moderately alkaline.

Fitzwater Series

The Fitzwater series consists of very deep, well drained soils that formed in colluvium and residuum derived from basalt and tuff. Fitzwater soils are on mountains. Slopes are 0 to 70 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is 46 degrees F.

Typical pedon of Fitzwater loam, 0 to 5 percent slopes, in an area of rangeland; in Hart Mountain National Antelope Refuge; in the SW1/4SW1/4NE1/4 of sec. 21, T. 35 S., R. 26 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak thin platy structure parting to moderate very fine granular; soft, very friable, slightly sticky and nonplastic; many very fine and fine roots; 5 percent gravel; neutral; clear smooth boundary.

A2—4 to 10 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium and fine subangular blocky structure; soft, friable, slightly sticky and nonplastic; many very fine and fine roots; 10 percent gravel; neutral; clear smooth boundary.

2Bw—10 to 19 inches; dark brown (10YR 4/3) extremely cobbly clay loam, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, firm, sticky and plastic; common fine roots; 5 percent stones, 45 percent cobbles, and 25 percent gravel; neutral; diffuse irregular boundary.

2C—19 to 60 inches; dark brown (10YR 4/3) extremely cobbly loam, pale brown (10YR 6/3) dry; massive; slightly hard, firm, slightly sticky and slightly plastic; few fine roots; 20 percent stones, 45 percent cobbles, and 25 percent gravel; neutral.

The particle-size control section is 60 to 90 percent rock fragments, 18 to 25 percent clay, and 30 to 50 percent sand. Depth to bedrock is more than 60 inches. The mollic epipedon is 7 to 12 inches thick. The solum is 10 to 30 inches thick.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry. It is 0 to 40 percent stones, 0 to 30 percent cobbles, and 5 to 30 percent gravel. It is loam or extremely stony loam. Areas that are loam and are less than 15 percent rock fragments typically have slopes of 5 percent or less.

The 2Bw horizon has hue of 7.5YR or 10YR, and it has value of 3 or 4 when moist and 5 or 6 when dry. It is loam or clay loam and is 18 to 30 percent clay, 5 to 10 percent stones, 30 to 50 percent cobbles, and 20 to 30 percent gravel.

The 2C horizon has hue of 7.5YR or 10YR, value of 5 or 6 when dry, and chroma of 3 or 4 when dry. It is 10 to 40 percent stones, 30 to 50 percent cobbles, and 15 to 30 percent gravel.

Floke Series

The Floke series consists of soils that are shallow to a hardpan and are well drained. These soils formed in colluvium derived from basalt and tuff. Floke soils are on tablelands. Slopes are 2 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Floke very stony loam in an area of Floke complex, 2 to 15 percent slopes, in an area of rangeland; in the NW1/4NW1/4SE1/4 of sec. 36, T. 36 S., R. 26 E.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) very stony loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; slightly hard, friable, slightly sticky and nonplastic; many very fine roots; many very fine and fine vesicular pores; 20 percent stones, 10 percent cobbles, and 10 percent gravel; moderately alkaline; abrupt smooth boundary.

A2—3 to 8 inches; dark grayish brown (10YR 4/2) very stony loam, light brownish gray (10YR 6/2) dry; moderate thin platy structure parting to moderate fine angular blocky; hard, firm, sticky and slightly plastic; many very fine roots; many very fine vesicular pores; 20 percent stones, 5 percent cobbles, and 20 percent gravel; moderately alkaline; abrupt smooth boundary.

2Bt—8 to 12 inches; brown (10YR 4/3) clay, brown (10YR 5/3) dry; strong fine prismatic structure; very hard, very firm, very sticky and very plastic; few very fine roots; many very fine irregular pores; common distinct clay films on peds and in pores; 10 percent gravel; moderately alkaline; gradual smooth boundary.

2Bk—12 to 15 inches; brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; massive; hard, firm, sticky and plastic; few very fine roots; 10 percent gravel; slightly effervescent; carbonates are disseminated; moderately alkaline; abrupt smooth boundary.

3Bkqm—15 to 20 inches; indurated hardpan; abrupt wavy boundary.

4R—20 inches; basalt.

Depth to bedrock is 20 to 30 inches. Depth to the indurated hardpan is 14 to 20 inches. There is an absolute clay increase of 15 to 30 percent between the A and 2Bt horizons.

The A horizon has value of 5 or 6 when dry and 3 or 4 when moist, and it has chroma of 2 or 3 when moist. It is extremely stony loam or very stony loam and is 15 to 35 percent stones, 5 to 20 percent cobbles, and 5 to 30 percent gravel. The horizon is mildly alkaline or moderately alkaline. It is 2 to 10 inches thick.

The 2Bt horizon has value of 3 or 4 when moist, and it has chroma of 3 or 4 when moist or dry. It is 0 to 10 percent cobbles and 5 to 15 percent gravel.

The 2Bk horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 3 when moist and 2 or 3 when dry. It is clay loam or silty clay loam and is 30 to 40 percent clay. It is 0 to 10 percent cobbles and 5 to 15 percent gravel. The horizon is slightly effervescent to strongly effervescent. Carbonates are segregated in filaments or are disseminated.

The 3Bkqm horizon is cemented fragments of basalt and tuff ranging in size from stones to gravel. The laminar cap is 1 millimeter to 1 centimeter thick or more. The horizon is 4 to 15 inches thick.

Fluvaquents

Fluvaquents consist of very deep, poorly drained or somewhat poorly drained soils that formed in unconsolidated alluvium along the shoreline of Goose Lake. Slopes are 0 to 2 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 49 degrees F.

Reference pedon of Fluvaquents, 0 to 2 percent slopes; about 2 miles northwest of New Pine Creek; in the NE1/4SW1/4 of sec. 14, T. 41 S., R. 20 E.

A—0 to 2 inches; very dark grayish brown (10YR 4/2) silty clay loam, light gray (10YR 7/2) dry; weak very fine granular structure; hard, firm, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; neutral; clear wavy boundary.

AC—2 to 6 inches; dark brown (10YR 4/2) silt loam, brown (10YR 5/2) dry; many fine faint strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to strong medium subangular blocky; hard, firm, slightly sticky and slightly plastic; common medium roots and few fine roots; 5 percent gravel and 1 percent cobbles; neutral; gradual smooth boundary.

C1—6 to 11 inches; dark brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; few fine prominent red (2.5YR 4/6) mottles; weak medium and fine subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common medium roots and few fine roots; 1 percent cobbles; neutral; clear smooth boundary.

C2—11 to 20 inches; dark brown (10YR 4/2) silt loam, brown (10YR 5/2) dry; few fine distinct dark red (2.5YR 3/6) and red (2.5YR 4/8) mottles; massive; hard, firm, slightly sticky and slightly plastic; common medium roots and few fine roots; 5 percent gravel; neutral; clear smooth boundary.

2C3—20 to 32 inches; pale brown (10YR 6/3) very cobbly clay loam, light gray (10YR 7/2) dry; few fine faint strong brown (7.5YR 5/8) mottles; massive; hard, firm, sticky and slightly plastic; common fine roots and few medium roots; 35 percent cobbles and 5 percent gravel; neutral; clear smooth boundary.

3C4—32 to 60 inches; dark brown (10YR 4/2) very gravelly coarse sand, light gray (10YR 7/1) dry; single grain; loose, nonsticky and nonplastic; few medium roots; 10 percent cobbles and 30 percent gravel; mildly alkaline.

A seasonal high water table is at the surface to a depth of 36 inches in November to May. The depth to the water table varies with the water level of the lake. These soils are flooded annually when the level of the lake rises as a result of stream runoff. The soils are highly stratified lacustrine sediment and have numerous layers of silty clay loam, clay, silt loam, clay loam, coarse sand, or sand. They are 0 to 50 percent gravel and 0 to 50 percent cobbles. Ice-formed mounds are along the shoreline in winter. The lower layers in areas adjacent to the lake have a high content of salt. These soils are dissected by numerous small, braided streams that flow into the lake. The soils are neutral to moderately alkaline.

Fordney Series

The Fordney series consists of very deep, excessively drained soils that formed in sandy lacustrine sediment. Fordney soils are on terraces. Slopes are 0 to 15 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Fordney gravelly loamy sand, 0 to 5 percent slopes, in a seeded area of crested wheatgrass; about 1 mile northwest of Valley Falls; in the SE1/4NW1/4SE1/4 of sec. 13, T. 33 S., R. 18 E.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly loamy sand, grayish brown (10YR 5/2) dry; single grain; loose, nonsticky and nonplastic; many very fine and fine roots; many very fine tubular pores; 10 percent fine gravel and 10 percent coarse gravel; mildly alkaline; clear smooth boundary.

C1—7 to 26 inches; dark brown (10YR 3/3) loamy sand, brown (10YR 5/3) dry; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine tubular pores; 10 percent gravel; mildly alkaline; clear smooth boundary.

C2—26 to 35 inches; dark brown (10YR 3/3) loamy sand, brown (10YR 5/3) dry; massive; hard, firm, nonsticky and nonplastic; few fine and medium roots; few weakly cemented nodules; many very fine and fine irregular pores; 10 percent gravel; neutral; gradual smooth boundary.

C3—35 to 46 inches; dark brown (10YR 3/3) loamy sand, brown (10YR 5/3) dry; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; many very fine and fine irregular pores; 10 percent gravel; neutral; abrupt wavy boundary.

2C4—46 to 60 inches; brown (10YR 4/3) sand, very pale brown (10YR 7/3) dry; massive; loose, nonsticky and nonplastic; many very fine and fine irregular pores; 10 percent gravel; moderately alkaline.

The organic matter content decreases to less than 1 percent at a depth of 10 to 20 inches. The dark color at a depth of more than 20 inches (mollic epipedon) is mainly because of the uncoated sand grains. Depth to bedrock is more than 60 inches. The profile is neutral to moderately alkaline.

The A horizon has value of 3 to 5 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The C horizon has value of 3 to 5 when moist and 4 to 7 when dry, and it has chroma 2 or 3 when moist or dry. The horizon is loamy fine sand, loamy sand, or coarse sand. It is 0 to 15 percent gravel, most of which is less than 5 millimeters in size.

Freznik Series

The Freznik series consists of moderately deep, well drained soils that formed in colluvium over residuum derived from tuff and basalt. Freznik soils are on tablelands. Slopes are 2 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Freznik very stony loam, thin surface, 2 to 15 percent slopes, in an area of rangeland; about 1.25 miles north of Little Reservoir; in the NW$^{1}/_{4}$NE$^{1}/_{4}$ of sec. 36, T. 39 S., R. 26 E.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) very stony loam, light brownish gray (10YR 6/2) dry; moderate thick platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots and many fine roots; many very fine and fine vesicular and irregular pores; 30 percent stones, 10 percent cobbles, and 5 percent gravel; moderately alkaline; abrupt smooth boundary.

2Bt1—3 to 8 inches; dark yellowish brown (10YR 4/4) clay, light yellowish brown (10YR 6/4) dry; strong medium prismatic and strong medium angular blocky structure parting to strong fine angular blocky; hard, firm, sticky and plastic; many very fine and fine roots; common fine tubular pores; many prominent clay films on faces of peds; moderately alkaline; clear smooth boundary.

2Bt2—8 to 20 inches; dark yellowish brown (10YR 4/4) clay, light yellowish brown (10YR 6/4) dry; strong medium prismatic and strong medium angular blocky structure parting to strong fine angular blocky; hard, firm, sticky and plastic; common very fine roots and many fine roots; common fine tubular pores; many prominent clay films on faces of peds; moderately alkaline; clear smooth boundary.

2Bt3—20 to 25 inches; dark yellowish brown (10YR 4/4) clay, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; common fine tubular pores; few faint clay films on faces of peds; moderately alkaline; abrupt wavy boundary.

2BCt—25 to 32 inches; yellowish brown (10YR 5/6) clay loam, yellow (10YR 7/6) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; few faint clay films in pores; 5 percent gravel; mildly alkaline; abrupt wavy boundary

2R—32 inches; slightly fractured basalt.

An absolute clay increase of 15 to 25 percent is between the A and 2Bt horizons. Thickness of the solum and depth to bedrock are 20 to 40 inches. The profile is mildly alkaline or moderately alkaline.

The A horizon is 2 to 7 inches thick. It has value of 5 or 6 when dry and chroma of 2 or 3 when moist and 1 to 3 when dry. It is 1 inch to 7 inches thick.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is 0 to 15 percent rock fragments, mainly gravel, and 40 to 60 percent clay.

Goose Lake Series

The Goose Lake series consists of very deep, poorly drained soils that formed in lacustrine sediment derived from tuff, rhyolite, and basalt. Goose Lake soils are on lake terraces. Slopes are 0 to 1 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 46 degrees F.

Typical pedon of Goose Lake silt loam, 0 to 1 percent slopes, in a meadow; about 7 miles south of Lakeview; about 400 feet east of the southwest corner of sec. 23, T. 40 S., R. 20 E.

A—0 to 6 inches; black (N 2/0) silt loam, dark gray (N 4/0) dry; moderate very thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; few very fine tubular pores; slightly acid; abrupt smooth boundary.

Eg—6 to 10 inches; very dark gray (N 3/0) silt loam, gray (N 6/0) dry; moderate very thin platy structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; few very fine tubular pores; slightly acid; abrupt smooth boundary.

Btg1—10 to 19 inches; very dark gray (10YR 3/1) silty clay, gray (10YR 5/1) dry; strong coarse prismatic structure; very hard, very firm, very sticky and very plastic; common very fine roots; few very fine tubular pores; black (10YR 2/1) coatings on prisms in the upper few inches; continuous stress cutans on prisms; neutral; clear smooth boundary.

Btg2—19 to 33 inches; very dark gray (N 3/0) silty clay, dark gray (2.5Y 4/1) dry; strong coarse prismatic structure; very hard, very firm, very sticky and very plastic; continuous stress cutans on prisms; neutral; clear smooth boundary.

Bkg—33 to 42 inches; very dark gray (2.5YR 3/1) silty clay, gray (N 5/0) dry; moderate coarse prismatic structure; very firm, very sticky and very plastic; common very fine roots; few very fine tubular pores; slightly effervescent; common mycelial lime; many stress cutans on prisms; mildly alkaline; clear wavy boundary.

BCkg—42 to 62 inches; dark gray (10YR 4/1) clay loam, light gray (10YR 7/1) dry; massive; very hard, firm, sticky and plastic; slightly effervescent; mildly alkaline.

These soils are subject to rare flooding and have a high water table late in winter and in spring and summer. Thickness of the solum is 30 to 60 inches. Depth to carbonates is 30 to 50 inches. Depth to bedrock is more than 60 inches.

The A horizon has hue of 10YR or neutral, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 0 to 2 when moist or dry. It is silt loam or silty clay loam. It is slightly acid to moderately alkaline.

The Eg horizon has hue of 10YR or neutral, value of 2 to 4 when moist, and chroma of 0 or 1 when moist or dry. It is slightly acid to moderately alkaline.

The Btg horizon has hue of 10YR, 2.5Y, or neutral, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 0 to 2 when moist or dry. It is silty clay loam or silty clay and is 35 to 50 percent clay. The horizon is neutral to moderately alkaline.

The BCkg horizon is slightly effervescent and typically has faint coatings of lime. It is clay loam, loam, or sandy clay loam and is 20 to 30 percent clay. The horizon is neutral to moderately alkaline.

Hager Series

The Hager series consists of soils that are moderately deep to a hardpan and are well drained. These soils formed in colluvium and residuum derived from basalt and tuff. Hager soils are on tablelands. Slopes are 2 to 15 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Hager cobbly loam in an area of Hager complex, 2 to 15 percent slopes, in an area of rangeland; in the NW1/4NE1/4NW1/4 of sec. 31, T. 36 S., R. 24 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) cobbly loam, grayish brown (10YR 5/2) dry; strong fine granular structure parting to moderate fine subangular blocky; soft, very friable, slightly sticky and nonplastic; many very fine roots; 25 percent cobbles and 5 percent gravel; mildly alkaline; abrupt smooth boundary.

A2—4 to 8 inches; dark brown (10YR 3/3) cobbly loam, light brownish gray (10YR 6/2) dry; moderate very fine prismatic structure parting to strong thin platy; hard, friable, slightly sticky and nonplastic; many very fine roots; common very fine discontinuous vesicular pores; 10 percent cobbles and 5 percent gravel; mildly alkaline; clear smooth boundary.

2Bt1—8 to 15 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; moderate very fine prismatic structure; very hard, friable, sticky and slightly plastic; common very fine roots; 5 percent gravel; many distinct clay films on faces of peds; mildly alkaline; gradual wavy boundary.

2Bt2—15 to 24 inches; dark yellowish brown (10YR 3/4) silty clay loam, very pale brown (10YR 7/4) dry; strong very fine angular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; 5 percent gravel; many distinct clay films on faces of peds; moderately alkaline; abrupt smooth boundary.

2Bkq—24 to 37 inches; dark yellowish brown (10YR 4/4) loam, very pale brown (10YR 7/3) dry; massive; very hard, firm and brittle, slightly sticky and slightly plastic; few very fine roots; 5 percent gravel; slightly effervescent; lime segregated in few irregularly shaped seams and filaments; moderately alkaline; abrupt smooth boundary.

3Bkqm—37 to 42 inches; very pale brown (10YR 7/3) indurated hardpan, light yellowish brown (10YR 6/4) moist; clear wavy boundary.

4R—42 inches; tuff.

Depth to the indurated hardpan is 20 to 40 inches. Depth to the firm, brittle layer is 10 to 30 inches. Depth to bedrock is 40 to 60 inches. The particle-size control section is 25 to 35 percent clay and 15 to 52 percent sand, most of which is very fine sand and fine sand but more than 15 percent of which is coarser than very fine sand.

The A horizon has value of 5 or 6 when dry, and it has chroma of 2 to 4 when moist and 2 or 3 when dry.

It is 20 to 70 percent rock fragments, mostly cobbles and stones. The horizon has granular, subangular blocky, or platy structure. It is cobbly loam or extremely stony loam and is 20 to 25 percent clay.

The 2Bt horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 3 or 4 when moist and 3 to 6 when dry. It is 5 to 20 percent rock fragments, mostly gravel and cobbles. The fine earth fraction is clay loam, loam, or silty clay loam and is 0 to 5 percent stones, 0 to 10 percent cobbles, and 0 to 30 percent gravel. The horizon is slightly effervescent to violently effervescent. It has moderate or strong prismatic structure or angular blocky structure.

The 2Bkq horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 3 or 4 when moist and 3 to 6 when dry. It is 5 to 35 percent rock fragments, including 0 to 5 percent stones, 0 to 10 percent cobbles, and 5 to 30 percent gravel. In some pedons this horizon consists of fractured, consolidated lacustrine sediment.

The 3Bkqm horizon has value of 6 or 7 when moist and 7 or 8 when dry, and it has chroma of 4 or 6 when moist. The horizon is as much as 50 percent rock fragments, mostly gravel. It is 3 to 10 inches thick.

Hallihan Series

The Hallihan series consists of very deep, somewhat excessively drained soils that formed in colluvium and residuum derived from rhyolite. Hallihan soils are on mountains. Slopes are 0 to 60 percent. The mean annual precipitation is about 32 inches, and the mean annual air temperature is about 42 degrees F.

Typical pedon of Hallihan gravelly fine sandy loam, 15 to 40 percent north slopes, in an area of woodland; in the NW$^1/_4$SW$^1/_4$ of sec. 31, T. 37 S., R. 22 E.

Oi—2 inches to 0; white fir and lodgepole pine needles.

A1—0 to 2 inches; black (10YR 2/1) gravelly fine sandy loam, dark grayish brown (10YR 4/2) dry; weak very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; many fine irregular pores; 20 percent gravel; slightly acid; abrupt smooth boundary.

A2—2 to 6 inches; dark brown (10YR 3/3) gravelly fine sandy loam, brown (10YR 5/3) dry; weak very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; many fine irregular pores; 15 percent gravel; slightly acid; clear smooth boundary.

AB—6 to 13 inches; dark yellowish brown (10YR 4/4) gravelly fine sandy loam, yellowish brown (10YR 5/4) dry; weak very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and few medium roots; many fine irregular pores; 5 percent cobbles and 15 percent gravel; slightly acid; clear wavy boundary.

Bw—13 to 21 inches; dark yellowish brown (10YR 4/4) very gravelly fine sandy loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common fine and few medium roots; few very fine tubular pores; 40 percent gravel; slightly acid; gradual wavy boundary.

C1—21 to 33 inches; pale brown (10YR 6/3) very gravelly sandy loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, slightly sticky and nonplastic; common fine roots and few medium and coarse roots; common very fine and fine irregular pores; 55 percent gravel; slightly acid; gradual wavy boundary.

C2—33 to 43 inches; pale brown (10YR 6/3) very gravelly sandy loam, white (10YR 8/2) dry; massive; slightly hard, very friable, slightly sticky and nonplastic; few fine roots; common fine irregular pores; 55 percent gravel; slightly acid; clear wavy boundary.

C3—43 to 60 inches; pale brown (10YR 6/3) extremely gravelly sandy loam, white (10YR 8/2) dry; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few fine irregular pores; 25 percent cobbles and 60 percent gravel; moderately acid.

Depth to bedrock is more than 60 inches. The particle-size control section averages 35 to 60 percent rock fragments. The bulk density of the fine earth fraction is 0.85 to 0.95 grams per cubic centimeter. The profile is 0 to 15 percent cobbles and stones and 35 to 45 percent gravel. It is 7 to 18 percent clay. The very fine sand fraction contains 50 to 70 percent volcanic glass. The profile is moderately acid or slightly acid.

The A horizon has value of 2 to 4 when moist and 4 or 5 when dry, and it has chroma of 1 to 4 when moist or dry.

The Bw horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 4 to 6 when moist or dry. It is very gravelly sandy loam or very gravelly fine sandy loam.

The C horizon has value of 4 to 6 when moist and 6 to 8 when dry, and it has chroma of 2 to 4 when moist or dry. The horizon is 50 to 85 percent rock fragments, of which 10 to 25 percent is cobbles and stones and 40 to 60 percent is gravel.

Hammersley Series

The Hammersley series consists of deep, well drained soils that formed in colluvium and residuum derived dominantly from pyroclastic rock. Hammersley soils are on mountains. Slopes are 15 to 70 percent. The mean annual precipitation is about 32 inches, and the mean annual air temperature is about 42 degrees F.

Typical pedon of Hammersley loam in an area of Hammersley-Kittleson complex, 15 to 40 percent north slopes, in an area of woodland; in the SW¹/₄SW¹/₄ of sec 33, T. 37 S., R. 21 E.

Oi—3 inches to 0; white fir needles.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; many fine irregular pores; 5 percent gravel; neutral; abrupt smooth boundary.

A2—2 to 15 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate very fine and fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; many fine irregular pores; 5 percent gravel; neutral; clear wavy boundary.

Bt1—15 to 24 inches; very dark grayish brown (10YR 3/2) clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, firm, slightly sticky and plastic; many fine roots; common fine tubular pores; few distinct clay films on faces of peds and in pores; 10 percent gravel; slightly acid; gradual wavy boundary.

Bt2—24 to 35 inches; dark brown (10YR 3/3) clay, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine tubular pores; common distinct clay films on faces of peds and in pores; 10 percent gravel; slightly acid; gradual wavy boundary.

C—35 to 50 inches; dark yellowish brown (10YR 3/4) cobbly clay, brown (10YR 5/3) dry; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; few fine irregular pores; 15 percent cobbles and 10 percent gravel; slightly acid; abrupt wavy boundary.

Cr—50 inches; highly weathered tuff.

Depth to bedrock is 40 to 60 inches. The particle-size control section averages 10 to 25 percent rock fragments and is 35 to 50 percent clay. The mollic epipedon is 16 to 30 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist, and chroma of 2 to 4 when moist or dry. The horizon is clay loam, clay, gravelly clay loam, or gravelly clay. It is 0 to 10 percent cobbles and stones and 5 to 25 percent gravel.

The C horizon has value of 3 or 4 when moist and 4 or 5 when dry, and it has chroma of 3 or 4 when moist or dry. The horizon is cobbly clay or cobbly clay loam. It is 10 to 20 percent cobbles and stones and 5 to 15 percent gravel.

Harcany Series

The Harcany series consists of very deep, well drained soils that formed in residuum and colluvium derived from basalt and tuff. Harcany soils are on mountains and escarpments. Slopes are 5 to 70 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 42 degrees F.

Typical pedon of Harcany very gravelly loam in an area of Harcany complex, high precipitation, 5 to 30 percent slopes, in an area of rangeland; in Hart Mountain National Antelope Refuge; in the SE¹/₄SW¹/₄SE¹/₄ of sec. 25, T. 35 S., R. 25 E.

A1—0 to 12 inches; very dark brown (10YR 2/2) very gravelly loam, dark brown (10YR 3/3) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; 5 percent cobbles and 35 percent gravel; neutral; clear smooth boundary.

A2—12 to 24 inches; very dark brown (10YR 2/2) very gravelly loam, brown (10YR 4/3) dry; weak fine granular structure; loose, nonsticky and nonplastic; many fine and medium roots; 5 percent cobbles and 50 percent gravel; neutral; abrupt irregular boundary.

2A3—24 to 40 inches; dark brown (10YR 3/3) extremely cobbly loam, brown (10YR 5/3) dry; massive; loose, nonsticky and nonplastic; common fine and medium roots; 40 percent cobbles and 30 percent gravel; neutral; gradual irregular boundary.

2C—40 to 60 inches; dark brown (10YR 3/3) extremely stony loam, brown (10YR 5/3) dry; massive; loose, nonsticky and nonplastic; few fine and medium roots; 30 percent stones, 20 percent cobbles, and 30 percent gravel; neutral.

Depth to bedrock is more than 60 inches. The particle-size control section averages 10 to 20 percent clay and 50 to 80 percent rock fragments. The mollic epipedon is 30 to 50 inches thick.

The A and 2A horizons have value of 2 or 3 when moist and 3 to 5 when dry, and they have chroma of 2 or 3 when moist or dry.

The 2C horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist and 3 or 4 when dry. It is 60 to 80 percent rock fragments, most of which are gravel and cobbles in the upper part and stones and cobbles in the lower part.

Harriman Series

The Harriman series consists of very deep, well drained soils that formed in lacustrine sediment derived from volcanic tuff, basalt, and diatomite. Harriman soils are on lake terraces. Slopes are 0 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Harriman loam, 0 to 5 percent slopes, in an area of rangeland; at an elevation of 4,496 feet, in Warner Valley; in the NW¹/₄NE¹/₄NW¹/₄ of sec. 16, T. 37 S., R. 24 E.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) loam, gray (10YR 5/1) dry; weak very thin platy structure; soft, friable, slightly sticky and slightly plastic; few fine roots; many fine vesicular pores; neutral; abrupt smooth boundary.

A2—2 to 10 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; weak medium prismatic structure; slightly hard, friable, sticky and plastic; common fine roots; many very fine tubular pores; neutral; gradual smooth boundary.

Bt1—10 to 24 inches; dark brown (7.5YR 3/2) clay loam, brown (7.5YR 5/2) dry; weak medium prismatic structure; hard, friable, sticky and plastic; common fine roots; many fine tubular pores; many distinct clay films on faces of peds and few faint clay films in pores; neutral; gradual smooth boundary.

Bt2—24 to 40 inches; dark brown (7.5YR 3/2) clay loam, brown (7.5YR 5/2) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many very fine and fine tubular pores; few faint clay films on faces of peds; neutral; gradual smooth boundary.

C—40 to 64 inches; dark brown (7.5YR 4/2) sandy clay loam, pinkish gray (7.5YR 6/2) dry; massive; hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine pores; mildly alkaline.

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 45 inches thick.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 1 or 2 when dry.

The Bt horizon has hue of 10YR or 7.5YR, value of 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry. It is 27 to 35 percent clay and 0 to 25 percent gravel. The horizon is neutral or mildly alkaline.

The C horizon has hue of 10YR or 7.5YR, and it has value of 4 to 6 when moist and 6 or 7 when dry. It is clay loam or sandy clay loam and is 0 to 35 percent gravel. The horizon is neutral or mildly alkaline.

Hart Series

The Hart series consists of deep, well drained soils that formed in alluvium and residuum derived from basalt and tuff. Hart soils are on relict fan piedmonts on tablelands. Slopes are 2 to 50 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Hart very gravelly loam in an area of Hart complex, 2 to 15 percent slopes, in an area of rangeland; in the NE¹/₄NW¹/₄SW¹/₄ of sec. 1, T. 37 S., R. 22 E.

A—0 to 9 inches; dark brown (7.5YR 3/2) very gravelly loam, brown (7.5YR 4/2) dry; strong fine granular structure; loose, very friable, slightly sticky and nonplastic; many very fine and fine roots; 5 percent cobbles and 40 percent gravel; mildly alkaline; abrupt smooth boundary.

2Bt—9 to 19 inches; brown (7.5YR 4/4) clay, brown (7.5YR 4/4) dry; strong fine prismatic structure; very hard, firm, very sticky and plastic; few very fine roots; few very fine irregular pores; 5 percent fine gravel; many distinct clay films in pores and on faces of peds; mildly alkaline; gradual wavy boundary.

3Bk1—19 to 25 inches; dark brown (7.5YR 4/4) very gravelly silty clay loam, pink (7.5YR 7/4) dry; massive; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent cobbles and 40 percent fine gravel; violently effervescent; carbonates segregated in many irregularly shaped seams and filaments; moderately alkaline; gradual wavy boundary.

3Bk2—25 to 30 inches; dark brown (7.5YR 4/4) very gravelly loam, pinkish gray (7.5YR 7/2) dry; massive; hard, very firm, slightly sticky and nonplastic; 5 percent cobbles and 30 percent fine gravel; strongly effervescent; carbonates are disseminated; moderately alkaline; abrupt smooth boundary.

3Bkq—30 to 43 inches; dark brown (10YR 4/3) extremely gravelly loam, pale brown (10YR 6/3) dry; massive; very hard, very firm and brittle, nonsticky and nonplastic; 5 percent cobbles and 60 percent gravel; strongly effervescent; carbonates are disseminated and coat rock fragments; moderately alkaline; abrupt irregular boundary.

4R—43 inches; tuff; coatings of silica and calcium carbonate in fractures.

The mollic epipedon is 7 to 12 inches thick. Thickness of the A and 2Bt horizons combined is 15 to 30 inches. Depth to bedrock is 40 to 60 inches. Depth to the brittle layer is 30 to 50 inches. The particle-size control section is 45 to 55 percent clay. An abrupt textural increase of 20 to 40 percent is within 3 inches of the upper boundary of the argillic horizon. Depth to the argillic horizon is 4 to 10 inches.

The A horizon has hue of 7.5YR or 10YR, and it has value of 2 or 3 when moist and 4 or 5 when dry. It is extremely cobbly loam or very gravelly loam and is 5 to 50 percent cobbles and 10 to 50 percent gravel.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 3 or 4 when moist or dry. It is clay or gravelly clay and is 0 to 5 percent cobbles and 5 to 25 percent gravel, most of which is less than 1/4 inch in diameter. The horizon has common to many, distinct to prominent clay films. It has strong prismatic to strong fine angular blocky structure.

The 3B horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 to 4 when moist or dry. It is very gravelly silty clay loam, gravelly loam, or very gravelly loam. It is 0 to 5 percent cobbles and 20 to 40 percent gravel, most of which is less than 1/4 inch in diameter. The horizon is slightly effervescent to strongly effervescent.

The 3Bkq horizon has value of 3 or 4 when moist, and it has chroma of 3 to 6 when moist or dry. It is very gravelly loam or extremely gravelly loam and is 5 to 10 percent cobbles and 30 to 60 percent gravel. The horizon is brittle throughout or is 20 to 50 percent durinodes.

Helphenstein Series

The Helphenstein series consists of very deep, somewhat poorly drained soils that formed in lacustrine sediment. Helphenstein soils are on lake terraces. Slopes are 0 to 2 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Helphenstein fine sandy loam in an area of Playas-Helphenstein complex, 0 to 2 percent slopes, in an area of rangeland; in the NE1/4SE1/4SW1/4 of sec. 3, T. 36 S., R. 24 E.

Akn1—0 to 7 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure parting to weak medium platy; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common very fine discontinuous vesicular pores; strongly effervescent (3 percent calcium carbonate); carbonates are disseminated; sodium adsorption ratio is 100; electrical conductivity is 7 millimhos per centimeter; very strongly alkaline; abrupt wavy boundary.

2Akn2—7 to 12 inches; brown (10YR 4/3) loam, light gray (10YR 7/2) dry; strong medium platy structure; soft, very friable, slightly sticky and nonplastic; common fine and coarse roots; common very fine discontinuous vesicular pores; strongly effervescent (8 percent calcium carbonate); carbonates are disseminated; sodium adsorption ratio is 170; electrical conductivity is 8 millimhos per centimeter; very strongly alkaline; abrupt wavy boundary.

3Bkn1—12 to 16 inches; brown (10YR 4/3) loam, light gray (10YR 7/2) dry; strong very fine angular blocky structure; hard, very friable, slightly sticky and nonplastic; many very fine to coarse roots; violently effervescent (6 percent calcium carbonate); carbonates are disseminated; sodium adsorption ratio is 36; electrical conductivity is 3 millimhos per centimeter; very strongly alkaline; clear wavy boundary.

3Bkn2—16 to 36 inches; brown (10YR 4/3) loam, light gray (10YR 7/2) dry; moderate very fine prismatic structure parting to strong very fine angular blocky; hard, very friable, slightly sticky and nonplastic; few very fine roots; violently effervescent (6 percent calcium carbonate); carbonates segregated in common fine irregular seams and filaments; sodium adsorption ratio is 375; electrical conductivity is 10 millimhos per centimeter; very strongly alkaline; gradual wavy boundary.

4Bkn3—36 to 50 inches; dark brown (10YR 3/3) silt loam, light gray (10YR 7/2) dry; moderate thin platy structure parting to strong fine angular blocky; very hard, firm, nonsticky and nonplastic; strongly effervescent (7 percent calcium carbonate); carbonates segregated in common fine irregular seams and filaments; sodium adsorption ratio is 59; electrical conductivity is 3 millimhos per centimeter; strongly alkaline; gradual wavy boundary.

5Bk—50 to 55 inches; brown (10YR 5/3) silt loam, light gray (10YR 7/2) dry; massive; slightly hard, friable, slightly sticky and nonplastic; slightly effervescent; lime is disseminated; moderately alkaline; abrupt wavy boundary.

6C—55 to 60 inches; light gray (10YR 7/1) very fine sandy loam, white (10YR 8/1) dry; massive; soft, very friable, nonsticky and nonplastic, moderately alkaline; abrupt wavy boundary.

7C—60 to 65 inches; brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; massive; extremely hard, brittle, extremely firm, nonsticky and nonplastic; few very fine roots; moderately alkaline.

These soils have a high water table late in winter and in spring. Depth to bedrock is more than 60 inches. The particle-size control section is 18 to 30 percent clay and 35 to 50 percent sand, most of which is fine sand and very fine sand but more than 15 percent of which is coarser than very fine sand. The solum is 2 to 10 percent calcium carbonates and less than 1 percent salts.

The A horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 6 or 7 when dry, and chroma of 2 or 3 moist. It has platy or blocky structure. Sodium adsorption ratio is 80 to 200, and electrical conductivity is 5 to 10 millimhos per centimeter.

The Bkn horizon has hue of 10YR or 2.5Y, value of 2 to 4 when moist and 6 or 7 when dry, and chroma of 2 or 3 when moist. It is silt loam, loam, or silty clay loam and is 18 to 30 percent clay. Sodium adsorption ratio is 50 to 400. Electrical conductivity is 2 to 10 millimhos per centimeter. Structure is rocklike, and angular blocks consist of fractured, semiconsolidated sediment.

The Bk and C horizons have hue of 10YR or 2.5Y, value 3 to 7 when moist and 6 to 8 when dry, and chroma of 1 to 3 when moist and 1 or 2 when dry. These horizons consist of stratified layers of silt loam, very fine sandy loam, and fine sand with thin strata of white volcanic ash in some pedons. Structure is massive and rocklike. Sodium adsorption ratio is 5 or less. Electrical conductivity is less than 2 millimhos per centimeter.

Hinton Series

The Hinton series consists of very deep, well drained soils that formed in stratified lacustrine beach sediment and eolian deposits. Hinton soils are on lake terraces. Slopes are 0 to 5 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Hinton gravelly loamy sand in an area of Zorravista-Hinton complex, 0 to 8 percent slopes, in an area of rangeland; in the SE$^1/_4$SW$^1/_4$NE$^1/_4$ of sec. 4, T. 33 S., R. 19 E.

A1—0 to 1 inch; very dark grayish brown (10YR 3/2) gravelly loamy sand, dark grayish brown (10YR 4/2) dry; single grain; loose, nonsticky and nonplastic; 10 percent fine gravel, 10 percent coarse gravel, and 2 percent pumice sand; moderately alkaline; gradual smooth boundary.

A2—1 inch to 12 inches; dark brown (10YR 3/3) loamy sand, grayish brown (10YR 5/2) dry; moderate thin and thick platy structure; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and medium roots and few coarse roots; many fine tubular pores; 5 percent fine gravel and 5 percent coarse gravel; moderately alkaline; abrupt smooth boundary.

2Bkq—12 to 18 inches; dark brown (7.5YR 3/4) gravelly loam, pale brown (10YR 6/3) dry; massive; extremely hard, firm and brittle; slightly sticky and nonplastic; slightly effervescent; carbonates are segregated in few fine filaments; 10 percent fine gravel and 5 percent coarse gravel; neutral; abrupt smooth boundary.

3Bk—18 to 24 inches; dark gray (10YR 4/1) extremely gravelly sand, gray (10YR 6/1) dry; massive; loose, nonsticky and nonplastic; few very fine roots; violently effervescent; 50 percent fine gravel, 35 percent coarse gravel, and 2 percent cobbles; neutral; clear wavy boundary.

4Bq—24 to 28 inches; brown (10YR 5/3) sand, light brownish gray (10YR 6/2) dry; massive; hard, firm and brittle, slightly sticky and slightly plastic; 5 percent fine gravel and 5 percent coarse gravel; mildly alkaline; abrupt smooth boundary.

5Bk—28 to 32 inches; brown (10YR 4/3) extremely gravelly sand, pale brown (10YR 6/3) dry; massive; loose, nonsticky and nonplastic; slightly effervescent (3 percent calcium carbonate); 55 percent fine gravel and 10 percent coarse gravel; moderately alkaline; gradual wavy boundary.

5C—32 to 40 inches; brown (10YR 4/3) extremely gravelly sand, light gray (10YR 7/2) dry; massive; loose, nonsticky and nonplastic; 30 percent fine gravel, 30 percent coarse gravel, and 2 percent cobbles; moderately alkaline; abrupt smooth boundary.

6Bkq—40 to 43 inches; brown (10YR 4/3) gravelly sand, pale brown (10YR 6/3) dry; massive; hard, firm and brittle; nonsticky and nonplastic; slightly effervescent; 15 percent fine gravel and 10 percent coarse gravel; moderately alkaline; gradual smooth boundary.

6Bk—43 to 60 inches; brown (10YR 4/3) extremely gravelly sand, pale brown (10YR 7/2) dry; massive; loose, nonsticky and nonplastic; violently effervescent; 30 percent fine gravel, 30 percent coarse gravel, and 2 percent cobbles; moderately alkaline.

Depth to the firm, brittle layer is 10 to 20 inches. Depth to bedrock is more than 60 inches. The particle-size control section is 2 to 10 percent clay, 70 to 90 percent sand, and 35 to 70 percent rock fragments, dominantly gravel.

The A horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 or 3 when moist or dry. Organic matter content is 1 to 2 percent in the upper part and less than 1 percent in the lower part.

The B horizon has hue of 10YR or 7.5YR, value of 3 to 5 when moist and 5 to 7 when dry, and chroma of 1 to 4 when moist and 1 to 3 when dry. It consists of multiple strata of firm, brittle, calcareous sand and gravel over layers of calcareous sand and gravel that are not brittle. The horizon typically is extremely gravelly sand or very gravelly sand with thin layers of sand or gravelly sand. It is neutral to moderately alkaline.

The C horizon is present only in some pedons. It is not brittle and does not contain carbonates.

Icene Series

The Icene series consists of very deep, moderately well drained soils that formed in lacustrine sediment. Icene soils are on lake terraces. Slopes are 0 to 1 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Icene fine sandy loam in an area of Icene-Playas complex, 0 to 1 percent slopes, in an area of rangeland; in the SW$^1/_4$SW$^1/_4$NW$^1/_4$ of sec. 3, T. 36 S., R. 24 E.

Akn—0 to 5 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure parting to weak medium platy; soft, very friable, nonsticky and slightly plastic; many very fine and fine roots; strongly effervescent (trace of calcium carbonates); carbonates are disseminated; sodium adsorption ratio is 19; electrical conductivity is 2 millimhos per centimeter; 0.1 percent salts; very strongly alkaline; abrupt wavy boundary.

2Akn—5 to 10 inches; dark brown (10YR 4/3) silt loam, light gray (2.5Y 7/2) dry; strong medium platy structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; violently effervescent (trace of calcium carbonates); carbonates are disseminated; sodium adsorption ratio is 77; electrical conductivity is 10 millimhos per centimeter; 0.4 percent salts; very strongly alkaline; abrupt wavy boundary.

3Bknz—10 to 23 inches; dark brown (10YR 4/3) loam, light gray (2.5Y 7/2) dry; strong fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine to coarse roots; violently effervescent (10 percent calcium carbonates); carbonates are disseminated; sodium adsorption ratio is 109; electrical conductivity is 41 millimhos per centimeter; 2.4 percent salts; strongly alkaline; clear wavy boundary.

3BCknz—23 to 28 inches; dark brown (10YR 4/3) loam, light gray (2.5Y 7/2) dry; massive; slightly hard, friable, slightly sticky and nonplastic; few very fine roots; strongly effervescent (5 percent calcium carbonates); carbonates are disseminated; sodium adsorption ratio is 97; electrical conductivity is 38 millimhos per centimeter; 2.7 percent salts; massive material is rocklike, has strong medium angular blocky structure, and is derived from consolidated lacustrine sediment that has been fractured; moderately alkaline; clear wavy boundary.

4Cknz—28 to 65 inches; dark brown (10YR 3/3) silt loam, light brownish gray (2.5Y 6/2) dry; massive; very hard and brittle, firm, nonsticky and nonplastic; strongly effervescent (2 percent calcium carbonates); carbonates segregated in common medium irregular seams and filaments; sodium adsorption ratio is 58; electrical conductivity is 28 millimhos per centimeter; 2.1 percent salts; massive material is rocklike, has strong medium angular blocky structure, and is derived from consolidated lacustrine sediment that has been fractured; moderately alkaline.

Depth to bedrock is more than 60 inches. These soils have a high water table late in winter and in spring. The particle-size control section averages 20 to 30 percent clay, 20 to 50 percent sand that is mostly fine and very fine, and more than 15 percent material that is coarser than very fine sand. Electrical conductivity is more than 16 millimhos per centimeter. Sodium adsorption ratio is more than 45. The profile is less than 10 percent calcium carbonate. Depth to the salic horizon is 5 to 15 inches. The salic horizon is 12 to 30 inches thick and 2 to 4 percent salts. Depth to consolidated, compacted sediment is 20 to 40 inches. Hue is 10YR or 2.5Y throughout the profile.

The A horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 or 3 when moist. The horizon has platy or subangular blocky structure. Sodium adsorption ratio is 15 to 90, and electrical conductivity is 2 to 16 millimhos per centimeter. The horizon is less than 1 percent salts.

The B horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 2 or 3 when moist. It is silt loam, loam, or silty clay loam. It has prismatic, subangular blocky, or angular blocky structure. The horizon is strongly alkaline or moderately alkaline. Sodium adsorption ratio is 90 to 120, and electrical conductivity is more than 16 millimhos per centimeter. The horizon is 2 to 4 percent salts.

The C horizon has value 3 to 7 when moist and 6 to 8 when dry, and it has chroma of 1 to 3 when moist and 1 or 2 when dry. It is dominantly silt loam and silty clay loam but has thin strata of fine sandy loam, fine sand, and white volcanic ash in some pedons. The horizon is moderately alkaline or strongly alkaline. Sodium adsorption ratio is 20 to 70, and electrical conductivity is more than 16 millimhos per centimeter. The horizon is 1 to 3 percent salts.

Itca Series

The Itca series consists of shallow, well drained soils that formed in colluvium and residuum derived from basalt and tuff. Itca soils are on mountains. Slopes are 5 to 70 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Itca very cobbly loam in an area of Pernog-Itca association, 5 to 30 percent slopes, in an area of rangeland; about 1/4 mile south of Mill Creek Trail, in the SW1/4SE1/4 of sec. 29, T. 33 S., R. 18 E.

A—0 to 5 inches; dark brown (10YR 3/3) very cobbly loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; 15 percent cobbles and 25 percent gravel; mildly alkaline; clear smooth boundary.

Bt1—5 to 12 inches; dark brown (10YR 3/3) very cobbly clay loam, brown (10YR 5/3) dry; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots and few medium roots; common very fine tubular pores; few faint clay films on peds and in pores; 25 percent cobbles and 20 percent gravel; mildly alkaline; clear smooth boundary.

Bt2—12 to 16 inches; brown (10YR 4/3) extremely cobbly clay, pale brown (10YR 6/3) dry; weak medium prismatic structure parting to strong fine and medium angular blocky; very hard, very firm, sticky and plastic; few very fine roots; few very fine tubular pores; common distinct clay films on peds; 60 percent cobbles and 20 percent gravel; mildly alkaline; clear smooth boundary.

R—16 inches; basalt.

The mollic epipedon is 7 to 15 inches thick. Thickness of the solum and depth to bedrock are 10 to 20 inches.

The A horizon has value of 2 or 3 moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 3 to 7 inches thick.

The Bt horizon has hue of 7.5YR or 10YR. It is very cobbly clay loam, very stony clay loam, or extremely cobbly clay loam in the upper part and is very cobbly clay or extremely cobbly clay in the lower part.

Jesse Camp Series

The Jesse Camp series consists of very deep, well drained soils that formed in lacustrine sediment. Jesse Camp soils are on lake terraces. Slopes are 2 to 5 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Jesse Camp silt loam, 2 to 5 percent slopes, in the SE1/4SE1/4SE1/4 of sec. 33, T. 40 S., R. 27 E.

A—0 to 4 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; strong thin platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine discontinuous random vesicular pores; mildly alkaline; abrupt smooth boundary.

Bw1—4 to 19 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; mildly alkaline; clear wavy boundary.

Bw2—19 to 29 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; 15 percent very hard medium cylindrical durinodes; mildly alkaline; clear wavy boundary.

Bw3—29 to 34 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; massive; hard, firm, slightly sticky and slightly plastic; few very fine and fine roots; mildly alkaline; abrupt wavy boundary.

Bk—34 to 50 inches; dark yellowish brown (10YR 4/4) silt loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; 5 percent gravel; strongly effervescent, carbonates segregated in few very fine irregularly shaped seams and filaments; moderately alkaline; clear wavy boundary.

2C—50 to 60 inches; dark yellowish brown (10YR 4/4) very gravelly sandy loam, very pale brown (10YR 7/3) dry; single grain; loose, nonsticky and nonplastic; 35 percent fine gravel; moderately alkaline.

The particle-size control section is 18 to 27 percent clay and less than 15 percent material that is coarser than very fine sand.

The A horizon has value of 5 or 6 when dry. It is mildly alkaline or moderately alkaline.

The Bw horizon has value of 6 or 7 when dry. It is as much as 20 percent brittle durinodes. It is mildly alkaline or moderately alkaline.

The Bk horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 3 or 4 when moist or dry. It is silt loam with thin strata of very fine sandy loam. The horizon is as much as 10 percent gravel and 20 percent hard or extremely hard durinodes. Carbonates are segregated in few to many seams and filaments. The horizon is moderately alkaline or strongly alkaline.

The 2C horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 3 or 4 when moist or dry. It is gravelly or very gravelly sandy loam or loam and is 15 to 50 percent fine gravel.

Kewake Series

The Kewake series consists of very deep, excessively drained soils that formed in eolian sand. Kewake soils are on sand dunes. Slopes are 1 to 15 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Kewake fine sand in an area of Kewake-Ozamis-Reese complex, 0 to 15 percent slopes, in an area of rangeland; in the SE¼NE¼SW¼NE¼ of sec. 31, T. 38 S., R. 25 E.

Ak—0 to 5 inches; dark grayish brown (10YR 4/2) fine sand, light brown (10YR 7/2) dry; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; violently effervescent; 25 percent pumice sand; moderately alkaline; gradual wavy boundary.

Ck1—5 to 10 inches; dark grayish brown (10YR 4/2) fine sand, light brownish gray (10YR 6/2) dry; massive; loose, nonsticky and nonplastic; many very fine, fine, and medium roots; violently effervescent; 20 percent pumice sand; strongly alkaline; gradual wavy boundary.

Ck2—10 to 20 inches; dark brown (10YR 4/3) fine sand, light gray (10YR 7/2) dry; massive; loose, nonsticky and nonplastic; few coarse roots and many very fine and fine roots; violently effervescent; 15 percent pumice sand; few weakly cemented nodules; strongly alkaline; diffuse wavy boundary.

Ck3—20 to 60 inches; dark brown (10YR 4/3) fine sand, very pale brown (10YR 7/3) dry; massive; loose, nonsticky and nonplastic; few coarse roots and common very fine and fine roots; violently effervescent; 20 percent pumice sand; few weakly cemented nodules; very strongly alkaline.

These soils are fine sand throughout, but strata of sand or loamy fine sand are present in some pedons. The soils are as much as 30 percent pumice sand. The profile has hue of 10YR or 7.5YR, value of 4 to 6 when moist and 5 to 8 when dry, and chroma of 2 to 4 when moist or dry. It is moderately alkaline or strongly alkaline in the upper part and strongly alkaline or very strongly alkaline in the lower part.

Kittleson Series

The Kittleson series consists of deep, well drained soils that formed in colluvium and residuum derived from pyroclastic rock. Kittleson soils are on mountains. Slopes are 15 to 70 percent. The mean annual precipitation is about 32 inches, and the mean annual air temperature is about 42 degrees F.

Typical pedon of Kittleson sandy loam in an area of Hammersley-Kittleson complex, 15 to 40 percent north slopes, in an area of woodland; in the SW¼NE¼ of sec. 35, T. 37 S., R. 21 E.

Oi—3 inches to 0; white fir needles.

A1—0 to 2 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, very friable, slightly sticky and nonplastic; common fine and medium roots; many very fine and fine irregular pores; 5 percent gravel; slightly acid; clear smooth boundary.

A2—2 to 16 inches; dark brown (10YR 3/4) sandy loam, brown (10YR 5/4) dry; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common fine and medium roots; common very fine and fine irregular pores; 5 percent gravel; moderately acid; clear wavy boundary.

Bw1—16 to 23 inches; dark brown (10YR 4/4) sandy loam, light brown (10YR 6/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots; common very fine and fine irregular pores; 5 percent gravel; moderately acid; gradual wavy boundary.

Bw2—23 to 44 inches; dark brown (10YR 4/4) sandy loam, light brown (10YR 6/4) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and nonplastic; common fine roots; few very fine tubular pores; 10 percent soft gravel; moderately acid; abrupt wavy boundary.

Cr—44 inches; highly weathered tuffaceous bedrock.

Depth to bedrock is 40 to 60 inches. The particle-size control section averages 0 to 10 percent gravel and 10 to 18 percent clay. The very fine sand fraction is 50 to 70 percent glass. Bulk density is 0.85 to 0.95 per cubic centimeter. The profile is moderately acid or slightly acid.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist.

The Bw horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is loam or sandy loam. The horizon is 0 to 15 percent rock fragments, of which 0 to 5 percent is cobbles and 0 to 15 percent is gravel.

Lakeview Series

The Lakeview series consists of very deep, moderately well drained soils that formed in alluvium derived from tuff, rhyolite, basalt, and small amounts of ash. Lakeview soils are on flood plains and alluvial fans. Slopes are 0 to 2 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Lakeview loam, 0 to 2 percent slopes, in an area of rangeland; 50 feet south of State Highway 140, on the west bank of Muddy Creek; in the northwest corner of the NE1/4NE1/4 of sec. 20, T. 39 S., R. 19 E.

A—0 to 4 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very thin platy structure parting to moderate very fine granular; soft, friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; mildly alkaline; clear smooth boundary.

Bt1—4 to 8 inches; black (N 2/0) silty clay loam, dark gray (N 4/0) dry; weak medium prismatic structure; very hard, firm, sticky and plastic; common very fine roots; few very fine tubular pores; few faint cutans on faces of peds; neutral; clear smooth boundary.

Bt2—8 to 14 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; weak coarse prismatic structure; hard, firm, sticky and plastic; common very fine roots; few very fine tubular pores; few faint cutans on faces of peds; neutral; gradual smooth boundary.

2Btb—14 to 20 inches; very dark brown (10YR 2/2) sandy clay loam, dark grayish brown (2.5Y 4/2) dry; weak medium prismatic structure and weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; common faint cutans on faces of peds; mildly alkaline; clear smooth boundary.

2C1—20 to 32 inches; very dark grayish brown (2.5Y 3/2) sandy clay loam, grayish brown (2.5Y 5/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine pores; mildly alkaline; clear smooth boundary.

2C2—32 to 60 inches; dark grayish brown (2.5Y 4/2) sandy clay loam, light brownish gray (2.5Y 6/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine pores; scattered white mycelial lime; mildly alkaline.

Depth to bedrock is more than 60 inches. These soils are subject to rare or occasional flooding and have a high water table late in winter, in spring and summer, and early in fall. The mollic epipedon is 20 to 36 inches thick. The particle-size control section averages 20 to 35 percent clay. The A horizon and upper part of the B horizon are slightly acid to mildly alkaline. The lower part of the B horizon and the 2C horizon are neutral or mildly alkaline.

The A horizon and upper part of the B horizon have value of 3 to 5 when dry, and they have chroma of 0 to 2 when moist or dry. The A horizon is loam or silty clay loam.

The 2B horizon has hue of neutral, 10YR, or 2.5Y; value of 2 or 3 when moist and 4 to 6 when dry; and chroma of 0 to 3 when moist or dry. It is clay loam, loam, or sandy clay loam.

The 2C horizon has hue of 2.5Y or 10YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 2 or 3 when moist or dry. It is sandy clay loam, loam, or silt loam.

Lambring Series

The Lambring series consists of deep, well drained soils that formed in colluvium and residuum derived from basalt. Lambring soils are on mountains and hills. Slopes are 5 to 70 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 42 degrees F.

Typical pedon of Lambring very gravelly loam in an area of Lambring-Rock outcrop complex, 30 to 70 percent north slopes, in an area of rangeland; on the north side of Beatys Butte; 1 mile southeast of Buena Vista Springs; in the NW1/4SW1/4 of sec. 33, T. 36 S., R. 29 E.

A1—0 to 4 inches; very dark brown (10YR 2/2) very gravelly loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine roots and many fine roots; few very fine irregular pores; 5 percent cobbles and 40 percent gravel; neutral; clear smooth boundary.

A2—4 to 10 inches; dark brown (10YR 3/3) very gravelly loam, brown (10YR 4/3) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, many fine, and few medium roots; few very fine irregular pores; 10 percent cobbles and 40 percent gravel; neutral; clear smooth boundary.

Bw1—10 to 20 inches; dark brown (10YR 3/3) very cobbly loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; few very fine irregular pores; 5 percent stones, 25 percent cobbles, and 25 percent gravel; neutral; clear smooth boundary.

Bw2—20 to 34 inches; dark brown (10YR 4/3) extremely cobbly loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, common fine, and few medium roots; few very fine irregular pores; 5 percent stones, 25 percent cobbles, and 45 percent gravel; neutral; abrupt wavy boundary.

C—34 to 52 inches; yellowish brown (10YR 5/4) extremely cobbly sandy loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine irregular pores; 5 percent stones, 30 percent cobbles, and 45 percent gravel; neutral; abrupt irregular boundary.

R—52 inches; basalt.

The mollic epipedon is 20 to 30 inches thick. The particle-size control section is 50 to 70 percent rock fragments and 15 to 27 percent clay. The profile is neutral or mildly alkaline.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 5 to 10 inches thick.

The Bw horizon has value of 2 to 4 when moist and 4 or 5 when dry, and it has chroma of 2 to 4 when moist or dry. It is very cobbly loam, extremely cobbly loam, or extremely gravelly loam.

The C horizon has value of 3 to 5 when moist and 4 to 6 when dry, and it has chroma of 2 to 4 when moist or dry. It is extremely cobbly sandy loam or very cobbly loam.

Langslet Series

The Langslet series consists of very deep, somewhat poorly drained soils that formed in lacustrine sediment. Langslet soils are on low lake terraces. Slopes are 0 to 2 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Langslet silt loam, 0 to 2 percent slopes, in an area of rangeland; about 0.6 mile northeast of Bureau of Land Management Road 6106; at the south end of Guano Lake; in the SW$^1/_4$NW$^1/_4$ of sec. 35, T. 39 S., R. 27 E.

A—0 to 8 inches; dark grayish brown (2.5Y 4/2) silt loam, grayish brown (2.5Y 5/2) dry; moderate thin platy structure; slightly hard, very friable, sticky and slightly plastic; common very fine and fine roots; common very fine and few fine vesicular pores; 5 percent gravel; mildly alkaline; clear smooth boundary.

Bw1—8 to 32 inches; dark grayish brown (2.5Y 4/2) silty clay, light grayish brown (2.5Y 6/2) dry; strong medium prismatic structure; hard, firm, sticky and plastic; common very fine roots; few very fine tubular pores; few slickensides; mildly alkaline; clear smooth boundary.

Bw2—32 to 47 inches; dark grayish brown (2.5Y 4/2) silty clay, light grayish brown (2.5Y 6/2) dry; few fine prominent dark reddish brown (5YR 3/3) mottles; strong medium prismatic structure and strong medium subangular blocky; hard, firm, sticky and plastic; common very fine roots; few very fine tubular pores; common slickensides; mildly alkaline; gradual smooth boundary.

Bk—47 to 60 inches; olive (5Y 4/3) silty clay, light gray (5Y 7/1) dry; moderate medium prismatic structure and strong medium subangular blocky; hard, firm, sticky and plastic; few very fine tubular pores; many prominent slickensides; strongly effervescent, lime segregated in common rounded medium-sized soft masses; mildly alkaline.

These soils are ponded and have a high water table late in winter and in spring. The particle-size control section averages 0 to 5 percent gravel and 40 to 60 percent clay. Depth to mottles is 20 to 40 inches. Depth to carbonates is 30 to 50 inches. Depth to bedrock and thickness of the solum are more than 60 inches. The profile is mildly alkaline or moderately alkaline. The B horizon cracks and develops slickensides. The cracks extend to the base of the A horizon and are open from about mid-August through mid-November.

The A horizon has hue of 2.5Y or 5Y, and it has value of 3 or 4 when moist and 5 to 7 when dry.

The Bw horizon is silty clay or clay. It has hue of 2.5Y or 5Y, value of 4 or 5 when moist, and chroma of 1 or 2 when moist or dry.

The Bk horizon is silty clay or clay. It has value of 4 or 5 when moist and 6 or 7 when dry, and it has chroma of 1 or 2 when moist or dry.

Lasere Series

The Lasere series consists of moderately deep, well drained soils that formed in colluvium and lake sediment over basalt and tuff. Lasere soils are on wave-cut benches on hills and mountains. Slopes are 2 to 50 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Lasere loam, 2 to 15 percent slopes, in an area of rangeland; in the NW1/4SE1/4SE1/4SE1/4 of sec. 10, T. 35 S., R. 19 E.

A1—0 to 3 inches; grayish brown (2.5Y 5/2) loam, very dark gray (10YR 3/1) moist; weak medium and fine subangular blocky structure parting to weak medium granular; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; 14 percent fine gravel; slightly acid; clear smooth boundary.

A2—3 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; 10 percent fine gravel; slightly acid; clear wavy boundary.

2Bt1—10 to 15 inches; brown (10YR 5/3) silty clay, olive brown (2.5Y 4/4) moist; moderate fine and medium subangular blocky structure; very hard, firm, sticky and very plastic; common very fine, fine, and medium roots; 5 percent fine gravel; many prominent clay films on faces of peds; slightly acid; clear wavy boundary.

2Bt2—15 to 23 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate medium and fine subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; common prominent clay films on faces of peds; neutral; abrupt wavy boundary.

3Cr—23 to 25 inches; pale yellow (2.5Y 7/4) weathered volcanic tuff; clear wavy boundary.

3R—25 inches; tuff.

The mollic epipedon is 7 to 15 inches thick and includes the upper part of the argillic horizon in some pedons. Thickness of the solum and depth to bedrock are 20 to 40 inches. The solum is slightly acid or neutral. These soils have a clay increase of 20 percent or more between the A and 2Bt horizons.

The A horizon has value of 3 to 5 when moist or dry, and it has chroma of 1 or 2 when moist or dry. It is 5 to 20 percent gravel and 0 to 25 percent cobbles and stones. The horizon is 5 to 15 inches thick. It is loam or very stony loam.

The 2Bt horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 2 to 5 when moist and 3 to 6 when dry; and chroma of 2 to 4 when moist or dry. Texture is mainly clay or silty clay, but it ranges to silty clay loam in the lower part. The horizon is 35 to 60 percent clay, but it averages about 50 percent clay. It is 0 to 10 percent rock fragments. Clay films are distinct or prominent.

Lobert Series

The Lobert series consists of very deep, well drained soils that formed in material derived from diatomite, lacustrine sediment, and ash. Lobert soils are on high terraces. Slopes are 2 to 15 percent. The mean annual precipitation is about 17 inches, and the mean annual air temperature is about 46 degrees F.

Typical pedon of Lobert loam, 2 to 15 percent slopes, in an area of woodland; about 10 miles northwest of Lakeview; in the SE1/4SE1/4SE1/4 NE1/4NE1/4 of sec. 21, T. 38 S., R. 19 E.

Oi—1 inch to 0; ponderosa pine needles.

A—0 to 2 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; slightly acid; abrupt smooth boundary.

AB—2 to 15 inches; dark brown (10YR 3/3) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine tubular pores; slightly acid; gradual smooth boundary.

Bw—15 to 29 inches; dark brown (7.5YR 3/3) loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine tubular pores; neutral; gradual smooth boundary.

Bq1—29 to 38 inches; dark brown (7.5YR 4/3) loam, pale brown (10YR 6/3) dry; weak coarse subangular blocky structure; hard, friable, sticky and slightly plastic; common fine roots; common fine tubular pores; 10 percent firm, brittle nodules 0.5 inch to 1.5 inches in diameter; neutral; clear smooth boundary.

Bq2—38 to 60 inches; dark brown (7.5YR 4/3) loam, pale brown (10YR 6/3) dry; massive; hard, friable, slightly sticky and slightly plastic; few fine roots;

many fine tubular pores; few thin slightly brittle lenses; slightly acid.

Depth to bedrock is more than 60 inches. The particle-size control section is 0 to 15 percent gravel and 10 to 18 percent clay. The mollic epipedon is 20 to 45 inches thick. The profile is moderately acid to neutral.

The A and AB horizons have value of 2 or 3 when moist and 4 or 5 when dry, and they have chroma of 2 or 3 when moist or dry.

The Bw horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry. It is loam, fine sandy loam, or sandy loam. In some pedons the horizon is as much as 20 percent durinodes by volume. The durinodes are brittle, but they are easily crushed by hand when moist.

The Bq horizon has value of 3 or 4 when moist, and it has chroma of 2 to 4 when moist or dry. It is loamy fine sand, fine sandy loam, or loam.

Locane Series

The Locane series consists of shallow, well drained soils that formed in colluvium and residuum derived from igneous rock. Locane soils are on mountains and tablelands. Slopes are 2 to 30 percent. The mean annual precipitation is about 10 inches, and the mean annual air temperature is about 43 degrees F.

Typical pedon of Locane cobbly clay loam in an area of Locane-Anawalt complex, 2 to 15 percent slopes, in an area of rangeland; about 2 miles north of Spalding Reservoir; in the NE¹/₄NE¹/₄ of sec. 1, T. 39 S., R. 28 E.

A1—0 to 2 inches; dark grayish brown (10YR 4/2) cobbly clay loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 10 percent cobbles and 10 percent gravel; mildly alkaline; clear smooth boundary.

A2—2 to 10 inches; brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots and few medium roots; common very fine tubular pores; 10 percent gravel; mildly alkaline; abrupt smooth boundary.

Bt1—10 to 15 inches; dark yellowish brown (10YR 3/4) very cobbly clay, light yellowish brown (10YR 6/4) dry; moderate medium prismatic structure parting to strong fine angular blocky; very hard, very firm, sticky and plastic; few very fine roots; few very fine tubular pores; many prominent clay films on face of peds; 30 percent cobbles and 20 percent gravel; moderately alkaline; clear smooth boundary.

Bt2—15 to 18 inches; dark yellowish brown (10YR 4/4) very cobbly clay, yellowish brown (10YR 5/4) dry; strong fine angular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; few very fine tubular pores; many prominent clay films on faces of peds; 20 percent cobbles and 30 percent gravel; moderately alkaline; clear smooth boundary.

R—18 inches; basalt.

The particle-size control section averages 35 to 50 percent rock fragments, mainly cobbles and gravel, and 40 to 50 percent clay. Thickness of the solum and depth to bedrock are 10 to 20 inches.

The A horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 2 or 3 when moist or dry.

The Bt horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. It is mildly alkaline or moderately alkaline.

Lofftus Series

The Lofftus series consists of soils that are moderately deep to a hardpan and are somewhat poorly drained. These soils formed in lacustrine sediment with an ash mantle. Lofftus soils are on low lake terraces. Slopes are 0 to 1 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Lofftus silt loam in an area of Lofftus-Mesman complex, 0 to 2 percent slopes, in an area of rangeland; about 10 miles southeast of Adel, in Coleman Valley; in the center of the SE¹/₄SE¹/₄ of sec. 7, T. 41 S., R. 25 E.

Akn—0 to 2 inches; dark grayish brown (10YR 4/2) silt loam, gray (10YR 6/1) dry; moderate very thin platy structure; slightly hard, friable, very sticky and plastic; many very fine and fine roots; common fine vesicular pores; strongly effervescent, carbonates are disseminated; white salt stains and black organic stains in patches on surface; very strongly alkaline; clear smooth boundary.

Bkn1—2 to 12 inches; dark grayish brown (2.5Y 4/2) silt loam, light gray (10YR 7/1) dry; weak very thin platy structure; slightly hard, friable, very sticky and plastic; many very fine and fine roots; common very fine tubular pores; strongly effervescent, carbonates are disseminated; strongly alkaline; clear smooth boundary.

Bkn2—12 to 30 inches; dark grayish brown (2.5Y 4/2) silt loam, light gray (10YR 7/1) dry; weak very thin platy structure; soft, very friable, very sticky and plastic; many fine and medium roots to a depth of 24 inches and few roots below; violently effervescent, carbonates are disseminated; strongly alkaline; abrupt smooth boundary.

2Bkqm—30 to 50 inches; dark grayish brown (2.5Y 4/2) hardpan, light gray (10YR 7/1) dry; strongly cemented; very hard, very firm; few fine tubular pores; coatings of silica in some pores and on the surface of the hardpan; violently effervescent, carbonates are disseminated; brittle; strongly alkaline; abrupt wavy boundary.

3C—50 to 60 inches; stratified loamy and silty lacustrine sediment.

These soils have a high water table in spring and early in summer. Depth to the strongly cemented hardpan is 20 to 40 inches. Depth to bedrock is more than 60 inches. The particle-size control section has bulk density of 0.80 to 1.00 grams per cubic centimeter above the hardpan, electrical conductivity of 8 to 16 millimhos per centimeter, sodium adsorption ratio of 25 to 50, and calcium carbonate content of 2 to 8 percent. The profile is strongly alkaline or very strongly alkaline throughout.

The A horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 1 or 2 when moist. The sand fraction is mostly very fine and fine sand that is high in content of volcanic ash. An efflorescence of white salt and black to dark brown organic stains commonly is on the surface.

The B horizon has hue of 10YR, 2.5Y, or neutral; value of 4 or 5 when moist and 6 or 7 when dry; and chroma of 0 to 2 when moist or dry. The sand fraction is mostly very fine and fine sand that is high in content of volcanic ash. Layers of white ash a few inches thick are in some pedons.

The 2Bkqm horizon is strongly cemented and is 15 to 30 inches thick.

Longjohn Series

The Longjohn series consists of very deep, somewhat excessively drained soils that formed in colluvium and residuum derived mainly from rhyolite. Longjohn soils are on mountains. Slopes are 15 to 50 percent. The mean annual precipitation is about 32 inches, and the mean annual air temperature is about 42 degrees F.

Typical pedon of Longjohn gravelly coarse sandy loam, 15 to 50 percent north slopes, in an area of woodland; in the NE$^1/_4$SE$^1/_4$ of sec. 6, T. 38 S., R. 22 E.

Oi—1 inch to 0; pine needles.

A1—0 to 1 inch; black (10YR 2/1) gravelly coarse sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and medium roots; many fine and medium irregular pores; 15 percent gravel; very strongly acid; abrupt smooth boundary.

A2—1 inch to 5 inches; dark brown (10YR 3/3) gravelly coarse sandy loam, yellowish brown (10YR 5/4) dry; weak fine and medium granular structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; many fine and medium irregular pores; 25 percent gravel; very strongly acid; abrupt smooth boundary.

A3—5 to 13 inches; dark brown (10YR 3/3) very gravelly coarse sandy loam, brown (10YR 5/3) dry; weak fine and medium granular structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; many fine and medium irregular pores; 40 percent gravel; strongly acid; gradual wavy boundary.

Bw—13 to 24 inches; dark yellowish brown (10YR 4/4) very gravelly coarse sandy loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; many fine and medium irregular pores; 45 percent gravel; strongly acid; gradual wavy boundary.

C1—24 to 42 inches; brown (10YR 5/3) extremely cobbly coarse sandy loam, very pale brown (10YR 7/3) dry; massive; soft, very friable, nonsticky and nonplastic; common fine and few medium roots; many fine and medium irregular pores; 5 percent stones, 25 percent cobbles, and 40 percent gravel; strongly acid; gradual wavy boundary.

C2—42 to 60 inches; brown (10YR 5/3) extremely cobbly coarse sandy loam, very pale brown (10YR 7/3) dry; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; many fine and medium irregular pores; 15 percent stones, 35 percent cobbles, and 30 percent gravel; strongly acid.

Depth to bedrock is more than 60 inches. The particle-size control section averages 35 to 60 percent rock fragments. Base saturation is 5 to 20 percent. The profile is 2 to 10 percent clay. The very fine sand fraction is 50 to 70 percent glass. Bulk density is 0.85 to 0.95 grams per cubic centimeter. The profile is very strongly acid or strongly acid.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist and 2 to 4 when dry.

The Bw horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. It is very gravelly coarse sandy loam or very gravelly sandy loam. The horizon is 35 to 60 percent rock fragments, of which 0 to 10 percent is cobbles and 35 to 50 percent is gravel.

The C horizon has value of 4 or 5 when moist and 6 or 7 when dry, and it has chroma of 3 or 4 when moist or dry. It is extremely cobbly coarse sandy loam or extremely gravelly coarse sandy loam. This horizon is 60 to 85 percent rock fragments, of which 20 to 35 percent is cobbles, 5 to 15 percent is stones, and 30 to 50 percent is gravel.

Lorella Series

The Lorella series consists of shallow, well drained soils that formed in colluvium and residuum derived from tuff and basalt. Lorella soils are on hills, mountains, and tablelands. Slopes are 2 to 70 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Lorella very stony loam, 2 to 30 percent slopes, in an area of rangeland; about 10 miles northwest of Lakeview; in the NE$^1/_4$NE$^1/_4$SW$^1/_4$ of sec. 30, T. 37 S., R. 20 E.

A—0 to 4 inches; dark brown (10YR 3/2) very stony loam, dark grayish brown (10YR 4/2) dry; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 25 percent stones, 15 percent cobbles, and 15 percent gravel; slightly acid; clear smooth boundary.

Bt1—4 to 11 inches; dark brown (7.5YR 3/3) very cobbly clay loam, dark brown (7.5YR 4/2) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; few faint clay films on faces of peds and in pores; 20 percent gravel and 20 percent cobbles; neutral; clear smooth boundary.

Bt2—11 to 19 inches; dark brown (7.5YR 3/3) very cobbly clay loam, brown (7.5YR 5/2) dry; moderate fine angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine tubular pores; nearly continuous cutans on faces of peds, few faint clay films in pores; about 20 percent gravel and 30 percent cobbles; neutral; abrupt smooth boundary.

R—19 inches; tuff.

Thickness of the solum and depth to bedrock are 10 to 20 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 5 to 35 percent gravel and 0 to 50 percent cobbles and stones. The horizon is gravelly sandy loam, very gravelly loam, very gravelly clay loam, or very stony loam. It is slightly acid or neutral.

The Bt horizon has hue of 10YR or 7.5YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist or dry. It is clay loam or clay and averages 35 to 50 percent clay. The horizon is 35 to 60 percent rock fragments, of which 5 to 50 percent is gravel and 10 to 45 percent is cobbles and stones. The horizon is neutral or mildly alkaline.

Macyflet Series

The Macyflet series consists of very deep, moderately well drained soils that formed in lacustrine deposits derived from basalt and tuff. Macyflet soils are in basins on tablelands. Slopes are 0 to 2 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 43 degrees F.

Typical pedon of Macyflet silty clay loam in an area of Macyflet-Boulder Lake association, 0 to 2 percent slopes, in an area of rangeland; about 50 feet north of the Nevada state line, on Macy Flat; about 2,700 feet south and 1,600 feet west of the northeast corner of sec. 22, T. 41 S., R. 26 E.

A1—0 to 2 inches; dark grayish brown (10YR 4/2) silty clay loam, light gray (10YR 7/2) dry; weak thick platy structure; slightly hard, very friable, sticky and plastic; common fine and medium roots; many very fine and fine vesicular pores; neutral; abrupt smooth boundary.

A2—2 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; massive; slightly hard, very friable, sticky and plastic; common very fine, fine, and medium roots; few fine tubular pores and many very fine interstitial pores; neutral; abrupt smooth boundary.

Bt1—9 to 15 inches; brown (10YR 4/3) clay, light brownish gray (10YR 6/2) dry; strong medium prismatic structure parting to moderate medium angular blocky; hard, very friable, very sticky and very plastic; few fine and medium roots; common very fine interstitial pores and few very fine and fine tubular pores; continuous pressure faces; neutral; abrupt smooth boundary.

Bt2—15 to 32 inches; brown (10YR 4/3) clay, pale brown (10YR 6/3) dry; strong medium prismatic structure; very hard, very firm, very sticky and very plastic; few fine and medium roots; very few fine tubular pores; continuous pressure faces; neutral; gradual smooth boundary.

Bt3—32 to 47 inches; olive brown (2.5Y 4/4) clay, light yellowish brown (10YR 6/4) dry; few fine distinct light olive brown (2.5Y 5/6) mottled manganese stains; strong fine angular blocky structure; very hard, very firm, very sticky and, very plastic; few very fine roots; few fine tubular pores; continuous pressure faces; mildly alkaline; abrupt smooth boundary.

2C1—47 to 49 inches; light gray (10YR 7/1) loamy sand, white (10YR 8/1) dry; massive; hard, very friable, nonsticky and nonplastic; common fine interstitial pores; mildly alkaline; abrupt smooth boundary.

3C2—49 to 60 inches; light brownish gray (2.5Y 6/2) loamy fine sand, light gray (2.5Y 7/2) dry; common fine prominent brownish yellow (10YR 6/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine interstitial pores; moderately alkaline.

Depth to bedrock is more than 60 inches. These soils have a high water table late in winter and in spring.

The A horizon has value of 3 to 5 when moist and 6 or 7 when dry, and it has chroma of 2 or 3 when moist or dry. It slightly acid to mildly alkaline.

The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist or dry. It is 60 to 70 percent clay. The horizon is slightly acid to mildly alkaline.

The C horizon has hue of 10YR or 2.5Y. It is loamy sand or loamy fine sand and is high in content of volcanic ash. The horizon is mildly alkaline to strongly alkaline.

Madeline Series

The Madeline series consists of shallow, well drained soils that formed in colluvium and residuum derived from basalt and tuff. Madeline soils are on tablelands. Slopes are 5 to 30 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Madeline gravelly loam in an area of Madeline-Ninemile complex, 5 to 15 percent slopes, in an area of rangeland; in the SE1/4SW1/4NW1/4 of sec. 11, T. 41 S., R. 26 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly loam, brown (10YR 5/3) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; common very fine discontinuous vesicular pores; 5 percent cobbles and 10 percent gravel; neutral; clear wavy boundary.

A2—4 to 12 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; few very fine vesicular pores; 5 percent cobbles and 10 percent gravel; neutral; clear smooth boundary.

2Bt—12 to 19 inches; brown (7.5YR 4/4) gravelly clay loam, brown (7.5YR 6/4) dry; moderate medium angular blocky structure; hard, firm, sticky and plastic; common very fine roots; few very fine irregular pores; 5 percent cobbles and 25 percent gravel; many faint clay films in pores and on faces of peds; mildly alkaline; abrupt irregular boundary.

2R—19 inches; tuff; coatings of silica and calcium carbonate in fractures.

Depth to bedrock is 10 to 20 inches. The particle-size control section is 35 to 60 percent clay and 15 to 35 percent rock fragments.

The A horizon has chroma of 2 or 3 when moist or dry. It is slightly acid or neutral. It is 7 to 15 inches thick.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 or 4 moist or dry. It is gravelly clay loam or gravelly clay. The horizon has common to many, faint to distinct clay films. It has moderate fine prismatic structure or moderate medium or coarse angular blocky structure. The horizon is slightly acid to mildly alkaline.

Malin Series

The Malin series consists of very deep, poorly drained soils that formed in mixed alluvial and lacustrine material that includes a small amount of ash. Malin soils are on alluvial flats in lake basins. Slopes are 0 to 1 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Malin silty clay loam, 0 to 1 percent slopes, in an area of rangeland; about 1.25 miles south of Lakeview; about 1,700 feet east and 1,300 feet south of the northwest corner of sec. 27, T. 39 S., R. 20 E.

Akn—0 to 10 inches; black (N 2/0) silty clay loam, dark gray (N 4/0) dry; weak thin platy structure; hard, firm, sticky and plastic; many very fine roots; many very fine pores; strongly effervescent; strongly alkaline; clear smooth boundary.

Bkn1—10 to 15 inches; very dark gray (N 3/0) silty clay loam, gray (N 6/0) dry; weak fine angular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine pores; strongly effervescent; strongly alkaline; clear smooth boundary.

Bkn2—15 to 25 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, grayish brown (2.5Y 5/2) dry;

many medium very dark gray (N 3/0) mottles; weak fine angular blocky structure; hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores; strongly effervescent; strongly alkaline; clear smooth boundary.

2Bkn3—25 to 37 inches; grayish brown (2.5Y 5/2) clay loam, light gray (2.5Y 7/2) dry; many very fine very dark gray (N 3/0) mottles; massive; hard, firm, sticky and plastic; many very fine roots; few very fine tubular pores; strongly effervescent; strongly alkaline; clear smooth boundary.

2Bkn4—37 to 60 inches; dark grayish brown (10YR 4/2) clay loam, light brownish gray (10YR 6/2) dry; many very fine very dark gray (N 3/0) mottles; massive; very hard, firm, sticky and plastic; common very fine roots; few very fine tubular pores; strongly effervescent; strongly alkaline.

Depth to bedrock is more than 60 inches. These soils are subject to rare flooding and have a high water table in spring and early in summer. The mollic epipedon is 10 to 24 inches thick. The sodium adsorption ratio is 20 to 30 in the mollic epipedon, and the ratio decreases as depth increases. The profile is calcareous throughout. The particle-size control section is 35 to 50 percent clay and more than 15 percent material that is coarser than very fine sand.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 0 or 1 when moist or dry. It is strongly alkaline or very strongly alkaline.

The B horizon has value of 3 to 5 when moist and 5 to 7 when dry, and it has chroma of 0 to 2 when moist or dry. It is clay loam, silty clay loam, or silty clay. The sodium adsorption ratio is 13 to 30. The horizon is moderately alkaline or strongly alkaline, and it decreases in alkalinity as depth increases.

Mascamp Series

The Mascamp series consists of shallow, well drained soils that formed in colluvium and residuum. Mascamp soils are on the sides and toe slopes of mountains. Slopes are 15 to 50 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Mascamp very gravelly loam in an area of Newlands-Hart-Mascamp complex, 15 to 30 percent slopes, in an area of rangeland; in the SW1/4NW1/4NW1/4 of sec. 14, T. 37 S., R. 22 E.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) very gravelly loam, dark brown (10YR 4/3) dry; weak very fine granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; 50 percent gravel; neutral; clear smooth boundary.

Bt1—2 to 5 inches; very dark grayish brown (10YR 3/2) very gravelly clay loam, dark brown (10YR 4/3) dry; moderate medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable, sticky and slightly plastic; many very fine and fine roots; common very fine tubular pores; common faint clay films on faces of peds and in pores; 40 percent gravel; neutral; clear smooth boundary.

Bt2—5 to 12 inches; dark brown (7.5YR 3/3) very gravelly clay loam, dark brown (7.5YR 4/4) dry; moderate fine subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common very fine and fine roots; few fine tubular pores; common faint clay films on faces of peds and in pores; 40 percent gravel; neutral; clear irregular boundary.

R—12 inches; basalt.

Depth to bedrock is 12 to 20 inches. The mollic epipedon is 7 to 12 inches. The particle-size control section is 25 to 35 percent clay and 40 to 60 percent rock fragments. It is slightly acid or neutral.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5 when dry, and chroma of 2 or 3 when moist and 3 or 4 when dry. It is very gravelly loam, very gravelly sandy clay loam, or very gravelly clay loam.

McConnel Series

The McConnel series consists of very deep, somewhat excessively drained soils that formed in gravelly alluvium derived from basalt and tuff. McConnel soils are on lake terraces and fans. Slopes are 0 to 50 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 49 degrees F.

Typical pedon of McConnel very gravelly sandy loam, 2 to 15 percent slopes (fig. 26), in an area of rangeland; in the NW1/4SE1/4NE1/4 of sec. 8, T. 36 S., R. 24 E.

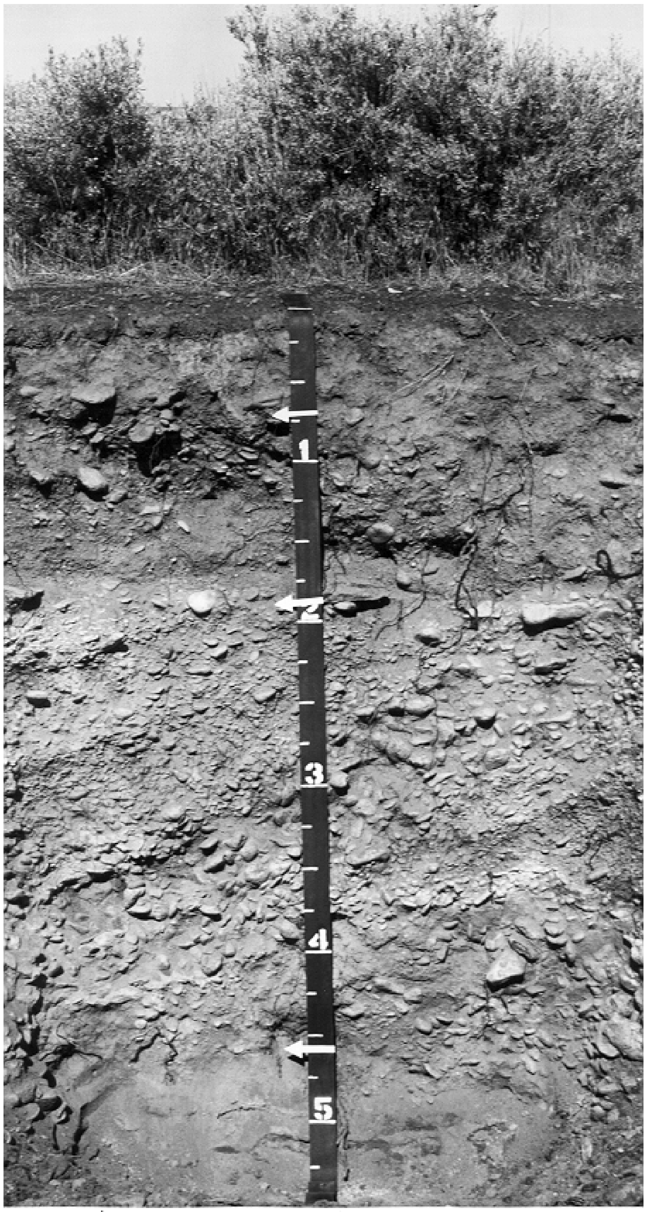


Figure 26.—Profile of McConnel very gravelly sandy loam, 2 to 15 percent slopes. The discontinuity between the very gravelly surface mantle and the extremely gravelly loamy coarse sand lower part is at a depth of about 22 inches.

A—0 to 10 inches; dark yellowish brown (10YR 3/4) very gravelly sandy loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine to coarse roots; 40 percent gravel; mildly alkaline; abrupt smooth boundary.

Bk1—10 to 22 inches; brown (10YR 4/3) very gravelly coarse sandy loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; 50 percent fine gravel; strongly effervescent, carbonates segregated in common medium irregularly shaped lenses; moderately alkaline; abrupt smooth boundary.

2Bk2—22 to 47 inches; multicolored extremely gravelly loamy coarse sand; single grain; loose, nonsticky and nonplastic; few very fine roots; 80 percent gravel; strongly effervescent, carbonates segregated in few large irregularly shaped weakly cemented lenses; moderately alkaline; abrupt smooth boundary.

2C—47 to 60 inches; multicolored extremely gravelly loamy coarse sand; single grain; loose, nonsticky and nonplastic; 60 percent fine gravel; moderately alkaline.

Depth to bedrock is more than 60 inches. Depth to the multicolored sand and gravel is 10 to 25 inches. Depth to carbonates is 10 to 20 inches. The particle-size control section averages 0 to 5 percent clay and 50 to 80 percent rock fragments, mainly gravel.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. It is gravelly sandy loam, extremely stony loam, or very gravelly sandy loam.

The Bk horizon or the Bw horizon, where present, has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 to 4 when moist or dry. The horizon is 35 to 50 gravel. It is mildly alkaline or moderately alkaline.

The 2Bk and 2C horizons have value of 3 to 5 when moist and 5 to 7 when dry, and they have chroma of 2 to 4 when moist or dry. These horizons are 50 to 80 percent rock fragments, most of which are gravel and are less than 1/4 inch in diameter. The horizons are stratified very gravelly or extremely gravelly coarse sand to loamy sand. They are moderately alkaline to very strongly alkaline, nonsaline or slightly saline, and nonsodic to moderately sodic.

McNye Series

The McNye series consists of deep, somewhat excessively drained soils that formed in alluvium over basalt. McNye soils are on bedrock-controlled lake terraces. Slopes are 2 to 50 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 49 degrees F.

Typical pedon of McNye cobbly loam in an area of McNye-Wildhill complex, 2 to 15 percent slopes, in an area of rangeland; along a jeep trail 1/4 mile east of Soda Lake and 1/2 mile west of Twenty Mile Slough; in the NW1/4SE1/4 of sec. 1, T. 40 S., R. 24 E.

A—0 to 7 inches; brown (10YR 4/3) cobbly loam, pale brown (10YR 6/3) dry; moderate thick platy structure parting to moderate medium platy; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine irregular and tubular pores; 5 percent stones, 15 percent cobbles, and 10 percent gravel; mildly alkaline; clear smooth boundary.

Bk—7 to 16 inches; brown (10YR 4/3) very gravelly sandy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; common fine irregular pores; 10 percent stones, 10 percent cobbles, and 35 percent gravel; slightly effervescent, carbonates are disseminated; few fine disseminated masses of lime; moderately alkaline; clear wavy boundary.

BC—16 to 27 inches; brown (10YR 4/3) extremely cobbly loamy sand, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; many fine irregular pores; 20 percent stones, 35 percent cobbles, and 25 percent gravel; moderately alkaline; gradual wavy boundary.

C—27 to 42 inches; brown (10YR 4/3) extremely gravelly loamy sand, light yellowish brown (10YR 6/4) dry; single grain; loose, nonsticky and nonplastic; few fine and medium roots; many fine irregular pores; 5 percent cobbles and 75 percent gravel; mildly alkaline; abrupt smooth boundary.

2R—42 inches; fractured basalt.

Depth to bedrock is 40 to 60 inches. Thickness of the solum is 10 to 30 inches. Depth to disseminated carbonates is 5 to 15 inches. The particle-size control section is 50 to 85 percent rock fragments, mainly gravel and cobbles, and 0 to 10 percent clay.

The A horizon has value of 3 to 5 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry. It is 1 to 2 percent organic matter.

The Bk horizon has value of 4 or 5 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. It is mildly alkaline or moderately alkaline.

Merlin Series

The Merlin series consists of shallow, well drained soils that formed in residuum derived from basalt and tuff. Merlin soils are on tablelands. Slopes are 0 to 15 percent. The mean annual precipitation is about 20 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Merlin extremely stony loam, 0 to 15 percent slopes, in an area of rangeland; in the NW1/4NE1/4 of sec. 23, T. 36 S., R. 21 E.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) extremely stony loam, brown (10YR 5/3) dry; moderate medium platy structure parting to moderate fine granular; slightly hard, friable, sticky and slightly plastic; many very fine and fine roots; common very fine and fine irregular pores; 15 percent stones, 20 percent cobbles, and 25 percent gravel; neutral; clear smooth boundary.

BAt—4 to 7 inches; dark brown (10YR 3/3) gravelly clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, very sticky and plastic; many very fine and fine roots; common very fine and fine tubular pores; common faint clay films on faces of peds; 5 percent cobbles and 15 percent gravel; neutral; clear smooth boundary.

Bt2—7 to 12 inches; dark brown (10YR 3/3) clay, brown (7.5YR 5/3) dry; moderate fine subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; common distinct clay films on faces of peds and in pores; 10 percent gravel; neutral; abrupt smooth boundary.

Bt3—12 to 18 inches; dark brown (7.5YR 4/4) clay, brown (7.5YR 5/4) dry; strong fine angular blocky structure; very hard, firm, very sticky and very plastic; few fine roots; few fine tubular pores; many distinct clay films on faces of peds and in pores; 55 percent soft gravel; neutral; abrupt smooth boundary.

R—18 inches; hard fractured basalt.

Depth to hard bedrock is 10 to 20 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The BAt horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry. It is clay loam or gravelly clay loam. The horizon is 0 to 15 percent gravel, 0 to 15 percent cobbles, and 30 to 40 percent clay.

The Bt horizon has colors similar to those of the BAt horizon, but chroma ranges to 4 when moist. The horizon is 60 to 70 percent clay.

A Cr horizon is present in some pedons.

Mesman Series

The Mesman series consists of very deep, well drained soils that formed in lacustrine sediment. Mesman soils are on lake terraces. Slopes are 0 to 15 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon Mesman fine sandy loam in an area of Als-Mesman complex, 0 to 15 percent slopes, in an area of rangeland; in the SE1/4SW1/4NE1/4 of sec. 4, T. 36 S., R. 24 E.

Akn—0 to 9 inches; dark brown (10YR 3/3) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure parting to weak fine subangular blocky; soft, very friable, nonsticky and slightly plastic; many very fine to coarse roots; slightly effervescent; sodium adsorption ratio is 26; electrical conductivity is 3.9 millimhos per centimeter; strongly alkaline; abrupt smooth boundary.

2Btkn—9 to 20 inches; brown (10YR 4/3) sandy clay loam, pale brown (10YR 6/3) dry; weak very fine prismatic structure parting to moderate thin platy; slightly hard, friable, sticky and slightly plastic; common very fine roots; few very fine discontinuous random vesicular pores; slightly effervescent (trace of calcium carbonates); carbonates are disseminated; sodium absorption ratio is 53; electrical conductivity is 28 millimhos per centimeter; common distinct clay films on faces of peds; moderately alkaline; abrupt smooth boundary.

3Bkn1—20 to 25 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; massive; slightly hard, firm, slightly sticky and slightly plastic; few very fine roots; slightly effervescent (1 percent calcium carbonates), carbonates segregated in common medium irregular seams and filaments; sodium adsorption ratio is 61; electrical conductivity is 43 millimhos per centimeter; moderately alkaline; clear wavy boundary.

4Bkn2—25 to 35 inches; brown (10YR 4/3) very fine sandy loam, pale brown (10YR 6/3) dry; massive; soft, friable, nonsticky and slightly plastic; few very fine roots; 5 percent fine gravel; slightly effervescent (1 percent calcium carbonates), carbonates segregated in few medium irregular seams and filaments; moderately alkaline; clear wavy boundary.

5Bkn3—35 to 60 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; massive; hard, brittle, extremely firm, slightly sticky and slightly plastic; slightly effervescent (3 percent calcium carbonates); sodium adsorption ratio is 52; electrical conductivity is 31 millimhos per centimeter; moderately alkaline.

Depth to bedrock is more than 60 inches. The organic matter content of the surface layer is 1 to 2 percent. The particle-size control section averages 18 to 35 percent clay and 25 to 50 percent sand, mostly very fine or fine sand. Depth to consolidated, compacted sediment is 20 to 40 inches.

The A horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 or 3 when moist or dry. It has granular or blocky structure. Sodium adsorption ratio is 5 to 30, and electrical conductivity is 2 to 8 millimhos per centimeter. The horizon is moderately alkaline or strongly alkaline.

The 2Bt horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry. It is loam, clay loam, or sandy clay loam. The horizon has prismatic or columnar structure parting to blocky or platy. Sodium adsorption ratio is 25 to 70, and electrical conductivity is more than 16 millimhos per centimeter.

The Bkn horizon has value of 3 to 6 when moist and 6 to 8 when dry, and it has chroma of 2 or 3 when moist or dry. It is stratified very fine sandy loam, silt loam, or loam. Lenses of white volcanic ash are present in some pedons. The horizon commonly is massive, but it has strong fine and medium angular blocky rocklike structure in some areas. Sodium adsorption ratio is 20 to 70, and electrical conductivity is more than 16 millimhos per centimeter.

Mound Series

The Mound series consists of deep, well drained soils that formed in colluvium over residuum derived from basalt and tuff. Mound soils are on mountains. Slopes are 0 to 70 percent. The mean annual precipitation is about 22 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Mound stony loam in an area of Mound-Royst-Nuss association, 15 to 40 percent slopes, in an area of woodland; southwest of Camas Prairie, in the NW1/4SW1/4SW1/4 of sec. 8, T. 39 S., R. 21 E.

Oi—2 inches to 0; partially decomposed ponderosa pine needles, cones, and small limbs.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) stony loam, dark brown (10YR 3/3) dry; weak fine and very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots and common medium roots; 20 percent rock fragments, including 10 percent stones, 5 percent cobbles, and 5 percent gravel; slightly acid; clear smooth boundary.

A2—2 to 13 inches; very dark grayish brown (10YR 3/2) stony loam, dark brown (10YR 3/3) dry; weak medium and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; 20 percent rock fragments, including 10 percent stones, 5 percent cobbles, and 5 percent gravel; slightly acid; clear smooth boundary.

2Bt1—13 to 18 inches; dark brown (10YR 3/3) very cobbly clay loam, dark brown (10YR 4/3) dry; moderate medium and fine subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; few faint clay films on faces of peds and in some pores; 40 percent rock fragments, including 5 percent stones, 25 percent cobbles, and 10 percent gravel; slightly acid; clear smooth boundary.

2Bt2—18 to 29 inches; dark brown (10YR 3/3) very cobbly clay, dark brown (10YR 4/3) dry; moderate coarse and medium subangular structure; very hard, firm, sticky and plastic; few very fine and fine roots; many very fine tubular pores; many prominent clay films on faces of peds and in pores; 45 percent rock fragments, including 10 percent stones, 25 percent cobbles, and 10 percent gravel; slightly acid; clear smooth boundary.

2C—29 to 42 inches; dark brown (7.5YR 4/4) clay loam, light brown (7.5YR 6/3) dry; massive; slightly hard, firm, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; 60 percent soft weathered tuff fragments, 5 percent cobbles, and 5 percent gravel; slightly acid; abrupt smooth boundary.

2Cr—42 to 45 inches; brown (7.5YR 4/4) partially weathered tuff, light brown (7.5YR 6/3) dry; clear wavy boundary.

2R—45 inches; brown (7.5YR 4/4) tuff, light brown (7.5YR 6/3) dry.

The mollic epipedon is 20 to 35 inches thick, and it includes all or most of the argillic horizon. Depth to bedrock is 40 to 60 inches. The particle-size control section averages 35 to 50 percent clay and 35 to 50 percent rock fragments. The base saturation of the upper 30 inches is 60 to 85 percent, and that of the lower part is less than 75 percent. The Oi horizon is $^1/_2$ inch to 2 inches thick.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry, and it has chroma of 2 or 3 when moist and 1 or 2 when dry. It is 20 to 45 percent rock fragments, including 0 to 15 percent boulders, 10 to 20 percent stones, 5 to 10 percent cobbles, and 5 to 15 percent gravel. The horizon is 4 to 6 percent organic matter. It is stony loam or very bouldery loam.

Hue of the 2Bt horizon commonly is 10YR, but it ranges to 7.5YR or 2.5Y. The horizon is clay loam, clay, silty clay, or silty clay loam and is 35 to 50 percent clay. It is 35 to 50 percent rock fragments, including 0 to 10 percent stones, 15 to 30 percent cobbles, and 10 to 20 percent gravel. The horizon is slightly acid or neutral.

The 2C horizon is 35 to 60 percent soft rock fragments and less than 20 percent hard rock fragments. It is clay loam or gravelly clay loam. It is slightly acid or neutral.

Mudpot Series

The Mudpot series consists of very deep, poorly drained soils that formed in lacustrine sediment. Mudpot soils are on lake terraces. Slopes are 0 to 2 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 46 degrees F.

Typical pedon of Mudpot silty clay, 0 to 2 percent slopes, in an area of rangeland; about 1,200 feet east of Bureau of Land Management Road 6106; at the north end of Guano Lake; in the NE$^1/_4$SW$^1/_4$ of sec. 35, T. 39 S., R. 27 E.

A—0 to 5 inches; dark grayish brown (2.5Y 4/2) silty clay, grayish brown (2.5Y 5/2) dry; weak medium prismatic structure and moderate thin platy; slightly hard, very friable, sticky and slightly plastic; few very fine roots; common very fine and many fine vesicular pores; moderately alkaline; gradual smooth boundary.

Bw—5 to 14 inches; grayish brown (2.5Y 5/2) silty clay, light brownish gray (2.5Y 6/2) dry; few fine prominent dark reddish brown (5YR 3/3) mottles; weak fine subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine roots; few very fine vesicular pores; few slickensides; moderately alkaline; clear smooth boundary.

Bkss—14 to 49 inches; grayish brown (2.5Y 5/2) silty clay, light brownish gray (2.5Y 6/2) dry; moderate coarse subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; many slickensides; slightly effervescent; lime segregated in common rounded medium-sized soft masses; moderately alkaline; clear smooth boundary.

Bk—49 to 60 inches; grayish brown (2.5Y 5/2) silty clay, light gray (2.5Y 7/2) dry; massive; hard, firm, sticky and plastic; few very fine roots; common very fine tubular pores; strongly effervescent; lime segregated in common rounded medium-sized soft masses; moderately alkaline.

Depth to bedrock is more than 60 inches. These soils are ponded and have a high water table late in winter and in spring and summer. Depth to mottles is 3 to 15 inches. Depth to carbonates is 10 to 30 inches.

The B horizon cracks and develops slickensides. The cracks extend to the base of the A horizon, and they are open from about mid-August through mid-November. The particle-size control section averages 0 to 5 percent gravel and 40 to 60 percent clay. The profile has hue of 2.5Y or 5Y.

The A horizon has value of 5 to 7 when dry and 3 or 4 when moist, and it has chroma of 1 or 2 when dry.

The Bw horizon has value of 4 or 5 when moist and 6 or 7 when dry, and it has chroma of 1 or 2 when moist or dry. It is clay, silty clay, or silty clay loam.

The Bk horizon has value 4 or 5 when moist and 6 or 7 when dry, and it has chroma 1 or 2 when moist or dry. It is silty clay or clay.

Newlands Series

The Newlands series consists of deep, well drained soils that formed in colluvium derived from tuff and basalt. Newlands soils are on mountains. Slopes are 5 to 50 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Newlands loam in an area of Newlands-Hart complex, 5 to 15 percent slopes, in an area of rangeland; in the NE$^1/_4$NE$^1/_4$NW$^1/_4$ of sec. 12, T. 38 S., R. 22 E.

A1—0 to 2 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; strong very fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; 10 percent fine gravel; neutral; clear wavy boundary.

A2—2 to 7 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate very fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots and few medium roots; 10 percent fine gravel; neutral; clear wavy boundary.

2Bt1—7 to 16 inches; dark brown (7.5YR 3/3) gravelly clay loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine roots; few very fine and fine tubular pores; few faint clay films on faces of peds and in pores; 15 percent fine gravel; mildly alkaline; clear wavy boundary.

2Bt2—16 to 36 inches; dark brown (7.5YR 3/4) gravelly clay loam, brown (7.5YR 5/4) dry; moderate fine angular blocky structure; hard, friable, sticky and plastic; few very fine roots; few very fine tubular pores; many prominent clay films on faces of peds and in pores; 10 percent cobbles, 5 percent coarse gravel, and 15 percent fine gravel; mildly alkaline; gradual wavy boundary.

2BCt—36 to 49 inches; strong brown (7.5YR 4/6) gravelly clay loam, reddish yellow (7.5YR 6/6) dry; massive; slightly hard, friable, sticky and plastic; common very fine tubular pores; few faint clay films in pores; 10 percent coarse gravel and 20 percent fine gravel; mildly alkaline; clear wavy boundary.

2R—49 inches; slightly weathered tuff.

Depth to bedrock is 40 to 60 inches. The mollic epipedon is 10 to 16 inches thick and includes the upper part of the argillic horizon. The particle-size control section is 27 to 35 percent clay and 15 to 35 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry. It is slightly acid or neutral.

The 2Bt horizon has hue of 10YR to 5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is gravelly clay loam or gravelly sandy clay loam. It is slightly acid to mildly alkaline.

The 2BCt horizon has hue of 7.5YR or 5YR, and it has chroma of 4 to 6 when moist or dry. It is gravelly clay loam or gravelly sandy clay loam. It is slightly acid to mildly alkaline.

The Newlands soils in this survey area are a taxadjunct to the Newlands series because they have a frigid soil temperature regime.

Ninemile Series

The Ninemile series consists of shallow, well drained soils that formed in residuum and colluvium derived from basalt and tuff. Ninemile soils are on tablelands and mountains. Slopes are 2 to 50 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Ninemile extremely gravelly loam, thin surface, 2 to 15 percent slopes, in an area of rangeland; in the SW$^1/_4$NE$^1/_4$NE$^1/_4$ of sec. 31, T. 37 S., R. 23 E.

A—0 to 2 inches; dark brown (10YR 3/3) extremely gravelly loam, brown (10YR 4/3) dry; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine vesicular pores; 55 percent gravel that is mostly fine gravel, 10 percent cobbles, and 1 percent stones; neutral; abrupt smooth boundary.

2Bt1—2 to 8 inches; dark brown (10YR 3/3) clay, dark brown (10YR 3/3) dry; strong fine prismatic structure and strong fine angular blocky; extremely hard, very firm, very sticky and very plastic; common very fine and fine roots; many very fine irregular pores; common distinct clay films on faces of peds and in pores; 10 percent gravel, mostly fine gravel; neutral; gradual smooth boundary.

2Bt2—8 to 17 inches; dark brown (10YR 3/3) gravelly clay, dark brown (10YR 3/3) dry; strong fine prismatic structure and strong fine angular blocky; extremely hard, firm, very sticky and very plastic; few very fine and fine roots; many distinct clay films on faces of peds; 20 percent fine gravel; neutral; abrupt smooth boundary.

2R—17 inches; tuff; coatings of calcium carbonate and silica in fractures.

Depth to bedrock is 10 to 20 inches. The mollic epipedon is 6 to 17 inches thick, and it includes part or all of the argillic horizon. The particle-size control section averages 40 to 60 percent clay and 0 to 30 percent rock fragments.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is very gravelly loam, extremely gravelly loam, or very cobbly loam. The horizon is neutral or mildly alkaline. It is 1 inch to 7 inches thick.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma 3 or 4 when moist or dry. It is clay or gravelly clay and is 40 to 60 percent clay and 0 to 30 percent gravel. It is neutral or mildly alkaline.

Norad Series

The Norad series consists of very deep, moderately well drained soils that formed in silty lacustrine sediment. Norad soils are on lake terraces. Slopes are 0 to 2 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Norad silt loam, 0 to 2 percent slopes, in an area of rangeland; about 1/4 mile north of the north shore of Flook Lake, in Hart Mountain National Antelope Refuge; about 1,600 feet east and 1,100 feet south of the northwest corner of sec. 34, T. 34 S., R. 27 E.

A1—0 to 2 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; weak thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine and fine vesicular pores; neutral; abrupt smooth boundary.

A2—2 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam, gray (10YR 6/1) and grayish brown (10YR 5/2) dry; weak thin platy structure; hard, firm, sticky and plastic; common very fine roots; many very fine irregular pores; neutral; clear smooth boundary.

Bt1—4 to 6 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2 crushed) silty clay loam, light brownish gray (10YR 6/2) dry; moderate very fine subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores; few faint clay films on faces of peds and in pores; neutral; clear wavy boundary.

Bt2—6 to 10 inches; dark brown (10YR 4/3) silty clay, brown (10YR 5/3) dry; moderate very fine angular blocky structure; very hard, very firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; many distinct clay films on faces of peds and few faint clay films in pores; moderately alkaline; clear smooth boundary.

Bt3—10 to 14 inches; dark brown (10YR 4/3) silty clay loam, brown (10YR 5/3) dry; moderate very fine subangular blocky structure; common very fine roots; many very fine tubular pores; common faint clay films on faces of peds and in pores; slightly effervescent, lime is disseminated; moderately alkaline; clear smooth boundary.

Bt4—14 to 24 inches; dark grayish brown (10YR 4/2) and brown (10YR 5/2) silty clay loam, pale brown (10YR 6/3) and grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; common very fine tubular pores; common faint clay films on faces of peds, few faint clay films in pores; slightly effervescent, lime is disseminated; moderately alkaline; gradual smooth boundary.

C1—24 to 33 inches; dark grayish brown (2.5Y 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; hard, very firm, sticky and plastic; few very fine roots; common very fine tubular pores; slightly effervescent, lime is disseminated; moderately alkaline; clear smooth boundary.

2C2—33 to 60 inches; dark grayish brown (10YR 4/2) clay loam, light brownish gray (10YR 6/2) dry; massive; hard, friable, sticky and plastic; few very fine roots; common very fine tubular pores; mildly alkaline.

The particle-size control section averages 27 to 35 percent clay and is less than 15 percent sand that is coarser than very fine sand. Depth to bedrock is more than 60 inches. These soils have a high water table in spring.

The A horizon has value of 5 or 6 when dry, and it has chroma of 1 or 2 when moist or dry. It is 1 to 2 percent organic matter.

The Bt horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 or 3 when moist or dry. It is silty clay loam with thin layers of silty clay. The horizon is 27 to 45 percent clay.

The C horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 or 3 when moist or dry.

Nuss Series

The Nuss series consists of shallow, well drained soils that formed in residuum derived from tuff and basalt. Nuss soils are on hills. Slopes are 0 to 70 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Nuss gravelly loam in an area of Booth-Nuss complex, 5 to 30 percent slopes, in an area of rangeland; about 5 1/2 miles south of Valley Falls; in the SW1/4NW1/4SW1/4 of sec. 31, T. 36 S., R. 21 E.

A—0 to 3 inches; very dark grayish brown (10YR 3/1) gravelly loam, brown (10YR 4/3) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots, few medium and coarse roots; common very fine tubular pores; 2 percent stones, 2 percent cobbles, and 25 percent gravel; neutral; abrupt smooth boundary.

Bw—3 to 17 inches; very dark grayish brown (10YR 3/2) clay loam, brown (10YR 5/3) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; common very fine tubular pores; 2 percent stones, 2 percent cobbles, 10 percent gravel, and 5 percent pumice sand; slightly acid; abrupt wavy boundary.

Cr—17 to 19 inches; fractured, partially weathered tuff; clear wavy boundary.

R—19 inches; tuff.

Depth to bedrock is 12 to 20 inches. The mollic epipedon is 7 to 17 inches thick. The profile averages 5 to 30 percent rock fragments throughout. The solum is slightly acid or neutral. It has hue of 10YR or 7.5YR.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 1 to 3 when moist or dry. It is stony loam or gravelly loam. It is 0 to 25 percent stones, 0 to 10 percent cobbles, and 5 to 20 percent gravel.

The Bw horizon has value of 2 to 4 when moist and 4 to 6 when dry, and it has chroma of 2 to 4 when moist or dry. It is loam, gravelly loam, or clay loam and averages 18 to 30 percent clay. The horizon is 0 to 5 percent stones, 0 to 5 percent cobbles, and 5 to 20 percent tuffaceous gravel.

Observation Series

The Observation series consists of moderately deep, well drained soils that formed in colluvium and residuum derived from basalt and tuff. Observation soils are on tablelands. Slopes are 0 to 15 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 43 degrees F.

Typical pedon of Observation cobbly loam in an area of Observation-Booth complex, 0 to 15 percent slopes, in an area of rangeland; about 500 feet northwest of trail in the NE1/4NW1/4 of sec. 6, T. 41 S., R. 23 E.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) cobbly loam, dark grayish brown (10YR 4/2) dry; weak thick platy structure; soft, friable, slightly sticky and nonplastic; few very fine roots; few very fine irregular pores; 15 percent cobbles and 15 percent gravel; neutral; clear smooth boundary.

Bt1—7 to 14 inches; very dark grayish brown (10YR 3/2) clay loam, dark brown (10YR 4/3) dry; moderate medium subangular blocky structure; slightly hard, firm, sticky and slightly plastic; few very fine and fine roots; few very fine irregular pores; common faint clay films on faces of peds; 10 percent gravel; neutral; clear smooth boundary.

Bt2—14 to 25 inches; dark yellowish brown (10YR 3/6) clay loam, dark yellowish brown (10YR 4/6) dry; strong medium subangular blocky structure; hard, firm, sticky and slightly plastic; few very fine roots; few very fine irregular pores; common faint clay films on faces of peds; mildly alkaline; abrupt smooth boundary.

R—25 inches; dark yellowish brown (10YR 4/4) tuff, yellowish brown (10YR 5/6) dry; weathered in the upper 1 inch.

The mollic epipedon is 8 to 14 inches thick and extends into the upper part of the argillic horizon. The particle-size control section averages 35 to 50 percent clay and 0 to 25 percent rock fragments, mainly gravel and a few cobbles. Thickness of the solum and depth to bedrock are 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 10 to 20 percent cobbles and 5 to 20 percent gravel.

The Bt horizon has value of 3 or 4 when moist and 4 or 5 when dry, and it has chroma of 2 to 6 when moist or dry. It is clay loam, clay, or gravelly clay loam. The horizon is neutral or mildly alkaline.

Old Camp Series

The Old Camp series consists of shallow, well drained soils that formed in colluvium and residuum derived from basalt and tuff. Old Camp soils are on tablelands and hills. Slopes are 2 to 50 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 49 degrees F.

Typical pedon of Old Camp very cobbly loam, 2 to 15 percent slopes, in an area of rangeland; in the NE1/4NE1/4SW1/4 of sec. 5, T. 36 S., R. 24 E.

A—0 to 5 inches; dark brown (10YR 3/3) very cobbly loam, light brownish gray (10YR 6/2) dry; weak fine subangular structure; soft, very friable, slightly sticky and nonplastic; many very fine to coarse roots; common fine vesicular pores; 20 percent gravel, 20 percent cobbles, and 10 percent stones; mildly alkaline; clear smooth boundary.

Bt1—5 to 9 inches; dark brown (10YR 3/3) very cobbly clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common very fine to coarse roots; common very fine interstitial pores; 25 percent gravel, 20 percent cobbles, and 5 percent stones; slightly effervescent, common faint clay films on faces of peds; mildly alkaline; clear smooth boundary.

Bt2—9 to 15 inches; dark yellowish brown (10YR 3/4) extremely cobbly clay loam, brown (10YR 5/3) dry; massive; loose, nonsticky and nonplastic; few very fine roots; common very fine interstitial pores; 30 percent gravel, 30 percent cobbles, and 10 percent stones; strongly effervescent; common faint clay films on faces of rock fragments; mildly alkaline; abrupt irregular boundary.

R—15 inches; tuff; coating of calcium carbonate in fractures.

Depth to bedrock is 10 to 20 inches. The profile is neutral or mildly alkaline.

The A horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 or 3 when moist or dry.

The Bt horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 to 4 when moist or dry. It is clay loam or sandy clay loam and is 27 to 35 percent clay and 50 to 70 percent rock fragments.

Oreneva Series

The Oreneva series consists of moderately deep, well drained soils that formed in residuum and colluvium derived from basalt and tuff. Oreneva soils are on tablelands. Slopes are 2 to 30 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Oreneva very gravelly loam, 2 to 15 percent slopes, in an area of rangeland; in the SW1/4NE1/4NW1/4 of sec. 1, T. 41 S., R. 26 E.

A—0 to 4 inches; dark brown (10YR 3/3) very gravelly loam, light brownish gray (10YR 6/2) dry; moderate thick platy structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine roots; many very fine discontinuous vesicular pores; 10 percent cobbles and 40 percent gravel; mildly alkaline; clear wavy boundary.

Bw1—4 to 12 inches; dark brown (10YR 3/3) very gravelly loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine to coarse roots; 35 percent gravel; mildly alkaline; clear smooth boundary.

Bw2—12 to 21 inches; dark brown (10YR 3/3) very gravelly clay loam, yellowish brown (10YR 5/4) dry; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine roots; 40 percent gravel; moderately alkaline; abrupt smooth boundary.

2R—21 inches; tuff; coatings of calcium carbonate and silica in fractures.

Depth to bedrock is 20 to 40 inches. The particle-size control section averages 18 to 27 percent clay and 35 to 50 percent rock fragments, mainly gravel.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when dry. The horizon is 5 to 15 percent cobbles and 15 to 40 percent gravel. It is neutral or mildly alkaline.

The upper part of the Bw horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 when moist or dry. The lower part has value of 3 to 5 when moist and 5 to 7 when dry, and it has chroma of 3 or 4 when moist and 4 when dry. The horizon is very gravelly loam or very gravelly clay loam and is 18 to 30 percent clay, 30 to 50 percent gravel, and 0 to 10 percent cobbles. It is mildly alkaline or moderately alkaline.

Orovada Series

The Orovada series consists of soils that are deep to a hardpan and are well drained. These soils formed in mixed, stratified material derived from various kinds of igneous rock. Orovada soils are on alluvial fans. Slopes are 0 to 5 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical profile of Orovada silt loam in an area of

Orovada-Mesman complex, 0 to 5 percent slopes, in an area of rangeland; in the NW1/4SE1/4SW1/4 of sec. 6, T. 41 S., R. 25 E.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; soft, friable, nonsticky and nonplastic; many very fine, fine, and medium roots, few coarse roots; common very fine and fine tubular pores; 5 percent gravel; neutral; clear wavy boundary.

A2—2 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry, yellowish brown (10YR 5/6) along root channels; moderate thin and medium platy structure; soft, friable, slightly sticky and nonplastic; many very fine, fine, and medium roots and common coarse roots; many very fine and fine interstitial pores and few very fine tubular pores; 5 percent gravel; mildly alkaline; clear smooth boundary.

Bw1—7 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine and fine roots and few coarse roots; common very fine interstitial pores; 5 percent gravel; mildly alkaline; clear smooth boundary.

2Bw2—11 to 19 inches; very dark brown (10YR 2/2) loam, brown (10YR 5/3) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots, few coarse roots; many very fine interstitial pores; 30 percent pumice sand; mildly alkaline; clear smooth boundary.

2Bw3—19 to 31 inches; dark brown (10YR 3/3) sandy loam, light brownish gray (10YR 6/2) dry; massive; loose, nonsticky and nonplastic; many very fine and fine roots, few coarse roots; many very fine and fine interstitial pores; 15 percent pumice sand; mildly alkaline; clear smooth boundary.

3C—31 to 34 inches; dark yellowish brown (10YR 4/4) extremely gravelly sand, brown (10YR 5/3) dry; single grain; loose, nonsticky and nonplastic; many very fine and fine roots, few coarse roots; few very fine interstitial pores; 85 percent fine gravel; mildly alkaline; abrupt smooth boundary.

4Bkqb—34 to 42 inches; brown (10YR 4/3) and yellowish brown (10YR 5/4) sandy loam, very pale brown (10YR 7/3 and 10YR 7/4) dry; massive; extremely hard, very firm, slightly sticky and slightly plastic; 80 percent hard, firm, and brittle durinodes; 10 percent pumice sand; slightly effervescent, carbonates are disseminated, moderately alkaline, abrupt smooth boundary.

4Bkqmb—42 to 65 inches; brown (10YR 4/3) and yellowish brown (10YR 5/4) strongly cemented hardpan, very pale brown (10YR 7/3 and 10YR 7/4) dry; massive; extremely hard, extremely firm; strongly effervescent, common fine carbonates in seams and filaments; moderately alkaline.

Depth to the strongly cemented hardpan is 40 to 60 inches. The particle-size control section is stratified sandy loam, very fine sandy loam, loam, or silt loam and is 5 to 18 percent clay.

The A horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 or 3 when moist or dry.

The Bw horizon has value of 2 to 5 when moist and 5 to 7 when dry, and it has chroma of 2 to 4 when moist or dry. It is 0 to 30 percent pumice sand and 0 to 15 percent gravel. The horizon is loam, silt loam, or fine sandy loam. It is mildly alkaline or moderately alkaline.

The upper part of the 4B horizon is 50 to 80 percent durinodes. It is stratified fine sandy loam to silt loam. The horizon is moderately alkaline or strongly alkaline.

Oxwall Series

The Oxwall series consists of soils that are shallow to a hardpan and are well drained. These soils formed in old alluvium and lacustrine sediment derived from rhyolite, basalt, and tuff. Oxwall soils are on lake terraces. Slopes are 0 to 5 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 46 degrees F.

Typical pedon of Oxwall gravelly loam, 0 to 5 percent slopes, in an area of rangeland; about 10 miles west of Lakeview, in Goose Lake Valley; about 2,925 feet east and 125 feet south of the northwest corner of sec. 25, T. 39 S. R. 18 E.

A—0 to 2 inches; very dark gray (10YR 3/1) gravelly loam, gray (10YR 5/1) dry; weak thin platy structure parting to weak very fine granular; soft, friable, slightly sticky and nonplastic; few very fine roots; many very fine and fine vesicular pores in the upper 1 inch and many very fine irregular pores below; 30 percent gravel; slightly acid; clear wavy boundary.

BA—2 to 11 inches; very dark brown (10YR 2/2) gravelly clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; hard, friable, sticky and plastic; many very fine roots to a depth of 6 inches and few very fine and fine roots below this depth; few very fine tubular pores; 20 percent gravel; slightly acid; abrupt wavy boundary.

Bt—11 to 16 inches; dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) gravelly clay, light yellowish brown (10YR 6/4) dry; strong fine subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; 30 percent gravel; common faint clay films on faces of peds and few faint clay films in pores; slightly acid; abrupt smooth boundary.

2Bqm—16 to 24 inches; olive brown (2.5YR 4/4 and 3/4) very gravelly indurated hardpan, light yellowish brown (10YR 6/4) dry; abrupt wavy boundary.

2C—24 to 60 inches; variegated, stratified very gravelly loam and very gravelly sandy loam; neutral.

Depth to bedrock is more than 60 inches. Depth to the indurated hardpan is 10 to 20 inches. The part of the profile above the hardpan is as much as 30 percent rock fragments, mostly gravel and cobbles.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 20 to 27 percent clay, 15 to 35 percent gravel, and 0 to 10 percent cobbles.

The BA horizon has color and consistence similar to that of the A horizon. The BA horizon is 25 to 35 percent clay and 15 to 25 percent gravel.

The Bt horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 or 4 when moist or dry. It is 40 to 60 percent clay and 5 to 30 percent rock fragments, dominantly gravel.

The hardpan, or 2Bqm horizon, is indurated and is weakly cemented to strongly cemented in the lower part. This horizon is 6 to 36 inches thick.

The 2C horizon is stratified gravelly and very gravelly sandy loam and loam. It is continuous and discontinuous layers of weakly cemented or strongly cemented material.

Ozamis Series

The Ozamis series consists of very deep, poorly drained soils that formed in sediment derived from basalt, tuff, thin strata of ash, and decomposing vegetation. These soils are on alluvial flats in lake basins and stream bottoms. Slopes are 0 to 1 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Ozamis silty clay loam, 0 to 1 percent slopes, in a meadow; about 2 miles southeast of Adel, in Warner Valley; about 1,200 feet east of the northwest corner of sec. 26, T. 39 S., R. 24 E.

A—0 to 10 inches; black (10YR 2/1) silty clay loam, dark gray (N 4/0) dry; moderate thin platy structure and weak very fine granular; hard, firm, sticky and plastic; many very fine roots; few very fine pores; moderately alkaline; clear smooth boundary.

Cg1—10 to 20 inches; dark gray (10YR 4/1) silt loam, dark gray (N 6/0) dry; many fine faint very dark gray (N 3/0) mottles; moderate very thin platy structure; hard, friable to firm, sticky and slightly plastic; many very fine roots; few very fine tubular pores; moderately alkaline; clear smooth boundary.

Cg2—20 to 34 inches; dark gray (10YR 4/1) silt loam, gray (N 6/0) dry; common medium faint very dark gray (N 3/0) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; few very fine tubular pores; mildly alkaline; abrupt smooth boundary.

2C—34 to 36 inches; very pale brown (10YR 7/3) coarse pumice sand or ash, white (N 8/0) dry; single grain; loose, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; mildly alkaline; abrupt smooth boundary.

3Cg3—36 to 60 inches; dark gray (10YR 4/1) very fine sandy loam, gray (10YR 5/1) dry; many medium and fine faint very dark gray (N 3/0) mottles; massive; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots; mildly alkaline.

Depth to bedrock is more than 60 inches. These soils are subject to rare flooding and have a high water table in spring and summer and early in fall. The mollic epipedon is 10 to 15 inches thick. Depth to the 2C or 3C horizon is 30 to 50 inches. The profile is neutral to moderately alkaline. Organic matter content decreases irregularly as depth increases. The profile has hue of 10YR, 2.5Y, or 5Y. It has chroma of 1 or less when moist or dry except in the 2C horizon where chroma ranges to 3 when moist. The particle-size control section is 25 to 35 percent clay.

The A horizon has value of 2 to 4 when dry. It is loam, silty clay loam, or silty clay. Electrical conductivity is as much as 12 millimhos per centimeter.

The Cg horizon has value of 4 to 6 when moist and 6 to 8 when dry. It has faint or distinct mottles. The horizon is mainly silt loam or silty clay loam with layers of clay loam or silty clay.

The 2C horizon, where present, has value of 6 or 7 when moist and 7 or 8 when dry.

The 3Cg horizon has value of 4 to 6 when moist and 5 to 7 when dry. It is stratified sandy loam to silty clay loam.

Pait Series

The Pait series consists of very deep, well drained soils that formed in colluvium derived from basalt and tuff. Pait soils are on fans and foot slopes below escarpments. Slopes are 1 to 30 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Pait very cobbly loam, 5 to 30 percent slopes, in the area of rangeland; in the SE1/4NE1/4NE1/4 of sec. 8, T. 36 S., R. 25 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) very cobbly loam, grayish brown (10YR 5/2) dry; weak very thin platy structure; soft, very friable, slightly sticky and nonplastic; many very fine roots; many very fine and fine vesicular pores; 2 percent stones, 35 percent cobbles, and 20 percent gravel; neutral; clear smooth boundary.

A2—4 to 8 inches; very dark grayish brown (10YR 3/2) very cobbly loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine roots; many very fine irregular pores; 15 percent cobbles and 30 percent gravel; neutral; clear smooth boundary.

Bw—8 to 24 inches; dark brown (10YR 3/3) extremely gravelly loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; common very fine tubular pores; 15 percent cobbles and 50 percent gravel; neutral; gradual wavy boundary.

2C1—24 to 30 inches; dark brown (10YR 3/3) very gravelly sandy loam, brown (10YR 5/3) dry; massive; hard, very friable, nonsticky and nonplastic; many very fine roots; few fine and common very fine tubular pores; 5 percent cobbles, 10 percent coarse gravel, and 35 percent fine gravel; neutral; clear smooth boundary.

3C2—30 to 41 inches; dark brown (10YR 3/3) very gravelly loamy sand, pale brown (10YR 6/3) and light brownish gray (10YR 6/2) dry; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; 35 percent gravel that is mostly fine gravel; neutral; gradual smooth boundary.

3Ck—41 to 60 inches; dark brown (10YR 3/3) very gravelly loamy sand, light brownish gray (10YR 6/2) dry; massive; very soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; 5 percent cobbles and 35 percent gravel; strongly effervescent; disseminated lime and coatings of lime on gravel; moderately alkaline.

The mollic epipedon is 7 to 15 inches thick. Dark-colored minerals exhibit mollic colors to a depth of 20 to 30 inches. Depth to the lithological discontinuity and thickness of the solum are 20 to 40 inches. The particle-size control section averages of 10 to 20 percent clay, more than 50 percent sand, and 35 to 60 percent rock fragments.

The A horizon has value of 4 or 5 when dry. It is 18 to 27 percent clay. The horizon is 20 to 60 percent rock fragments, of which 0 to 30 percent is stones, 0 to 40 percent is cobbles, and 10 to 35 percent is gravel. The horizon is very cobbly loam, very stony loam, or gravelly loam. It is 1 to 4 percent organic matter.

The Bw horizon is clay loam or loam and is 20 to 30 percent clay. It is less than 1 percent organic matter. The horizon is 10 to 20 percent cobbles and 25 to 50 percent gravel. Few faint clay films are in some pedons.

The 2C horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 or 3 when dry. The horizon is 5 to 20 percent clay. It is 0 to 10 percent cobbles and 35 to 50 percent gravel, mostly fine gravel.

The 3C horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 or 3 when dry. It is 5 to 15 percent clay. The horizon is 0 to 10 percent cobbles and 35 to 45 percent gravel.

Pearlwise Series

The Pearlwise series consists of moderately deep, well drained soils that formed in colluvium and residuum derived from basalt. Pearlwise soils are on tablelands and mountains. Slopes are 2 to 30 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 43 degrees F.

Typical pedon of Pearlwise loam, 2 to 30 percent slopes, in an area of rangeland; about 1,100 feet south-southwest of the junction of two trails in the NE1/4SE1/4 of sec. 9, T. 41 S., R. 28 E.

A1—0 to 4 inches; dark brown (10YR 3/3) loam, brown (10YR 4/3) dry; weak medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine irregular pores; 3 percent cobbles and 10 percent gravel; neutral; clear smooth boundary.

A2—4 to 15 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine irregular pores; 5 percent cobbles and 8 percent gravel; neutral; clear smooth boundary.

A3—15 to 25 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine irregular pores; 10 percent cobbles; neutral; clear smooth boundary.

Bw—25 to 35 inches; dark yellowish brown (10YR 4/4) cobbly loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine and fine irregular pores; 10 percent cobbles and 10 percent gravel; neutral; clear wavy boundary.

R—35 inches; basalt.

The mollic epipedon is 20 to 30 inches thick. The particle-size control section is 20 to 35 percent clay and 0 to 25 percent rock fragments. Depth to bedrock is 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 3 to 5 when dry, and it has chroma of 1 to 3 when moist or dry. It is 0 to 10 percent cobbles and 0 to 10 percent gravel.

The Bw horizon, where present, has value of 3 or 4 when moist and 4 to 6 when dry. It is loam or cobbly loam and is 0 to 10 percent cobbles and 0 to 15 percent gravel.

Pernog Series

The Pernog series consists of shallow, well drained soils that formed in colluvium derived from tuff and basalt. Pernog soils are on mountains. Slopes are 15 to 30 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Pernog very gravelly sandy loam in an area of Pernog-Itca association, 5 to 30 percent slopes, in an area of rangeland; about 700 feet northwest of road along the Chewaucan River; in the SW1/4NW1/4 of sec. 4, T. 34 S., R. 18 E.

A—0 to 3 inches; dark brown (7.5YR 3/2) very gravelly sandy loam, brown (7.5YR 5/2) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common very fine roots and few fine roots; common very fine tubular pores; 5 percent cobbles and 40 percent gravel; mildly alkaline; clear smooth boundary.

Bt—3 to 12 inches; dark brown (7.5YR 3/2) very gravelly clay loam, brown (7.5YR 5/2) dry; moderate fine angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; common distinct clay films on faces of peds and in pores; 40 percent gravel; mildly alkaline; clear smooth boundary.

R—12 inches; tuff.

Thickness of the mollic epipedon and depth to bedrock are 12 to 20 inches. The particle-size control section averages 35 to 50 percent rock fragments, mainly gravel, and 20 to 35 percent clay.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 when dry, and chroma of 2 or 3 when moist or dry.

The Bt horizon has hue of 10YR or 7.5YR, and it has chroma of 2 or 3 when moist or dry. It is very cobbly clay loam, very gravelly clay loam, or very gravelly loam.

Pit Series

The Pit series consists of very deep, poorly drained soils that formed in fine-textured alluvium over lacustrine sediment derived from basic igneous rock. Pit soils are on flood plains and on alluvial flats in lake basins. Slopes are 0 to 1 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Pit silty clay, 0 to 1 percent slopes, in an area of rangeland; about 8 miles south of Lakeview; on the section line and 2,620 feet south of the northeast corner of sec. 26, T. 40 S., R. 20 E.

A—0 to 5 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; strong very fine granular structure; very hard, firm, very sticky and very plastic; few very fine roots; many very fine interstitial pores; neutral; clear smooth boundary.

Bss—5 to 24 inches; black (10YR 2/1) clay, very dark gray (N 3/0) dry; strong coarse prismatic structure; very hard, very firm, very sticky and very plastic; few fine roots; few very fine tubular pores; strongly effervescent; many intersecting slickensides; neutral; gradual smooth boundary.

Bk—24 to 40 inches; very dark grayish brown (2.5Y 3/2) clay, dark grayish brown (2.5Y 4/2) dry; many faint olive brown (2.5Y 4/4) mottles; massive; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; strongly effervescent, lime in seams; mildly alkaline; clear wavy boundary.

C—40 to 60 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, dark grayish brown (2.5Y 4/2) dry; common fine distinct mottles; massive; very hard, very firm, very sticky and very plastic; few fine tubular pores; slightly effervescent; mildly alkaline.

Depth to bedrock is more than 60 inches. These soils are subject to rare flooding and have a high water table in winter and spring. Depth to carbonates is 20 to 26 inches. The profile has cracks 1 centimeter to 5 centimeters wide at a depth of 20 to 25 inches. The cracks are open in July through October and are closed the rest of the year.

The A horizon has value 2 or 3 when moist or 3 to 5 when dry, and it has chroma 0 or 1 when moist or dry. It is silty clay loam, silty clay, or silt loam. The horizon has granular or subangular blocky structure. It is neutral or mildly alkaline.

The Bss horizon has value of 2 or 3 when moist and 3 to 5 when dry, and it has chroma 0 or 1 when moist or dry. It has angular blocky or prismatic structure and is neutral or mildly alkaline. The horizon is clay or silty clay.

The Bk horizon has hue of 10YR or 2.5Y, and it has value of 2 or 3 when moist and 4 or 5 when dry. The horizon is mildly alkaline or moderately alkaline. It is clay or silty clay.

The C horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 2 or 3 when moist or dry. The horizon is silt loam or silty clay loam. It is mildly alkaline or moderately alkaline.

Polander Series

The Polander series consists of deep, well drained soils that formed in colluvium and residuum derived mainly from tuff and rhyolite. Polander soils are on mountains. Slopes are 0 to 70 percent. The mean annual precipitation is about 30 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Polander sandy loam in an area of Mound-Polander complex, 15 to 40 percent north slopes, in an area of woodland; in the SW1/4NE1/4 of sec. 28, T. 37 S., R. 21 E.

Oi—1 inch to 0; ponderosa pine needles.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; many very fine and fine irregular pores; 10 percent gravel; slightly acid; abrupt wavy boundary.

AB—3 to 14 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; slightly hard, friable, nonsticky and nonplastic; common fine and medium roots; common very fine and fine irregular pores; 10 percent gravel; slightly acid; gradual wavy boundary.

Bw—14 to 38 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; hard, friable, slightly sticky and nonplastic; common fine and medium roots; common very fine and fine irregular pores; 10 percent gravel; moderately acid; gradual wavy boundary.

C—38 to 50 inches; dark grayish brown (10YR 4/2) cobbly loam, light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) dry; massive; hard, friable, nonsticky and nonplastic; common fine roots; few very fine tubular pores; 15 percent cobbles and 10 percent gravel; moderately acid; abrupt wavy boundary.

Cr—50 inches; highly weathered tuff.

Depth to bedrock is 40 to 60 inches. The particle-size control section averages 0 to 15 percent rock fragments, of which 0 to 5 percent is cobbles and 0 to 10 percent is gravel. The profile is 10 to 18 percent clay. The very fine sand fraction is 50 to 70 percent glass. The profile is moderately acid or slightly acid.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and 2 to 4 when dry.

The Bw horizon has hue of 10YR or 7.5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 or 3 when moist or dry. It is loam or sandy loam. The horizon is 0 to 15 percent rock fragments, of which 0 to 5 percent is cobbles and 0 to 15 percent is gravel.

The C horizon has color similar to that of the Bw horizon. The C horizon is cobbly loam or cobbly sandy loam and is 10 to 30 percent cobbles and 5 to 20 percent gravel.

Ratto Series

The Ratto series consists of soils that are shallow to a hardpan and are well drained. These soils formed in colluvium derived from basalt and tuff. Ratto soils are on tablelands. Slopes are 2 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Ratto very cobbly loam in an area of Ratto-Coglin complex, 2 to 15 percent slopes, in an area of rangeland; in the NW1/4NW1/4NW1/4 of sec. 23, T. 34 S., R. 27 E.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) very cobbly loam, light brownish gray (10YR 6/2) dry; weak thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine and medium roots; many very fine and fine vesicular pores; 30 percent gravel, 15 percent cobbles, and 5 percent stones; neutral; abrupt smooth boundary.

AB—3 to 6 inches; dark brown (10YR 3/3) gravelly clay loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; soft, friable, sticky and nonplastic; many very fine and fine roots; few very fine irregular pores; 20 percent gravel and 5 percent cobbles; neutral; abrupt smooth boundary.
Bt1—6 to 9 inches; dark brown (10YR 3/3) gravelly clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; slightly hard, firm, sticky and plastic; many very fine and fine roots; few very fine irregular pores; common faint clay films on faces of peds and in pores; 20 percent gravel and 5 percent cobbles; neutral; abrupt smooth boundary.
Bt2—9 to 13 inches; brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; moderate very fine and medium angular blocky structure parting to moderate fine prismatic; slightly hard, firm, sticky and plastic; many very fine and fine roots; few very fine irregular pores; many distinct clay films on faces of peds and in pores; 10 percent gravel; moderately alkaline; abrupt smooth boundary.
Bk—13 to 15 inches; brown (10YR 4/3) gravelly clay loam, light brownish gray (10YR 6/2) dry; massive; hard, firm, slightly sticky and slightly plastic; few very fine roots; 30 percent gravel, most of which is less than 1/4 inch in diameter; strongly effervescent; carbonates segregated in many fine irregularly shaped seams and filaments; strongly alkaline; abrupt irregular boundary
2Bkqm—15 to 19 inches; indurated very gravelly hardpan; abrupt wavy boundary.
2Bk—19 to 60 inches; grayish brown (10YR 6/2) gravelly loamy sand, light gray (10YR 7/2) dry; single grain; loose, nonsticky and nonplastic; 30 percent gravel, most of which is less than 1/4 inch in diameter; violently effervescent, carbonates segregated in many fine irregularly shaped seams and filaments; strongly alkaline.

Depth to the indurated hardpan is 12 to 20 inches. The particle-size control section averages 35 to 45 percent clay.

The A horizon has value of 6 or 7 when dry, and it has chroma of 2 or 3 when moist or dry. It is very cobbly loam or very gravelly sandy loam.

The Bt horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 to 4 when moist or dry. The upper part is 27 to 35 percent clay. It is neutral or mildly alkaline. The lower part is clay loam, clay, or gravelly clay loam and is 35 to 45 percent clay. It is mildly alkaline or moderately alkaline.

The 2B horizon is strongly effervescent or violently effervescent. It is underlain by gravelly or very gravelly loamy sand.

Raz Series

The Raz series consists of soils that are shallow to a hardpan and are well drained. These soils formed in colluvium and alluvium over basalt. Raz soils are on tablelands. Slopes are 2 to 20 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Raz very cobbly loam in an area of Raz-Brace complex, 2 to 20 percent slopes, in an area of rangeland; southeast of Guano Canyon; near jeep trail in the NE1/4SE1/4 of sec. 13, T. 37 S., R. 27 E.

A—0 to 3 inches; dark brown (10YR 3/3) very cobbly loam, pale brown (10YR 6/3) dry; moderate thin platy structure; soft, very friable, slightly sticky and nonplastic; common very fine roots and few fine roots; few very fine and fine vesicular pores; 5 percent stones, 30 percent cobbles, and 10 percent gravel; mildly alkaline; clear smooth boundary.
Bw—3 to 13 inches; dark brown (10YR 4/4) cobbly clay loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few very fine and fine irregular pores; 20 percent cobbles and 5 percent gravel; mildly alkaline; gradual smooth boundary.
Bkq—13 to 18 inches; dark yellowish brown (10YR 4/6) gravelly clay loam, brownish yellow (10YR 6/6) dry; moderate medium subangular blocky structure; hard, firm and brittle, slightly sticky and slightly plastic; few very fine roots; slightly effervescent, coatings of carbonate on rock fragments; 20 percent gravel; moderately alkaline; clear smooth boundary.
Bkqm—18 to 21 inches; indurated hardpan; violently effervescent; moderately alkaline; abrupt smooth boundary.
2R—21 inches; basalt.

The particle-size control section is 20 to 35 percent clay and 15 to 30 percent rock fragments. Depth to the indurated hardpan is 10 to 18 inches. Depth to bedrock is 20 to 40 inches.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry. It is very cobbly loam or loamy sand.

The Bw and Bkq horizons have value of 4 to 6 when moist and 6 to 7 when dry, and they have chroma of 3 to 6 when moist or dry. These horizons are gravelly loam, cobbly clay loam, or gravelly clay loam.

Redcanyon Series

The Redcanyon series consists of moderately deep, well drained soils that formed in colluvium derived from basalt and tuff. Redcanyon soils are on hills and are associated with escarpments. Slopes are 30 to 50 percent. The mean annual precipitation is about 13 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Redcanyon extremely bouldery loam in an area of Redcanyon-Rock outcrop complex, 30 to 50 percent south slopes, in an area of rangeland; about 2 miles northwest of Valley Falls; in the SE1/4NW1/4SE1/4 of sec. 22, T. 35 S., R. 20 E.

A—0 to 8 inches; dark brown (7.5YR 3/2) extremely bouldery loam, brown (7.5YR 5/2) dry; weak medium and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium and coarse roots; 40 percent boulders, 10 percent stones, 10 percent cobbles, and 10 percent gravel; neutral; gradual wavy boundary.

AB—8 to 18 inches; dark brown (10YR 3/3) very bouldery loam, dark brown (10YR 4/3) dry; moderate medium and coarse subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots and few medium and coarse roots; 25 percent boulders, 15 percent stones, 5 percent cobbles, and 10 percent gravel; mildly alkaline; gradual wavy boundary.

Bw—18 to 29 inches; dark brown (10YR 3/3) extremely bouldery loam, pale brown (10YR 6/3) dry; massive; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; 20 percent boulders, 15 percent stones, 10 percent cobbles, and 20 percent gravel; mildly alkaline; gradual wavy boundary.

Bk—29 to 31 inches; dark brown (10YR 3/3) extremely bouldery loam, light yellowish brown (10YR 6/4) dry; massive; very hard, firm, slightly sticky and slightly plastic; few fine roots; violently effervescent, few fine filaments of carbonates and coatings of carbonates on the underside of rock fragments; 40 percent boulders, 15 percent stones, 10 percent cobbles, and 15 percent gravel; mildly alkaline; abrupt irregular boundary.

R—31 inches; fractured basalt.

Depth to bedrock is 20 to 40 inches. Depth to secondary carbonates is 15 to 30 inches. Thickness of the mollic epipedon is 7 to 20 inches. The particle-size control section is 18 to 30 percent clay and 50 to 70 percent rock fragments, mainly boulders and stones.

The A and AB horizons have hue of 10YR or 7.5YR, value 4 or 5 when dry, and chroma of 2 or 3 when moist or dry.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 or 4 when moist or dry. It is extremely bouldery loam, very stony loam, or extremely stony clay loam. The horizon is 50 to 70 percent rock fragments and 20 to 30 percent clay. It is neutral or mildly alkaline.

The Bk horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 to 7 when dry, and chroma of 3 or 4 when moist or dry. It is extremely bouldery loam or extremely stony loam. The horizon is 60 to 80 percent rock fragments and 18 to 27 percent clay. It is mildly alkaline or moderately alkaline.

Reese Series

The Reese series consists of very deep, poorly drained soils that formed in lacustrine sediment. Reese soils are on alluvial flats in lake basins. Slopes are 0 to 1 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Reese very fine sandy loam, 0 to 1 percent slopes, in an area of rangeland; in the NW1/4SE1/4SE1/4 of sec. 8, T. 35 S., R. 25 E.

An1—0 to 4 inches; dark brown (10YR 3/3) very fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine to coarse roots; slightly effervescent, carbonates are disseminated; very strongly alkaline; abrupt smooth boundary.

2An2—4 to 10 inches; brown (10YR 4/3) loam, light brownish gray (10YR 6/2) dry; moderate thin platy structure parting to moderate medium granular; slightly hard, very friable, slightly sticky and nonplastic; many very fine to coarse roots; strongly effervescent, carbonates are disseminated; very strongly alkaline; clear smooth boundary.

2Bn—10 to 20 inches; brown (10YR 5/3) clay loam, light gray (10YR 7/2) dry; moderate medium platy structure parting to moderate medium granular; slightly hard, firm, slightly sticky and nonplastic; many very fine and fine roots; strongly effervescent, carbonates are disseminated; very strongly alkaline; clear wavy boundary.

2Bqn—20 to 33 inches; brown (10YR 5/3) loam, light gray (10YR 7/2) dry; massive; slightly hard, firm, nonsticky and nonplastic; few very fine and fine roots; 15 percent medium and coarse cylindrical very firm durinodes; violently effervescent, carbonates are disseminated; very strongly alkaline; abrupt wavy boundary.

3Bq1—33 to 44 inches; light brownish gray (10YR 6/2) coarse sandy loam, white (10YR 8/1) dry; massive; slightly hard, very firm, nonsticky and nonplastic; few very fine and fine roots; 40 percent medium and coarse cylindrical very firm durinodes; violently effervescent, carbonates are disseminated; strongly alkaline; clear wavy boundary.

4Bq2—44 to 60 inches; light brownish gray (10YR 6/2) loam, white (10YR 8/1) dry; massive; slightly hard, firm, nonsticky and nonplastic; 15 percent medium and coarse cylindrical very firm durinodes; violently effervescent, carbonates are disseminated; strongly alkaline.

Depth to bedrock is more than 60 inches. These soils are subject to rare flooding and have a high water table in winter, spring, and summer. The profile has hue of 10YR or 2.5Y. It is strongly alkaline or very strongly alkaline. The profile is effervescent throughout, but the degree increases as depth increases.

The A horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 2 to 4 when moist or dry. Electrical conductivity is more than 16 millimhos per centimeter, and sodium adsorption ratio is more than 100. The horizon is very fine sandy loam, silty clay, or loam.

The 2B horizon has value of 4 or 5 when moist and 6 or 7 when dry, and it has chroma of 2 to 4 when moist or dry. Electrical conductivity is 2 to 16 millimhos per centimeter, and sodium adsorption ratio is more than 30. The horizon is loam or clay loam and is 20 to 30 percent clay.

The 3B and 4B horizons have value of 5 or 6 when moist and 7 or 8 when dry, and they have chroma of 1 to 3 when moist or dry. These horizons are loam with layers of sandy loam. They are 10 to 27 percent clay and 15 to 40 percent durinodes. Electrical conductivity is less than 2 millimhos per centimeter, and sodium adsorption ratio is 5 to 30.

Riddleranch Series

The Riddleranch series consists of moderately deep, well drained soils that formed in colluvium derived from basalt and tuff. Riddleranch soils are on mountains. Slopes are 30 to 70 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Riddleranch very gravelly loam in an area of Riddleranch-Rock outcrop complex, 30 to 70 percent north slopes, in an area of rangeland; in the NE$^1/_4$NW$^1/_4$NW$^1/_4$ of sec. 22, T. 35 S., R. 25 E.

A—0 to 15 inches; very dark brown (10YR 2/2) very gravelly loam, very dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many very fine roots; 5 percent stones, 10 percent cobbles, and 35 percent gravel; neutral; clear wavy boundary.

BA—15 to 23 inches; dark brown (10YR 3/3) very gravelly loam, dark yellowish brown (7.5YR 4/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine to coarse roots; 10 percent cobbles and 30 percent gravel; neutral; clear wavy boundary.

Bw—23 to 31 inches; dark yellowish brown (7.5YR 4/4) extremely cobbly loam, light yellowish brown (10YR 6/4) dry; moderate medium angular blocky structure; soft, very friable, slightly sticky and nonplastic; common very fine roots; 40 percent cobbles, 30 percent gravel, and 10 percent stones; neutral; abrupt wavy boundary.

R—31 inches; highly fractured bedrock.

Depth to a lithic contact and thickness of the solum are 20 to 40 inches. The mollic epipedon is 7 to 20 inches. The particle-size control section is 18 to 35 percent clay and 50 to 70 percent rock fragments. The profile has hue of 10YR or 7.5YR.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 0 to 10 percent stones, 5 to 20 percent cobbles, and 25 to 40 percent gravel.

The Bw horizon has value of 3 or 4 when moist and 4 to 7 when dry, and it has chroma of 2 or 3 when moist and 3 or 4 when dry. Faint clay films are on rock fragments in some pedons. The horizon is extremely cobbly, very cobbly, extremely gravelly, or very gravelly loam or clay loam.

Rogger Series

The Rogger series consists of moderately deep, well drained soils that formed in colluvium and residuum derived from andesite, basalt, and tuff. Rogger soils are on plateaus and mountains. Slopes are 0 to 60 percent. The mean annual precipitation is about 30 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Rogger very gravelly fine sandy loam, 15 to 40 percent north slopes, in an area of woodland; in the NE$^1/_4$SW$^1/_4$SW$^1/_4$ of sec. 18, T. 40 S., R. 22 E.

Oi—2 inches to 0; ponderosa pine and white fir needles.

A1—0 to 5 inches; very dark brown (10YR 2/2) very gravelly fine sandy loam, dark brown (10YR 4/3) dry; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; many very fine and fine irregular pores; 5 percent stones, 10 percent cobbles, and 25 percent gravel; slightly acid; clear wavy boundary.

A2—5 to 12 inches; very dark grayish brown (10YR 3/2) very gravelly fine sandy loam, dark brown (10YR 4/3) dry; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; many very fine and fine irregular pores; 5 percent stones, 10 percent cobbles, and 25 percent gravel; slightly acid; gradual wavy boundary.

AB—12 to 21 inches; dark yellowish brown (10YR 3/4) very gravelly fine sandy loam, yellowish brown (10YR 5/3) dry; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; common very fine and fine irregular pores; 10 percent cobbles and 30 percent gravel; slightly acid; gradual wavy boundary.

Bw—21 to 36 inches; dark yellowish brown (10YR 3/4) very cobbly loam, yellowish brown (10YR 5/4) dry; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few fine roots; common very fine and fine irregular pores; 25 percent cobbles and 30 percent gravel; slightly acid; abrupt wavy boundary.

Cr—36 inches; weathered basalt.

Depth to a paralithic contact is 20 to 40 inches. The particle-size control section averages 35 to 60 percent rock fragments and 10 to 18 percent clay.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 2 or 3 when moist and 3 or 4 when dry.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 3 or 4 when moist. It is loam or sandy loam. The horizon is 35 to 60 percent rock fragments, of which 10 to 30 percent is cobbles and stones and 25 to 50 percent is gravel.

Royst Series

The Royst series consists of moderately deep, well drained soils that formed in colluvium and residuum derived from tuff and basalt. Royst soils are on hills. Slopes are 0 to 60 percent. The mean annual precipitation is about 18 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Royst very stony loam in an area of Royst-Nuss complex, 2 to 30 percent slopes, in an area of woodland; west of Chandler State Park; in the NW$^1/_4$SW$^1/_4$NW$^1/_4$ of sec. 31, T. 36 S., R. 21 E.

Oi—2 inches to 0; ponderosa pine needles and twigs and mountain big sagebrush leaves.

A—0 to 4 inches; black (10YR 2/1) very stony loam, dark gray (10YR 4/1) dry; weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots and few coarse and very coarse roots; common very fine tubular pores; 15 percent stones, 15 percent cobbles, and 20 percent gravel; neutral; clear wavy boundary.

Bt—4 to 27 inches; dark brown (7.5YR 3/3 and 7.5YR 3/2) extremely stony clay, brown (7.5YR 4/4 and 7.5YR 4/2) dry; strong medium and fine subangular blocky structure; extremely hard, very firm, very sticky and very plastic; common medium and fine roots and few coarse and very coarse roots; common very fine tubular pores; many distinct clay films on faces of peds; 25 percent stones, 25 percent cobbles, and 15 percent gravel; root mat on the top of some stones; neutral; abrupt wavy boundary.

Cr—27 to 29 inches; fractured, partially weathered tuff; clear wavy boundary.

R—29 inches; tuff.

Depth to bedrock is 20 to 40 inches. The mollic epipedon is 20 to 30 inches thick. The particle-size control section is 35 to 85 percent rock fragments and 35 to 45 percent clay. The solum is slightly acid or neutral. The profile has hue of 10YR or 7.5YR. Some pedons do not have an O horizon.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 1 to 3 when moist or dry. It is about 35 to 50 percent rock fragments.

The Bt horizon has value of 3 or 4 when moist and 4 or 5 when dry, and it has chroma of 2 to 4 when moist or dry. The fine earth fraction is clay or clay loam and is 35 to 45 percent clay and 35 to 85 percent rock fragments, mostly stones and cobbles.

Rutab Series

The Rutab series consists of very deep, well drained soils that formed in alluvium. Rutab soils are on alluvial fans. Slopes are 2 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Rutab very gravelly sandy loam, 2 to 15 percent slopes, in an area of rangeland; about 1/4 mile west of West Road Gulch; in the SE1/4SE1/4 of sec. 11, T. 37 S., R. 28 E.

A—0 to 3 inches; dark brown (10YR 4/3) very gravelly sandy loam, brown (10YR 5/3) dry; weak medium platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine irregular pores; 40 percent gravel; mildly alkaline; clear smooth boundary.

Bw1—3 to 8 inches; brown (10YR 4/3) very gravelly loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; many fine irregular pores; 35 percent gravel; mildly alkaline; gradual wavy boundary.

Bw2—8 to 17 inches; brown (10YR 4/3) very gravelly sandy loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and medium roots and many fine roots; many fine irregular pores; 5 percent cobbles and 40 percent gravel; mildly alkaline; gradual wavy boundary.

C—17 to 30 inches; brown (10YR 4/3) very gravelly sandy loam, very pale brown (10YR 7/3) dry; single grain; loose, nonsticky and nonplastic; common very fine roots, many fine roots, and few medium roots; common very fine and fine irregular pores; 5 percent cobbles and 40 percent gravel; moderately alkaline; clear smooth boundary.

2Ck1—30 to 44 inches; brown (10YR 4/3) very gravelly loamy coarse sand, very pale brown (10YR 7/3) dry; single grain; loose, nonsticky and nonplastic; few very fine and medium roots and common fine roots; common very fine and fine irregular pores; 5 percent cobbles and 50 percent gravel; strongly effervescent, common fine segregations of lime in seams; strongly alkaline; gradual wavy boundary.

2Ck2—44 to 60 inches; yellowish brown (10YR 5/3) extremely gravelly loamy sand, very pale brown (10YR 7/3) dry; single grain; loose, nonsticky and nonplastic; few fine roots; few very fine irregular pores; 5 percent cobbles and 55 percent gravel; strongly effervescent, common fine segregations of lime in seams; strongly alkaline.

Depth to bedrock is more than 60 inches. The solum is 13 to 23 inches thick. Depth to carbonates is 25 to 45 inches.

The A horizon has value of 4 or 5 when moist and 5 to 7 when dry, and it has chroma of 2 or 3 when moist or dry.

The Bw horizon has value 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. The horizon is very gravelly loam or sandy loam and is 35 to 50 percent rock fragments and 8 to 18 percent clay.

The C and 2C horizons have value of 3 to 5 when moist and 6 or 7 when dry, and they have chroma of 3 or 4 when moist or dry. The C horizon is 35 to 60 percent rock fragments and 8 to 18 percent clay. It is mildly alkaline or moderately alkaline. The 2C horizon is very gravelly sandy loam, very gravelly loamy coarse sand, or extremely gravelly loamy sand and is 50 to 70 percent rock fragments and 3 to 12 percent clay. It is slightly effervescent or strongly effervescent and moderately alkaline or strongly alkaline.

Salisbury Series

The Salisbury series consists of soils that are moderately deep to hardpan and are well drained. These soils formed in old alluvium and lacustrine sediment derived from rhyolite, tuff, and basalt. Salisbury soils are on lake terraces. Slopes are 0 to 15 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 48 degrees F.

Typical profile of Salisbury loam, 0 to 5 percent slopes, in a pasture; about 15 miles southwest of Lakeview; about 1,000 feet west and 2,500 feet south of the northeast corner of sec. 18, T. 41 S., R. 19 E.

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; weak medium granular structure; slightly hard, friable, slightly sticky and plastic; common very fine roots; about 10 percent gravel; neutral; abrupt smooth boundary.

A—7 to 11 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine tubular pores; 5 percent gravel; neutral; abrupt smooth boundary.

2Bt1—11 to 16 inches; dark brown (10YR 3/3) clay, dark grayish brown (10YR 4/2) dry; moderate medium columnar structure parting to weak coarse angular blocky; extremely hard, very firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; common prominent clay films on faces of peds; neutral; gradual wavy boundary.

2Bt2—16 to 20 inches; dark brown (10YR 3/3) clay loam, dark grayish brown (10YR 4/2) dry; strong coarse angular blocky structure; extremely hard, very firm, very sticky and very plastic; common very fine roots; few very fine tubular pores;

common distinct clay films on faces of peds; neutral; abrupt smooth boundary.

3Bqm1—20 to 28 inches; dark brown (10YR 4/3) indurated hardpan, very pale brown (10YR 7/4) dry; silica laminar cap 1 millimeter to 5 millimeters thick on top; 25 percent gravel that is less than 0.75 inch in diameter; neutral; abrupt smooth boundary.

3Bqm2—28 to 43 inches; dark grayish brown (10YR 5/3) strongly cemented hardpan, light yellowish brown (2.5Y 7/4) dry; silica laminar plates; 25 percent gravel; neutral; abrupt smooth boundary.

4C—43 to 60 inches; yellowish brown (10YR 5/4) silt loam, white (5Y 8/2) dry; massive; very hard, very firm, slightly sticky and nonplastic; neutral.

Depth to the indurated hardpan is 20 to 40 inches. The A horizon is 0 to 15 percent gravel, and the 2Bt horizon is 5 to 15 percent gravel. Cobbles and stones are on the surface in some areas and on terrace escarpments.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 1 to 3 when moist or dry.

The 2Bt horizon has hue of 10YR or 7.5YR, value of 2 to 4 when moist and 4 to 6 when dry, and chroma of 2 to 4 when moist or dry. The upper part is clay or silty clay, and the lower part is clay loam or silty clay loam. Structure is moderate or strong prismatic or columnar in the upper part, but it ranges to angular blocky in the lower part. A thin layer of secondary lime is immediately above the hardpan in some pedons.

The upper part of the hardpan is indurated, and the lower part is strongly cemented or indurated. A silica laminar cap 1 millimeter to 5 millimeters thick is on top of the hardpan. The hardpan is 24 to 60 inches thick.

Sherval Series

The Sherval series consists of very deep, moderately well drained soils that formed in colluvium derived from basalt and tuff. Sherval soils are in concave areas on mountains. Slopes are 5 to 20 percent. The mean annual precipitation is about 30 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Sherval very cobbly loam, 5 to 20 percent slopes, in an area of rangeland; in the NE$^1/_4$SW$^1/_4$ of sec. 2, T. 37 S., R. 21 E.

Oi—1 inch to 0; partially decomposed grass and aspen leaves.

Al—0 to 3 inches; very dark grayish brown (10YR 3/2) very cobbly loam, dark brown (10YR 4/3) dry; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine irregular pores; 5 percent stones, 15 percent cobbles, and 15 percent gravel; moderately acid; clear smooth boundary.

A2—3 to 9 inches; very dark grayish brown (10YR 3/2) very cobbly loam, dark brown (10YR 4/3) dry; weak fine subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine irregular pores; 10 percent stones, 20 percent cobbles, and 20 percent gravel; moderately acid; clear smooth boundary.

Bt1—9 to 24 inches; dark brown (7.5YR 3/3) very cobbly clay loam, dark brown (7.5YR 4/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; common very fine and fine tubular pores; few faint clay films on faces of peds; 5 percent stones, 20 percent cobbles, and 20 percent gravel; moderately acid; clear wavy boundary.

2Bt2—24 to 38 inches; dark brown (7.5YR 3/4) very gravelly clay loam, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common very fine and fine tubular pores; common distinct clay films on faces of peds and in pores; 5 percent cobbles and 30 percent gravel; slightly acid; gradual wavy boundary.

2Bt3—38 to 60 inches; dark yellowish brown (10YR 3/6) and variegated dark yellowish brown and brownish yellow (10YR 4/6 and 6/8) very gravelly clay, dark yellowish brown (10YR 4/6) dry; common fine and medium subangular structure; hard, firm, very sticky and plastic; few fine roots; common very fine and fine tubular pores; many distinct clay films on faces of peds and in pores; 5 percent cobbles and 40 percent gravel; slightly acid.

Depth to bedrock is more than 60 inches. These soils have a high water table late in winter, in spring, and early in summer. The mollic epipedon is 20 to 30 inches thick. The particle-size control section averages 35 to 60 percent rock fragments, of which 20 to 30 percent is cobbles and stones and 15 to 30 percent is gravel. The particle-size control section averages 25 to 35 percent clay.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 or 4 when dry, and chroma of 2 or 3 when moist or dry.

The Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 4 to 6 when moist or dry. It is loam or clay loam and is

25 to 35 percent clay. The horizon is 35 to 60 percent rock fragments, of which 15 to 40 percent is cobbles and stones and 15 to 30 percent is gravel.

The 2Bt horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 4 or 5 when dry, and chroma of 4 to 8 when moist or dry. It is clay loam or clay and is 30 to 45 percent clay. The horizon is 35 to 60 percent rock fragments, of which 0 to 15 percent is cobbles and stones and 35 to 45 percent is gravel.

Simon Series

The Simon series consists of very deep, well drained soils that formed in mixed alluvium and lacustrine sediment derived from basalt and tuff. Simon soils are on terraces along drainageways and in basins. Slopes are 2 to 15 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature in about 44 degrees F.

Typical pedon of Simon silt loam in an area of Simon-Anawalt complex, 2 to 15 percent slopes, in an area of rangeland; about 1/4 mile southwest of Sagebrush Spring; in the SE1/4NW1/4 of sec. 4, T. 41 S., R. 28 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium platy structure parting to moderate thin platy; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots and common medium roots; common very fine and fine tubular pores; 5 percent gravel; neutral; clear smooth boundary.

A2—4 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine and fine tubular pores; 5 percent gravel; neutral; clear wavy boundary.

2Bt1—14 to 22 inches; dark yellowish brown (10YR 3/4) gravelly clay loam, dark yellowish brown (10YR 4/4) dry; strong medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine tubular pores; many distinct clay films on faces of peds; 25 percent gravel; neutral; clear wavy boundary.

3Bt2—22 to 40 inches; brown (10YR 4/3) sandy clay loam, pale brown (10YR 6/3) dry; strong coarse angular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine irregular pores; many prominent clay films on faces of peds; neutral; gradual smooth boundary.

3C1—40 to 50 inches; yellowish brown (10YR 5/4) sandy loam, light yellowish brown (10YR 6/4) dry; massive; hard, friable, nonsticky and nonplastic; few fine roots; few fine irregular pores; neutral; clear smooth boundary.

4C2—50 to 60 inches; olive (5Y 4/3) loamy fine sand, light olive gray (5Y 6/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; few fine irregular pores; neutral.

The mollic epipedon is 10 to 15 inches thick. The solum is 40 to 50 inches thick. Depth to bedrock is more than 60 inches.

The A horizon has chroma of 2 or 3 when moist or dry.

The upper part of the Bt horizon has value of 3 or 4 when moist and 4 to 6 when dry, and it has chroma of 3 or 4 when moist or dry. It is clay loam or loam and is 18 to 35 percent clay and 5 to 25 percent gravel. The lower part of the horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. It is loam or sandy clay loam and is 20 to 35 percent clay.

The upper part of the C horizon has value of 4 or 5 when moist and 5 or 6 when dry, and it has chroma of 2 to 4 when moist or dry. It is 10 to 20 percent clay. The lower part of the C horizon has hue of 10YR to 5Y. It is loamy sand or loamy fine sand.

Spangenburg Series

The Spangenburg series consists of very deep, well drained soils that formed in lacustrine sediment. Spangenburg soils are on lake terraces. Slopes are 0 to 2 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 46 degrees F.

Typical pedon of Spangenburg very fine sandy loam in an area of Spangenburg complex, 0 to 2 percent slopes, in an area of rangeland; in the NE1/4NE1/4NE1/4 of sec. 2, T. 41 S., R. 27 E.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) very fine sandy loam, grayish brown (10YR 5/2) dry; strong thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine discontinuous random vesicular pores; mildly alkaline; abrupt smooth boundary.

A2—4 to 10 inches; very dark grayish brown (10YR 3/2) loam, gray (10YR 6/1) dry; moderate medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine to coarse roots; mildly alkaline; abrupt smooth boundary.

2Bt1—10 to 22 inches; very dark grayish brown (10YR 3/2) clay, brown (10YR 5/3) dry; strong very fine prismatic structure; hard, firm, sticky and plastic;

common very fine roots; many distinct clay films on faces of peds; moderately alkaline; clear wavy boundary.

2Btk1—22 to 28 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate very fine prismatic structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine roots; common faint clay films on faces of peds; strongly effervescent, common fine irregularly shaped seams and filaments of carbonates; moderately alkaline; clear wavy boundary.

2Btk2—28 to 45 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate very fine prismatic structure; extremely hard, very firm, slightly sticky and nonplastic; few very fine roots; common faint clay films on faces of peds; strongly effervescent; many fine irregularly shaped soft masses of carbonates; moderately alkaline; clear wavy boundary.

3C—45 to 60 inches; dark yellowish brown (10YR 3/4) extremely gravelly coarse sand, light yellowish brown (10YR 6/4) dry; massive; slightly hard, friable, nonsticky and nonplastic; 65 percent fine gravel; moderately alkaline.

Depth to bedrock is more than 60 inches. The particle-size control section is 35 to 60 percent clay, but the upper part is 45 to 60 percent clay. An absolute clay increase of 15 to 25 percent is between the A and 2Bt horizons. Depth to the stratified C horizon is 30 to 50 inches.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 1 to 3 when dry. The surface typically is crusted. The horizon is neutral or mildly alkaline. It is 10 to 15 inches thick.

The 2Bt horizon has value of 2 to 4 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is clay or silty clay and is 45 to 60 percent clay. It is mildly alkaline or moderately alkaline.

The 2Btk horizon has value of 2 to 4 when moist and 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry. It is 30 to 40 percent clay. The horizon is mildly alkaline or moderately alkaline.

The 3C horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 3 or 4 when moist or dry. It is stratified loam, silt loam, loamy sand, or sand and is 40 to 70 percent gravel. The horizon is mildly alkaline or moderately alkaline.

Stockdrive Series

The Stockdrive series consists of very deep, somewhat poorly drained soils that formed in eolian material over lacustrine sediment. Stockdrive soils are on lake terraces. Slopes are 0 to 1 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Stockdrive fine sandy loam, 0 to 1 percent slopes, in an area of rangeland; about 0.75 mile southwest of Lakeview Airport; about 1,800 feet south and 200 feet east of the northwest corner of sec. 31, T. 39 S., R. 20 E.

Akn—0 to 3 inches; brown (10YR 4/3) fine sandy loam, light gray (10YR 7/2) dry; moderate thin platy structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine vesicular pores; violently effervescent; very strongly alkaline; abrupt smooth boundary.

2Btkn1—3 to 6 inches; dark brown (10YR 4/3) loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; few very fine and fine vesicular pores; very few faint yellowish brown (10YR 5/4) continuous clay films (cutans) on faces of peds; violently effervescent; very strongly alkaline; gradual smooth boundary.

Btkn2—6 to 12 inches; dark brown (10YR 4/3) silty clay loam, light yellowish brown (10YR 6/4) dry; weak fine and medium prismatic structure; hard, firm, very sticky and very plastic; common very fine and fine roots and few medium and coarse roots; few very fine and fine tubular pores; very few faint yellowish brown (10YR 5/4) clay films (cutans) on faces of peds; common fine and medium rounded soft masses of carbonates; violently effervescent; very strongly alkaline; gradual smooth boundary.

2Bkn—12 to 29 inches; dark yellowish brown (10YR 4/4) fine sandy loam, pale brown (10YR 6/3) dry; massive; soft, friable, nonsticky and nonplastic; few very fine and fine roots; few very fine and fine discontinuous tubular pores; few medium and coarse rounded soft masses of carbonates; violently effervescent; very strongly alkaline; clear smooth boundary.

3Bknz—29 to 32 inches; dark yellowish brown (10YR 4/4) very gravelly sand, pale brown (10YR 6/3) dry; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; few very fine and fine irregular pores; violently effervescent; salt wicking to the surface of the pit face; very strongly alkaline; 40 percent gravel; abrupt wavy boundary.

3Bnz—32 to 34 inches; dark grayish brown (10YR 4/2) extremely gravelly sand, light brownish gray (10YR 6/2) dry; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; few very fine and fine irregular pores; salt wicking to the surface of the pit face; very strongly alkaline; 60 percent gravel; clear wavy boundary.

3Bnqz1—34 to 38 inches; brown (10YR 5/3) very gravelly sand, light brownish gray (10YR 6/2) dry; massive; slightly hard, firm, nonsticky and nonplastic; very weakly cemented by silica; salt wicking to the surface of the pit face; very strongly alkaline; 40 percent gravel; clear smooth boundary.

3Bnqz2—38 to 44 inches; dark brown (10YR 4/3) sand, light brownish gray (10YR 6/2) dry; massive; slightly hard, friable, nonsticky and nonplastic; very weakly cemented by silica; salt wicking to the surface of the pit face; very strongly alkaline; 10 percent gravel; clear smooth boundary.

4Bknz1—44 to 56 inches; dark brown (10YR 3/3) silty clay loam, very pale brown (10YR 7/4) dry; coarse distinct black (10YR 2/1) manganese stains on faces of peds; strong fine and medium angular blocky structure; very hard, firm, slightly sticky and slightly plastic; slightly effervescent; filaments and threads of fine carbonates; very strongly alkaline; clear smooth boundary.

4Bknz2—56 to 66 inches; dark yellowish brown (10YR 4/6) silty clay loam, very pale brown (10YR 7/3) dry; coarse distinct black (10YR 2/1) manganese stains on faces of peds; strong fine and medium angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; slightly effervescent; very strongly alkaline.

Depth to bedrock is more than 60 inches. These soils are ponded and have a high water table in spring and early in summer. The soils are strongly alkaline or very strongly alkaline. The particle-size control section is 25 to 35 percent clay. Depth to the 3B horizon is 25 to 45 inches.

The A horizon has value 3 to 5 when moist and 6 or 7 when dry, and it has chroma of 2 or 3 when moist or dry. White and black alkali is on the surface. Sodium adsorption ratio is 15 to 40. Electrical conductivity is more than 8 millimhos per centimeter.

The 2Bt horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. It is loam or silty clay loam and is 25 to 35 percent clay. Sodium adsorption ratio is 30 to 70. Electrical conductivity is more than 8 millimhos per centimeter.

The 3B horizon has value of 3 to 5 when moist and 6 or 7 when dry, and it has chroma of 2 to 4 when moist or dry. The horizon is 0 to 70 percent gravel. Electrical conductivity is more than 16 millimhos per centimeter. Sodium adsorption ratio is 5 to 15.

The 4B horizon has hue of 10YR or 2.5Y, and it has value of 2 to 4 when moist and 5 to 7 when dry. It is sandy clay loam, clay loam, or silty clay loam. Sodium adsorption ratio is 5 to 10. Electrical conductivity is more than 16 millimhos per centimeter.

Swalesilver Series

The Swalesilver series consists of very deep, somewhat poorly drained soils that formed in lacustrine sediment. Swalesilver soils are on lake terraces and in depressions on tablelands. Slopes are 0 to 2 percent. The mean annual precipitation is about 11 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon of Swalesilver loam, 0 to 2 percent slopes, in an area of rangeland; in the NE1/4NW1/4NE1/4 of sec. 13, T. 40 S., R. 27 E.

A—0 to 5 inches; very dark gray (10YR 3/1) loam, gray (10YR 6/1) dry; few fine distinct yellowish red (5YR 4/6) mottles; moderate thin platy structure parting to moderate medium subangular blocky; soft, very friable, slightly sticky and nonplastic; many very fine roots; common very fine discontinuous random vesicular pores; mildly alkaline; abrupt wavy boundary.

2Bt1—5 to 12 inches; very dark grayish brown (10YR 3/2) clay, grayish brown (10YR 5/2) dry; strong fine prismatic structure; hard, very firm, sticky and plastic; common very fine and fine roots; many distinct clay films on faces of peds; mildly alkaline; clear smooth boundary.

2Bt2—12 to 35 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; strong fine prismatic structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common distinct clay films on faces of peds; mildly alkaline; clear wavy boundary.

3C—35 to 45 inches; dark brown (10YR 3/3) loam, light brownish gray (10YR 6/2) dry; massive; soft, very friable, nonsticky and nonplastic; 10 percent gravel; mildly alkaline; clear wavy boundary.

4C—45 to 60 inches; brown (10YR 5/3) silt loam, white (10YR 8/2) dry; massive; soft, very friable, nonsticky and nonplastic; moderately alkaline.

Depth to bedrock is more than 60 inches. These soils are ponded and have a high water table in winter and spring. The particle-size control section is 45 to 55 percent clay. Depth to the 2Bt horizon is 3 to 7 inches.

The A horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 1 or 2 when moist or dry. It is neutral or mildly alkaline.

The 2Bt horizon has value of 3 or 4 when moist and 5 or 6 when dry. It is clay or silty clay. It is mildly alkaline or moderately alkaline.

The 3C and 4C horizons have value of 3 to 5 when moist and 6 to 8 when dry, and they have chroma of 2 to 4 when moist or dry. They are stratified silt loam, silty clay loam, clay loam, or loam. These horizons are mildly alkaline to strongly alkaline. They are massive and are dense, consolidated, fractured lacustrine sediment. The sediment has rocklike structure consisting of strong medium angular blocks.

Tandy Series

The Tandy series consists of very deep, somewhat poorly drained soils that formed in wind- and water-deposited sandy and loamy sediment overlying silty lacustrine sediment. Tandy soils are on alluvial flats in lake basins that are slightly above the water level of the lake. Slopes are 0 to 1 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Tandy loamy fine sand, 0 to 1 percent slopes, in a meadow; about 6 miles south of Lakeview, near Goose Lake; near the center of the SW1/4SW1/4 of sec. 15, T. 40 S., R. 20 E.

Ak—0 to 9 inches; dark grayish brown (2.5Y 4/2) loamy fine sand, gray (2.5Y 6/1) dry; single grain; loose, nonsticky and nonplastic; common very fine roots; many very fine pores; strongly effervescent; about 25 percent small mollusk shell fragments; moderately alkaline; clear smooth boundary.

Ck1—9 to 12 inches; gray (2.5Y 5/1) fine sandy loam, gray (10YR 6/1) dry; massive; soft, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Ck2—12 to 34 inches; very dark grayish brown (2.5Y 3/2) loamy fine sand, light brownish gray (10YR 6/2) dry; massive; very soft, very friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

2Akb—34 to 40 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

2Ck3—40 to 60 inches; stratified clay loam to loamy fine sand; massive; strongly effervescent; moderately alkaline.

Depth to bedrock is more than 60 inches. These soils are subject to rare flooding and have a high water table throughout the year. Depth to the 2A horizon is 20 to 40 inches. The upper sandy mantle is 0 to 15 percent gravel and as much as 30 percent mollusk shell fragments. The profile is moderately alkaline or strongly alkaline throughout.

The Ak horizon has hue of 10YR or 2.5Y, and it has chroma of 1 or 2 when moist or dry.

The Ck1 horizon has hue of 10YR or 2.5Y, value of 3 to 5 when moist and 5 to 7 when dry, and chroma of 1 or 2 when moist or dry. It is fine sandy loam or loamy fine sand and averages 5 to 15 percent clay and more than 75 percent sand.

The 2A horizon has hue of 10YR or neutral, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 0 to 1 when moist or dry. It is 5 to 12 percent organic matter.

Thunderegg Series

The Thunderegg series consists of very deep, poorly drained soils that formed in eolian material over lacustrine sediment. Thunderegg soils are on lake terraces. Slopes are 0 to 1 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Thunderegg fine sandy loam, 0 to 1 percent slopes, in an area of meadow hay and pasture; about 2.5 miles north of Goose Lake; 900 feet south and 400 feet west of the northeast corner of sec. 9, R. 20 E., T. 40 S.

A—0 to 1 inch; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; weak thin platy structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine and fine discontinuous tubular pores; moderately alkaline; clear smooth boundary.

Ak—1 inch to 8 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; single grain; loose, nonsticky and nonplastic; common very fine and fine roots; strongly effervescent; strongly alkaline; abrupt smooth boundary.

2Btkn1—8 to 15 inches; dark grayish brown (10YR 4/2) silty clay loam, pale brown (10YR 6/3) dry; moderate medium and coarse prismatic structure; hard, very firm, slightly sticky and slightly plastic; common very fine and fine roots; few very fine and fine tubular pores; many faint dark grayish brown (10YR 4/2) clay films on faces of peds; violently effervescent; very strongly alkaline; clear wavy boundary.

2Btkn2—15 to 21 inches; 60 percent dark brown (10YR 4/3) and 40 percent dark yellowish brown (10YR 4/4) silty clay loam, 60 percent pale brown (10YR 6/3) and 40 percent grayish brown (10YR 5/2) dry; weak fine and medium prismatic structure; hard, very firm, slightly sticky and slightly plastic, common very fine and fine roots; few very fine and fine tubular pores; many faint dark yellowish brown (10YR 4/4) clay films on faces of peds; violently effervescent; very strongly alkaline; abrupt wavy boundary.

2Btknq—21 to 26 inches; 60 percent yellowish brown (10YR 5/4) and 40 percent light yellowish brown (10YR 6/4) loam, pale brown (10YR 6/3) dry; massive; very hard, extremely firm, slightly sticky and slightly plastic, few fine roots; common fine and medium vesicular and tubular pores; common distinct dark yellowish brown (10YR 4/4) clay films on fracture planes; 10 percent cylindrical and rounded silica and manganese nodules; violently effervescent; few fine threads of carbonates and few fine and medium rounded soft masses of carbonates; very strongly alkaline; clear wavy boundary.

3Bkn—26 to 31 inches; dark brown (10YR 4/3) sand, very pale brown (10YR 7/3) dry; many medium and coarse faint dark yellowish brown (10YR 4/6) mottles and common fine and medium distinct black (10YR 2/1) mottles; single grain; loose, nonsticky and nonplastic; strongly effervescent; few fine threads of carbonates and common medium and coarse irregular soft masses of carbonates; very strongly alkaline; abrupt smooth boundary.

3Bz—31 to 70 inches; dark brown (10YR 4/3) sand, light brownish gray (10YR 6/2) dry; many medium and coarse distinct dark yellowish brown (10YR 4/6) mottles and common fine and medium distinct black (10YR 2/1) mottles; single grain; loose, nonsticky and nonplastic; salt wicking extends to the surface of the pit face; strongly alkaline.

Depth to bedrock is more than 60 inches. The soil is ponded and has a high water table throughout the year. Depth to the 3B horizon is 25 to 50 inches. The mollic epipedon is 8 to 18 inches thick, and it includes the upper part of the natric horizon in some pedons. The particle-size control section averages 35 to 45 percent clay.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 0 to 1 when moist or dry.

The 2Bt horizon has hue of 10YR or 2.5Y, value of 3 to 6 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist or dry. It is strongly alkaline or very strongly alkaline. The upper part of the horizon is silty clay loam, silty clay, or clay and is 35 to 45 percent clay. The lower part is loam or clay loam and is 25 to 40 percent clay. Sodium adsorption ratio is 15 to 40. The lower part has nodules of hard, firm, brittle silica.

The 3Bkn horizon has value of 4 or 5 when moist and 6 or 7 when dry, and it has chroma of 2 to 4 when moist or dry.

The 3Bz horizon has value of 4 or 5 when moist and 6 or 7 when dry, and it has chroma of 2 to 4 when moist or dry. It is stratified sand and gravel. The horizon is 0 to 70 percent gravel. It typically is saturated throughout the year and has dissolved salts. Silty clay loam or sandy clay loam is below the layer of sand in some pedons.

Tulana Series

The Tulana series consists of very deep, poorly drained soils that formed in lacustrine sediment that is high in content of diatoms and amorphous material. Tulana soils are in slightly concave areas of alluvial flats in lake basins. Slopes are 0 to 1 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 46 degrees F.

Typical pedon of Tulana mucky silty clay loam, drained, 0 to 1 percent slopes; in Chewaucan Marsh; 300 feet west of the Chewaucan River and 2,500 feet north of the Brattain Ditch; about 5.5 miles southeast of Paisley; in the SW1/4SW1/4SW1/4 of sec. 12, T. 34 S., R. 19 E.

A1—0 to 3 inches; black (2.5Y 2/0) mucky silty clay loam, dark gray (10YR 4/1) dry; weak thin platy structure and moderate fine granular; very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine pores; neutral; gradual smooth boundary.

A2—3 to 11 inches; black (2.5Y 3/0) mucky silty clay loam, gray (10YR 5/1) dry; moderate thin platy structure; friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine tubular pores; neutral; abrupt smooth boundary.

2C1—11 to 38 inches; light gray (2.5Y 7/2) silt loam, white (10YR 8/2) dry; many medium faint light yellowish brown (2.5Y 6/4) mottles, very dark gray (2.5Y 3/0) and gray (2.5Y 5/0) dry; organic stains in horizontal root channels; massive; firm, sticky and plastic; common roots; many fine and very fine tubular pores; neutral; abrupt smooth boundary.

3C2—38 to 44 inches; light brownish gray (2.5Y 6/2) fine sandy loam, white (2.5Y 8/2) dry; massive; loose, nonsticky and nonplastic; few fine roots; many very fine pores; 95 percent sand-sized pumice fragments and 5 percent pumice fragments that are 2 to 5 millimeters in diameter; mildly alkaline; clear smooth boundary.

4C3—44 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, white (2.5Y 8/2) dry; many medium faint pale brown (2.5Y 6/3) mottles; massive; firm, sticky and plastic; many very fine pores; mildly alkaline.

Depth to bedrock is more than 60 inches. These soils have a high water table throughout the year. The mollic epipedon is 10 to 20 inches thick. The moist bulk density is 0.40 to 0.85 grams per cubic centimeter. These soils have a high content of diatoms and amorphous material. Pumiceous ash layers are common at a depth of more than 35 inches.

The A horizon has chroma of 0 or 1 when moist or dry. It is 10 to 20 percent organic matter.

The C horizon has hue of 10YR to 5Y, value of 3 to 7 when moist and 6 to 8 when dry, and chroma of 0 to 2 when moist or dry. It is stratified silt loam, silt, or silty clay loam to a depth of 40 inches or more and is fine sand or fine sandy loam below this depth.

Tumtum Series

The Tumtum series consists of soils that are shallow to a hardpan and are well drained. These soils formed in old alluvium. Tumtum soils are on alluvial fans and lake basin terraces. Slopes are 5 to 15 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Tumtum cobbly loam, in an area of Deppy-Tumtum complex, 5 to 15 percent slopes; about 0.5 mile south of Black Canyon; in the SW$^1/_4$SW$^1/_4$ of sec. 2, T. 36 S., R. 28 E.

A—0 to 3 inches; dark brown (10YR 3/3) cobbly loam, brown (10YR 5/3) dry; weak medium platy structure; slightly hard, friable, slightly sticky and slightly plastic, common very fine and fine roots; many very fine and fine vesicular pores; 10 percent cobbles and 15 percent gravel; moderately alkaline; clear wavy boundary.

Bt—3 to 14 inches; dark yellowish brown (10YR 4/4) clay loam, light yellowish brown (10YR 6/4) dry; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine and fine roots; many very fine and fine irregular pores; common faint clay films on faces of peds; 10 percent gravel; moderately alkaline; abrupt wavy boundary.

Bkqm—14 to 22 inches; dark yellowish brown (10YR 4/6) indurated hardpan, very pale brown (10YR 7/4) dry; massive; thick plates; slightly effervescent; 40 percent gravel; clear wavy boundary.

2Ck—22 to 60 inches; dark yellowish brown (10YR 3/6) gravelly sandy loam, light yellowish brown (10YR 6/4) dry; massive; soft, very friable, nonsticky and nonplastic; common fine roots; many very fine irregular pores; violently effervescent, disseminated carbonates; 45 percent gravel; moderately alkaline.

The argillic horizon is 8 to 11 inches thick. Depth to the indurated hardpan is 9 to 16 inches. Depth to bedrock is more than 60 inches. The particle-size control section averages 5 to 20 percent rock fragments, mainly gravel, and 35 to 45 percent clay.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 or 3 when moist or dry.

The Bt horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. It is clay or clay loam.

The 2Ck horizon is gravelly or very gravelly sandy loam.

Turpin Series

The Turpin series consists of very deep, well drained soils that formed in lacustrine sediment. Turpin soils are on lake terraces. Slopes are 0 to 8 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Turpin sandy clay loam in an area of Turpin-Reese complex, 0 to 8 percent slopes, in an area of rangeland; in the SW$^1/_4$SW$^1/_4$SW$^1/_4$ of sec. 28, T. 33 S., R. 26 E.

Ak—0 to 5 inches; very dark grayish brown (10YR 3/2) sandy clay loam, light brownish gray (2.5Y 6/2) dry; moderate thin platy structure; soft, very friable, sticky and slightly plastic; many very fine and fine roots; strongly effervescent, carbonates are disseminated; very strongly alkaline; abrupt smooth boundary.

2Akn1—5 to 9 inches; very dark grayish brown (2.5Y 3/2) sandy clay loam, light brownish gray (2.5Y 6/2) dry; strong thin platy structure; slightly hard, friable, very sticky and plastic; many very fine and fine roots; strongly effervescent, carbonates are disseminated; very strongly alkaline; abrupt smooth boundary.

3Akn2—9 to 20 inches; dark grayish brown (2.5Y 4/2) sandy clay loam, light gray (2.5Y 7/2) dry; strong medium platy structure; slightly hard, firm, slightly sticky and slightly plastic; many fine and medium roots; violently effervescent, many medium irregular seams and filaments of carbonates; very strongly alkaline; clear smooth boundary.

3Bkn1—20 to 29 inches; dark grayish brown (2.5Y 4/2) sandy clay loam, light gray (2.5Y 7/2) dry; moderate fine prismatic structure; slightly hard, firm, nonsticky and nonplastic; common fine roots;

violently effervescent, common fine irregular seams and filaments of carbonates; very strongly alkaline; clear smooth boundary.

4Bkn2—29 to 60 inches; dark grayish brown (2.5Y 4/2) loam, light brownish gray (2.5Y 6/2) dry; massive; loose, nonsticky and nonplastic; few fine roots; violently effervescent, carbonates are disseminated; very strongly alkaline.

Depth to bedrock is more than 60 inches. The particle-size control section averages 20 to 30 percent clay and 40 to 70 percent sand, of which more than 15 percent is coarser than very fine sand. The solum is 2 to 10 percent carbonates and less than 1 percent salts. Sodicity and salinity increase as depth increases. The profile is very strongly alkaline throughout.

The A horizon has hue of 10YR or 2.5Y, chroma of 2 or 3 when moist and 5 to 7 when dry, and chroma of 2 or 3 when moist or dry. The sand fraction is mostly very fine sand and fine sand. The horizon has platy or prismatic structure. Sodium adsorption ratio is 5 to 50, and electrical conductivity is 1 millimho to 8 millimhos per centimeter.

The upper part of the B horizon has hue of 10YR or 2.5Y, value of 3 or 4 when moist and 6 or 7 when dry, and chroma of 2 to 4 when moist and 2 or 3 when dry. It has prismatic structure parting to subangular blocky. The upper part of the horizon is loam, clay loam, or sandy clay loam. The sand fraction is mostly fine and medium sand. Sodium adsorption ratio is 100 to 200, and electrical conductivity is 8 to 16 millimhos per centimeter.

The lower part of the B horizon has color similar to that of the upper part. The lower part is layers of sandy clay loam, fine sandy loam, loamy sand, or loam with semiconsolidated lacustrine silt. The sand fraction is mostly fine and medium sand. Sodium adsorption ratio is 200 to 300, and electrical conductivity is 8 to 16 millimhos per centimeter.

Twelvemile Series

The Twelvemile series consists of very deep, somewhat excessively drained soils that formed in colluvium and residuum derived mainly from rhyolite. Twelvemile soils are on mountains. Slopes are 0 to 60 percent. The mean annual precipitation is about 30 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Twelvemile very gravelly fine sandy loam, 15 to 40 percent south slopes, in an area of woodland; in the SE1/4NE1/4 of sec. 12, T. 38 S., R. 21 E.

Oi—1 inch to 0; partially decomposed conifer needles.

A1—0 to 2 inches; dark brown (10YR 3/3) very gravelly fine sandy loam, brown (10YR 5/3) dry; moderate fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and medium roots; many very fine and fine irregular pores; 10 percent cobbles and 25 percent gravel; slightly acid; clear smooth boundary.

A2—2 to 11 inches; dark brown (10YR 4/3) very gravelly fine sandy loam, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, nonsticky and nonplastic; many fine and medium roots; common very fine and fine irregular pores; 10 percent cobbles and 25 percent gravel; slightly acid; gradual wavy boundary.

Bw—11 to 24 inches; dark yellowish brown (10YR 4/4) very gravelly fine sandy loam, pale brown (10YR 6/3) dry; weak fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; many fine roots; many fine irregular pores; 40 percent gravel; slightly acid; clear wavy boundary.

Bt—24 to 37 inches; brown (10YR 5/3) very cobbly fine sandy loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many fine roots; few very fine tubular pores; few faint clay films on faces of peds and in pores; 15 percent cobbles and 35 percent gravel; slightly acid; gradual wavy boundary.

C—37 to 60 inches; brown (10YR 5/3) very cobbly sandy loam, very pale brown (10YR 7/3) dry; massive; slightly hard, friable, slightly sticky and nonplastic; common fine roots and few medium and coarse roots; few very fine and fine tubular pores; 15 percent cobbles and 30 percent gravel; slightly acid.

Depth to bedrock is more than 60 inches. The particle-size control section averages 35 to 60 percent rock fragments, of which 5 to 20 percent is cobbles and stones and 25 to 40 percent is gravel. The horizon is 7 to 18 percent clay. The very fine sand fraction is 50 to 70 percent glass. The profile is moderately acid or slightly acid.

The A horizon has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 2 to 4 when moist or dry.

The B horizon has value of 3 or 4 when moist, and it has chroma of 4 or 5 when moist or dry. It is sandy loam or fine sandy loam. The horizon is 35 to 60 percent rock fragments, of which 0 to 20 percent is cobbles and stones and 30 to 40 percent is gravel.

The C horizon has value of 4 to 6 when moist and 6 to 8 when dry, and it has chroma of 3 or 4 when moist or dry. It is 35 to 60 percent rock fragments, of which 10 to 25 percent is cobbles and stones and 25 to 35 percent is gravel.

Vitale Series

The Vitale series consists of moderately deep, well drained soils that formed in residuum and colluvium derived from basalt and tuff. Vitale soils are on hills and mountains. Slopes are 5 to 15 percent. The mean annual precipitation is about 16 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Vitale gravelly sandy loam in an area of Vitale-Bullump complex, 5 to 30 percent slopes; about 0.5 mile west of junction of main road and trail to Round Mountain Spring; in the NW$^1/_4$NE$^1/_4$ of sec. 16, T. 41 S., R. 23 E.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly sandy loam, grayish brown (10YR 5/2) dry; weak medium platy structure; soft, very friable, nonsticky and nonplastic; common very fine roots and few fine roots; common very fine irregular pores; 25 percent gravel; mildly alkaline; clear smooth boundary.

Bt1—7 to 15 inches; dark brown (10YR 3/3) very gravelly loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; few very fine roots; few very fine irregular pores; few faint clay films on faces of peds; 10 percent cobbles and 30 percent gravel; mildly alkaline; clear smooth boundary.

Bt2—15 to 23 inches; dark yellowish brown (10YR 4/4) extremely gravelly clay loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; common faint clay films on faces of peds; 20 percent cobbles and 45 percent gravel; mildly alkaline; clear smooth boundary.

R—23 inches; basalt.

The mollic epipedon is 15 to 17 inches thick, and it extends into the upper part of the argillic horizon. Depth to bedrock is 20 to 40 inches.

The A horizon has value of 4 or 5 when dry, and it has chroma of 2 or 3 when moist or dry.

The Bt horizon has hue of 7.5YR or 10YR. The upper part has value of 3 when moist and 5 when dry, and it has chroma of 2 or 3 when moist or dry. The lower part has value of 3 or 4 when moist and 5 or 6 when dry, and it has chroma of 3 or 4 when moist or dry. The horizon is extremely gravelly clay loam, very gravelly loam, or very gravelly clay loam and is 35 to 70 percent rock fragments, mainly gravel. It is 20 to 35 percent clay.

Welch Series

The Welch series consists of very deep, poorly drained or very poorly drained soils that formed in mixed alluvium. Welch soils are on narrow flood plains and in basins. Slopes are 0 to 2 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 44 degrees F.

Typical pedon Welch silty clay loam in an area of Degarmo-Welch complex, 0 to 2 percent slopes, in an area of rangeland; about 0.5 mile southwest of Deboy Ranch, along McDowell Creek; in the NW$^1/_4$NE$^1/_4$NE$^1/_4$ of sec. 14, T. 37 S., R. 22 E.

A1—0 to 9 inches; black (10YR 2/1) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; 5 percent gravel; neutral; clear smooth boundary.

A2—9 to 27 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; moderate medium and fine prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; 10 percent gravel; mildly alkaline; clear smooth boundary.

A3—27 to 41 inches; very dark brown (10YR 2/2) clay loam, dark grayish brown (10YR 4/2) dry; common fine distinct mottles that are dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) dry; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; few very fine tubular pores; 10 percent gravel; mildly alkaline; gradual smooth boundary.

C—41 to 62 inches; very dark brown (10YR 2/2) clay loam, dark grayish brown (10YR 4/2) dry; common fine distinct mottles that are dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) dry; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; 10 percent gravel; mildly alkaline.

Depth to bedrock is more than 60 inches. These soils are subject to frequent flooding and are ponded. They have a high water table in winter and spring and early in summer. The mollic epipedon is 26 to 60 inches thick or more. The particle-size control section is clay loam, but it has strata of silty clay loam or sandy clay loam. The content of organic matter decreases irregularly as depth increases.

The A horizon has value of 2 or 3 when moist and 3 or 4 when dry, and it has chroma of 1 or 2 when moist or dry. It is silty clay loam or clay loam and is 27 to 35 percent clay. The upper part is slightly acid or neutral, and the lower part is slightly acid to mildly alkaline.

The C horizon has hue of 10YR to 5Y, value of 2 to 5 when moist and 4 to 8 when dry, and chroma of 1 or 2 when moist or dry. It has strata of gravelly material in some pedons. It is slightly acid to mildly alkaline.

Westbutte Series

The Westbutte series consists of moderately deep, well drained soils that formed in colluvium. Westbutte soils are on mountains and hills. Slopes are 2 to 70 percent. The mean annual precipitation is about 14 inches, and the mean annual air temperature is about 42 degrees F.

Typical pedon of Westbutte extremely stony loam in an area of Fitzwater-Westbutte association, 30 to 50 percent slopes, on a north slope; about 0.75 mile east of Jack Creek, in the SE1/4SW1/4 of sec. 8, T. 39 S., R. 27 E.

A1—0 to 7 inches; very dark grayish brown (10YR 3/2) extremely stony loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots and common medium roots; many very fine and fine irregular pores; 35 percent stones, 30 percent cobbles, and 5 percent gravel; mildly alkaline; clear smooth boundary.

A2—7 to 16 inches; very dark grayish brown (10YR 3/2) very stony loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots and common medium roots; many very fine and fine irregular pores; 15 percent stones, 20 percent cobbles, and 5 percent gravel; mildly alkaline; clear smooth boundary.

Bw1—16 to 24 inches; dark brown (7.5YR 3/2) very stony loam, brown (7.5YR 4/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots and few medium roots; many very fine and fine irregular pores; 15 percent stones, 20 percent cobbles, and 5 percent gravel; mildly alkaline; clear smooth boundary.

Bw2—24 to 33 inches; dark brown (7.5YR 3/3) very cobbly loam, brown (7.5YR 4/4) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots and few medium roots; many very fine and fine irregular pores; 5 percent stones, 30 percent cobbles, and 5 percent gravel; mildly alkaline; abrupt wavy boundary.

R—33 inches; tuff.

The mollic epipedon is 20 to 40 inches thick. It is neutral or mildly alkaline. The particle-size control section averages 18 to 27 percent clay and 35 to 60 percent rock fragments, mainly cobbles and stones. Thickness of the solum and depth to bedrock are 20 to 40 inches.

The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 1 or 2 when moist or dry.

The B horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and 2 to 4 when dry. It is very stony loam to very cobbly loam.

Westside Series

The Westside series consists of very deep, well drained soils that formed in loess over alluvium derived from tuff and basalt. Westside soils are on lake terraces on tablelands. Slopes are 2 to 15 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 46 degrees F.

Typical pedon of Westside very gravelly silt loam in an area of Westside complex, 2 to 15 percent slopes, in an area of rangeland; about 1/2 mile from Flook Lake, in Hart Mountain National Antelope Refuge; in the SW1/4SW1/4NW1/4 of sec. 25, T. 34 S., R. 27 E.

A1—0 to 3 inches; dark brown (10YR 3/3) very gravelly silt loam, light brownish gray (10YR 6/2) dry; strong very fine granular structure; loose, very friable, sticky and slightly plastic; many very fine roots; 10 percent cobbles and 25 percent gravel; neutral; clear smooth boundary.

A2—3 to 8 inches; dark brown (10YR 3/3) cobbly silt loam, light brownish gray (10YR 6/2) dry; strong fine subangular blocky structure; soft, very friable, sticky and slightly plastic; many very fine roots; 20 percent cobbles and 10 percent gravel; mildly alkaline; abrupt smooth boundary.

2Bt1—8 to 14 inches; dark brown (10YR 3/3) cobbly clay, light brownish gray (10YR 6/2) dry; moderate very fine prismatic structure parting to strong fine angular blocky; very hard, firm, sticky and plastic; common very fine roots; many distinct clay films on faces of peds; 20 percent cobbles and 10 percent gravel; mildly alkaline; clear smooth boundary.

2Bt2—14 to 22 inches; dark brown (10YR 3/3) cobbly silty clay loam, pale brown (10YR 6/3) dry; strong medium prismatic structure parting to strong fine angular blocky; very hard, firm, sticky and plastic; few very fine roots; many distinct clay films on faces of peds; 10 percent cobbles and 10 percent gravel; mildly alkaline; gradual wavy boundary.

3Bt—22 to 29 inches; brown (10YR 4/3) very stony clay loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common faint clay films on faces of peds; 30 percent stones, 10 percent cobbles, and 10 percent gravel; mildly alkaline; clear smooth boundary.

4Bkq—29 to 60 inches; light yellowish brown (10YR 6/4), extremely cobbly loam, white (10YR 8/2) dry; massive; hard, firm and brittle, nonsticky and nonplastic; 30 percent cobbles and 30 percent gravel; violently effervescent; moderately alkaline.

The particle-size control section averages 35 to 45 percent clay and 15 to 35 percent rock fragments, mainly cobbles. Depth to bedrock or to an indurated hardpan is more than 60 inches. An absolute clay increase of 15 to 25 percent is between the A and 2Bt horizons. Depth to the hard, firm, brittle layer is 20 to 40 inches.

The A horizon has chroma of 2 or 3 when moist or dry. It is 25 to 45 percent rock fragments, of which 5 to 30 percent is cobbles and 10 to 40 percent is gravel. The horizon is very cobbly silt loam or very gravelly silt loam and is 10 to 20 percent clay. It is 3 to 15 inches thick. It is 1 to 2 percent organic matter.

The 2Bt horizon has value of 3 or 4 when moist, and it has chroma of 2 or 3 when moist or dry. It is cobbly silty clay loam or cobbly clay. The horizon is 15 to 30 percent rock fragments, mainly cobbles, and 35 to 50 percent clay.

The 3Bt horizon has value of 3 or 4 when moist. It is very cobbly or very stony silty clay loam or clay loam. The horizon is 35 to 50 percent rock fragments and 30 to 40 percent clay.

The 4Bkq horizon has value of 5 or 6 when moist and 7 or 8 when dry, and it has chroma of 2 to 4 when moist or dry. It is extremely cobbly loam or extremely stony loam and is 60 to 80 percent rock fragments.

Wildhill Series

The Wildhill series consists of moderately deep, well drained soils that formed in alluvium over basalt. Wildhill soils are on bedrock-controlled lake terraces. Slopes are 2 to 50 percent. The mean annual precipitation is about 8 inches, and the mean annual air temperature is about 48 degrees F.

Typical pedon of Wildhill very stony loam, 2 to 30 percent slopes, in an area of rangeland; about 500 feet east of a jeep trail in the NE1/4NE1/4SE1/4 of sec. 21, T. 40 S., R. 25 E.

A—0 to 6 inches; brown (10YR 5/3) very stony loam, light brownish gray (10YR 6/2) dry; moderate thick platy structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots and few medium roots; common fine irregular pores; 15 percent stones, 25 percent cobbles, and 15 percent gravel; moderately alkaline; clear wavy boundary.

Btk—6 to 19 inches; brown (10YR 5/3) extremely stony loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; common fine irregular pores; few faint clay films on faces of peds; slightly effervescent; disseminated carbonates; 20 percent stones, 30 percent cobbles, and 25 percent gravel; moderately alkaline; clear wavy boundary.

Btkq—19 to 26 inches; brown (10YR 5/3) extremely gravelly loam, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; hard, firm and brittle, nonsticky and nonplastic; few fine roots; few fine irregular pores; few faint clay films on faces of peds; strongly effervescent; few fine irregularly shaped soft accumulations of calcium carbonate; 15 percent cobbles and 60 percent gravel; strongly alkaline; abrupt wavy boundary.

2R—26 inches; basalt.

The particle-size control section averages 50 to 75 percent rock fragments and 20 to 35 percent clay. Depth to bedrock is 20 to 40 inches.

The A horizon has value of 4 or 5 when moist and 5 or 6 when dry, and it has chroma of 2 to 4 when moist or dry. It is 35 to 60 percent rock fragments, of which 10 to 25 percent is stones, 15 to 30 percent is cobbles, and 10 to 20 percent is gravel.

The Btk horizon has value of 6 or 7 when dry and chroma of 3 or 4 when moist or dry. It is extremely cobbly clay loam, extremely stony loam, or very cobbly clay loam and is 25 to 35 percent clay. The horizon is 15 to 30 percent stones, 20 to 40 percent cobbles, and 10 to 30 percent gravel. Sodium adsorption ratio is 5 to 20.

The Btq horizon has color similar to that of the Btk horizon. The Btq horizon is extremely cobbly loam or extremely gravelly loam. It is 0 to 10 percent stones, 10 to 30 percent cobbles, and 30 to 65 percent gravel. Sodium adsorption ratio is 5 to 13.

Winterim Series

The Winterim series consists of deep, well drained soils that formed in colluvium and residuum derived from basalt and tuff. Winterim soils are on plateaus and mountains. Slopes are 0 to 60 percent. The mean annual precipitation is about 30 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Winterim very gravelly loam, 15 to 40 percent south slopes, in an area of woodland; in the SE1/4NW1/4 of sec. 30, T. 39 S. R. 22 E.

Oi—1 inch to 0; ponderosa pine needles.

A—0 to 5 inches; black (10YR 2/1) very gravelly loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; slightly hard, very friable, sticky and plastic; many fine and medium roots; many fine irregular pores; 5 percent stones, 5 percent cobbles, and 25 percent gravel; slightly acid; clear smooth boundary.

Bt1—5 to 12 inches; dark brown (7.5YR 3/2) gravelly clay loam, brown (7.5YR 4/2) dry; weak medium subangular blocky structure parting to moderate fine granular; hard, friable, very sticky and plastic; many fine and medium roots; common very fine and fine tubular pores; few faint clay films on faces of peds; 5 percent cobbles and 15 percent gravel; slightly acid; clear wavy boundary.

Bt2—12 to 21 inches; dark reddish brown (5YR 3/3) very gravelly clay, reddish brown (5YR 4/3) dry; moderate fine and medium subangular structure; hard, firm, very sticky and very plastic; common fine roots; common very fine and fine tubular pores; common faint clay films on faces of peds and in tubular pores; 5 percent stones, 10 percent cobbles, and 40 percent gravel; slightly acid; clear wavy boundary.

Bt3—21 to 45 inches; dark reddish brown (5YR 3/4) very gravelly clay, reddish brown (5YR 4/4) dry; moderate medium angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; common very fine and fine tubular pores; many distinct clay films on faces of peds and in tubular pores; 35 percent gravel; slightly acid; gradual wavy boundary.

Cr—45 inches; weathered basalt.

Depth to bedrock is 40 to 60 inches. The mollic epipedon is 20 to 30 inches thick. The particle-size control section averages 35 to 60 percent rock fragments and 35 to 50 percent clay. The base saturation is 75 to 85 percent throughout the solum.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3 when moist and 3 to 5 when dry, and chroma of 1 or 2 when moist or dry. It is 0 to 20 percent cobbles and stones and 25 to 50 percent gravel.

The Bt horizon has hue of 7.5YR or 5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 or 4 when moist or dry. It is clay loam or clay. The horizon averages 35 to 60 percent rock fragments, of which 0 to 15 percent is cobbles and stones and 15 to 50 percent is gravel.

Woodchopper Series

The Woodchopper series consists of very deep, well drained soils that formed in residuum and colluvium derived mainly from andesite, basalt, and tuff. Woodchopper soils are on plateaus and mountains. Slopes are 0 to 40 percent. The mean annual precipitation is about 30 inches, and the mean annual air temperature is about 45 degrees F.

Typical pedon of Woodchopper gravelly loam in an area of Woodchopper-Rogger complex, 0 to 15 percent slopes, in an area of woodland; in the NW1/4SW1/4 of sec. 26, T. 39 S., R. 21 E.

Oi—3 inches to 0; ponderosa pine and white fir needles.

A1—0 to 4 inches; dark reddish brown (5YR 3/2) gravelly loam, reddish brown (5YR 4/3) dry; moderate fine granular structure; slightly hard, very friable, sticky and plastic; many fine and medium roots; many fine irregular pores; 2 percent stones and 15 percent gravel; moderately acid; clear smooth boundary.

A2—4 to 14 inches; dark reddish brown (5YR 3/2) gravelly loam, reddish brown (5YR 4/3) dry; moderate medium granular structure and weak fine subangular blocky; slightly hard, very friable, sticky and plastic; many fine and medium roots; many fine irregular pores; 2 percent stones and 15 percent gravel; slightly acid; clear wavy boundary.

Bt1—14 to 25 inches; dark reddish brown (5YR 3/3) cobbly clay loam, reddish brown (5YR 4/3) dry; moderate fine and medium subangular blocky structure; hard, friable, very sticky and plastic; common fine roots; common very fine and fine tubular pores; common faint clay films on faces of peds and in pores; 5 percent stones, 10 percent cobbles, and 15 percent gravel; neutral; gradual wavy boundary.

Bt2—25 to 36 inches; dark reddish brown (5YR 3/3) clay, reddish brown (5YR 4/3) dry; moderate fine and medium subangular blocky structure; hard, friable, very sticky and plastic; common fine roots; common very fine and fine tubular pores; common faint clay films on faces of peds and in pores; 25 percent soft rock fragments; neutral; gradual wavy boundary.

Bt3—36 to 49 inches; dark reddish brown (5YR 3/4) clay, reddish brown (5YR 5/3) dry; moderate fine and medium subangular blocky structure; hard, friable, very sticky and plastic; few fine roots; common very fine and fine tubular pores; many distinct clay films on faces of peds and in pores; 40 percent soft rock fragments; neutral; clear wavy boundary.

Bt4—49 to 60 inches; reddish brown (5YR 4/3) gravelly clay, reddish brown (5YR 5/3) dry; strong fine and medium subangular blocky structure; few fine roots; common very fine and fine tubular pores; many distinct clay films on faces of peds and in pores; 2 percent stones, 5 percent cobbles, 15 percent gravel, and 40 percent soft rock fragments; neutral.

Depth to bedrock is more than 60 inches. The mollic epipedon is 20 to 30 inches thick. The particle-size control section averages 5 to 30 percent rock fragments and 35 to 50 percent clay.

The A horizon has hue of 7.5YR or 5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and 3 or 4 when dry.

The Bt horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 3 or 4 when moist and 4 to 6 when dry, and chroma of 3 or 4 when moist or dry. It is clay loam or clay. The horizon is 0 to 35 percent rock fragments, of which 0 to 15 percent is cobbles and stones and 0 to 20 percent is gravel.

Xerolls

Xerolls consist of shallow to very deep, somewhat excessively to well drained soils that formed in colluvium and residuum derived mainly from andesite, basalt, and tuff. Xerolls are on mountain escarpments and hills. Slopes are 0 to 80 percent. The mean annual precipitation is about 24 inches, and the mean annual air temperature is about 46 degrees F.

Representative profile of Xerolls in an area of Xerolls-Rock outcrop complex, cool, 40 to 60 percent south slopes, in an area of rangeland; in the NE1/4SE1/4 of sec. 17, T. 41 S., R. 21 E.

A1—0 to 4 inches; dark brown (10YR 3/3) extremely stony loam, brown (10YR 5/3) dry; weak very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; 20 percent stones, 20 percent cobbles, and 30 percent gravel; neutral; gradual wavy boundary.

A2—4 to 11 inches; dark brown (10YR 3/3) extremely cobbly loam, brown (10YR 4/3) dry; weak very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine irregular pores; 10 percent stones, 40 percent cobbles, and 20 percent gravel; slightly acid; clear wavy boundary.

Bw—11 to 27 inches; dark yellowish brown (10YR 3/4) extremely cobbly loam, dark yellowish brown (10YR 4/4) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; 15 percent stones, 10 percent cobbles, and 40 percent gravel; slightly acid; abrupt irregular boundary.

R—27 inches; basalt.

Depth to bedrock is 10 to 70 inches or more. The particle-size control section averages 20 to 80 percent rock fragments and 8 to 40 percent clay.

The A horizon has hue of 7.5YR or 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist or dry.

The B horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist or dry. It is sandy loam, loam, or clay loam.

Zorravista Series

The Zorravista series consists of very deep, excessively drained soils that formed in deep eolian sand. Zorravista soils are on semistabilized sand dunes and sand sheets on lake terraces. Slopes are 0 to 8 percent. The mean annual precipitation is about 9 inches, and the mean annual air temperature is about 47 degrees F.

Typical pedon of Zorravista fine sand, 0 to 5 percent slopes, in a seeded area of crested wheatgrass, about 1 mile north of Paisley; about 1,860 feet west and 1,370 feet south of the northeast corner of sec. 13, T. 33 S., R. 18 E.

A—0 to 4 inches; dark brown (10YR 3/3) find sand, pale brown (10YR 6/3) dry; weak very fine granular structure; loose, very friable, nonsticky and nonplastic; many fine roots; many very fine interstitial pores; slightly effervescent; moderately alkaline; clear smooth boundary.

C1—4 to 12 inches; dark brown (10YR 3/3) fine sand, pale brown (10YR 6/3) dry; single grain; soft, very friable, slightly sticky and nonplastic; common fine roots; many very fine interstitial pores; slightly effervescent; mildly alkaline; abrupt smooth boundary.

C2—12 to 24 inches; dark brown (10YR 3/3) loamy fine sand, brown (10YR 5/3) and pale brown (10YR 6/3) dry; single grain; hard, friable, nonsticky and nonplastic; few fine roots; slightly effervescent; mildly alkaline; abrupt smooth boundary.

C3—24 to 60 inches; dark brown (10YR 4/3) loamy fine sand, grayish brown (10YR 5/2) and pale brown (10YR 6/3) dry; single grain; loose, very friable, nonsticky and nonplastic; few fine roots; mildly alkaline.

The profile is effervescent to a depth of 20 inches or more. It has hue of 10YR or 2.5Y.

The A horizon has value of 3 or 4 when moist and 6 or 7 when dry, and it has chroma of 2 or 3 when moist or dry.

The C horizon has value of 3 or 4 when moist and 5 to 7 when dry, and it has chroma of 2 to 4 when moist or dry. It is fine sand, sand, or loamy fine sand. It is mildly alkaline to strongly alkaline.

Formation of the Soils

Soil is the collection of natural bodies on the earth's surface that contains living matter and is capable of supporting plants. The nature of a soil depends upon the combination and interaction of five factors—climate, plant and animal life, parent material, topography, and time.

The relative influence of each factor varies from place to place, and in some places one factor is dominant over the others. The climate, parent material, vegetation, and topography in this survey area are highly variable.

The soil-forming factors of climate, plant and animal life, and parent material are discussed separately in this section. The factors of time and topography are grouped together and discussed under the heading "Geomorphology and Associated Landforms."

Climate

Climate, particularly moisture and temperature, greatly influences soil formation. The chemical and physical reactions taking place in soils are controlled largely by climate. Water dissolves soluble material in soils, and it transports material from one part of a soil to another. Water is necessary for the growth of plants and other organisms that contribute organic matter to soils.

Temperature affects the rate of chemical reactions and of physical breakdown caused by the freezing of water. Freezing and thawing of water causes expansion and contraction and influences the movement of soil particles and rock fragments in soils. The kind and amount of living organisms in and on a soil determine the kind and amount of organic matter added to the soil. The rate of decomposition of organic matter is controlled by temperature and moisture. When soils are moist and warm, weathering and organic matter decomposition can occur. When they are dry or cold, reactions are slow and chemical weathering may cease.

The past and present climatic conditions in the survey area have greatly influenced soil formation. Soil moisture and temperature vary greatly within the survey area because of the differences in the landscape. Precipitation ranges from about 8 inches in the basins and valleys to about 35 inches on the forested mountains. Precipitation falls as rain and snow from late in fall to late in spring with occasional thunderstorms in summer. Maritime tropical air masses account for the thunderstorms in summer, and these masses also cause heavy rainfall in winter that runs off into the basins and valleys ***(13)***. Soil temperatures conducive to chemical reactions are present from about March through November at the lower elevations and from May through October at the higher elevations.

The climate in the survey area has been cyclic during the past 15,000 years. Wetter and drier cycles have occurred throughout this period, and the resulting erosion and deposition of soil material is evident in the soil profiles and in the many shoreline deposits around the basins. About 10,000 years ago, the climate was warmer and drier than it is today. The basin lakes dried and became very shallow, and extensive areas of playas were exposed. About 2,000 to 4,000 years ago, the climate was cooler and more moist than it is today. This resulted in the expansion of Summer, Abert, Goose, and Warner Lakes to levels higher than the present levels ***(2)***. Marshes formed during this period of lake expansion. The Crump soil, which has a histic epipedon, exhibits characteristics from this wetter environment. The climatic changes are also reflected in the soils on tablelands and terraces. The dense claypan (argillic horizon), as in the Anawalt, Booth, Spangenburg, and Thunderegg soils, and the duripan, as in the Deppy, Drewsgap, Lofftus, and Salisbury soils, are evidence of a climate that provided a stronger weathering environment than the one present today. The surface horizon of these soils and others is thin, is low in organic matter content, and reflects the present-day climate.

The present climate is characterized by mesic, frigid, and cryic soil temperature regimes and aquic, aridic, xeric, and udic soil moisture regimes. The interaction of these regimes with the other soil-forming factors contributes to the development of specific soil characteristics.

The soils in the basins have a mesic or frigid soil temperature regime and an aquic, aridic, or xeric soil moisture regime. The soils on the shrub-covered tablelands and mountains have a mesic, frigid, or cryic soil temperature regime and an aridic or xeric soil moisture regime. The soils on the forested mountains and plateaus have a frigid or cryic soil temperature regime and a xeric or udic soil moisture regime.

The basin soils that have an aquic soil moisture regime and reducing condition because of a lack of oxygen show little evidence of development. Because the rate of decomposition is slow, organic matter accumulation is the primary evidence of soil formation. These soils typically are Mollisols and Inceptisols and include those of the Cressler, Malin, and Ozamis series (Fluvaquentic Haplaquolls); Boravall and Reese series (Aeric Halaquepts); Degarmo and Welch series (Cumulic Haplaquolls); Crump series (Histic Humaquepts); Tulana series (Aquandic Humaquepts); and Mudpot series (Typic Haplaquepts).

The basin and tableland soils that have an aridic soil moisture regime (8 to 12 inches of precipitation) typically exhibit minimal organic matter accumulation on the surface and have a weak argillic horizon or have weak structural development in the subsoil. These soils typically are Aridisols and Mollisols that have an aridic moisture regime and include those of the Alvodest, Helphenstein, and Turpin series (Natric Camborthids); McConnel and McNye series (Xerollic Camborthids); Hinton series (Durixerollic Camborthids); Donica, Fitzwater, and Pait series (Aridic Haploxerolls); and Fordney series (Torripsammentic Haploxerolls). Some of the soils on these landforms have a dense, clayey argillic horizon, which developed as a result of past climatic conditions.

The basin and tableland soils that have a xeric soil moisture regime (12 to 18 inches of precipitation) exhibit a thin or thick mollic epipedon, carbonate accumulation, and argillic horizon development. These soils typically are Mollisols and include those of the Calimus and Lobert series (Pachic Haploxerolls); Deter, Drews, and Harriman series (Pachic Argixerolls); Goose Lake series (Aquandic Argialbolls); Lakeview series (Cumulic Haploxerolls); and Vitale series (Typic Argixerolls).

On the steep, shrub-covered mountains, the soils range from those on south-facing slopes at the low elevations that have an aridic moisture regime and a mesic temperature regime and those on north-facing slopes at the low elevations that have an aridic moisture regime and a frigid temperature regime to those on south- and north-facing slopes at the high elevations that have a xeric moisture regime and a cryic temperature regime. Precipitation ranges from about 10 to 18 inches. Effective moisture for plant growth and soil development is significantly greater on the north-facing slopes. The epipedon increases in thickness as elevation increases, and it is thickest in the soils on north-facing slopes. The depth to carbonates increases as elevation increases, and the corresponding actual and effective moisture also increase. Weak to strong structural development is dominant throughout the subsoil, reflecting the influence of the active side slope topography. Soils of the Felcher series (Xerollic Camborthids) are on south-facing slopes and have an aridic moisture regime and a mesic temperature regime. Soils of the Riddleranch series (Aridic Haploxerolls) are on north-facing slopes and have an aridic moisture regime and a frigid temperature regime. Soils of the Pearlwise, Lambring, and Westbutte series (Pachic Haploxerolls) and the Bullump series (Pachic Argixerolls) are on north- and south-facing slopes and have a xeric moisture regime and a frigid temperature regime. Soils of the Harcany series (Pachic Cryoborolls) are on north-facing slopes and have a xeric moisture regime and a cryic temperature regime.

The forested mountains and plateaus receive about 14 to 35 inches of precipitation. Elevation is about 5,000 to 8,400 feet. The soils have a frigid or cryic temperature regime and a xeric or udic moisture regime. Above an elevation of about 7,000 feet, the soils have a udic moisture regime and a cryic temperature regime. Red fescue and whitebark pine are associated with these soils. Soils of the Drakespeak series (Typic Cryumbrepts) and the Longjohn series (Typic Vitricryands) are examples. These soils receive 30 inches of precipitation or more and have an umbric epipedon. Only about 5,500 acres of the soils in this survey area have a udic moisture regime.

Soils that have a frigid temperature regime typically are at elevations of about 5,000 to 6,500 feet, and those that have a cryic temperature regime are at elevations above about 6,500 feet. White fir is associated with the soils that are frigid, and lodgepole pine is associated with the soils that are cryic. Western juniper, ponderosa pine, white fir, and lodgepole pine plant communities are associated with the soils that are xeric. The parent material from which the soils develop under these plant communities and the soil moisture and temperature regimes strongly affect soil morphology. A thick mollic epipedon and distinct argillic horizon are typical in the soils that formed in material derived from basalt and tuff. Examples are soils of the Royst and Winterim series (Pachic Argixerolls), Mound and Woodchopper series (Pachic Ultic Argixerolls), and Hammersley series (Argic Pachic Cryoborolls). Andic soil properties are dominant in the solum of soils that formed in material derived from other pyroclastic rock, such as rhyolite. Examples are soils of the Polander and Twelvemile series (Typic Vitrixerands) and the Hallihan and Kittleson series (Xeric Vitricryands). Soil development is also expressed in the leaching and base saturation of the soil profile. Loss of bases correlates with higher precipitation and changes in the forest plant communities. Soils such as those of the Royst series, which receive about 14 to 20 inches of precipitation, and the Winterim series, which receive about 18 to 22 inches of precipitation, have higher base saturation than those of the Mound, Woodchopper, and Rogger soils, which receive about 20 to 32 inches of precipitation. The Mound, Woodchopper, and Rogger soils are associated with the white fir forest plant community and are Pachic Ultic or Ultic Argixerolls or Haploxerolls. The Royst and Winterim soils are associated with the western juniper and ponderosa pine forest plant communities and are Pachic Argixerolls.

Plant and Animal Life

Living organisms, especially the higher plants, are active in soil formation. The changes they bring about depend mainly on the life processes peculiar to each kind of organism. The kinds of organisms that live on and in soils are determined, in turn, by the climate, parent material, topography or relief, and age of soils. In this survey area, the effects of climate on vegetation are significant to soil formation.

Plant cover helps to reduce erosion and stabilize the soil surface. Leaves, twigs, roots, and the remains of entire plants accumulate on the surface of soils and are decomposed by micro-organisms, earthworms, and other soil fauna. Plant roots widen cracks in the underlying rock, which permits water to penetrate. The uprooting of trees by wind mixes soil layers and loosens the underlying material. Living organisms contribute to important processes such as the accumulation of organic matter, mixing of the soil profile, cycling of nutrients, stabilization of soil structure, and addition of nitrogen.

The soils in this survey area formed under three major types of plant cover, which are influenced by temperature and moisture. Salt-desert shrubs are dominant on the alluvial flats and low sodic terraces. Grasses and shrubs are dominant on the middle and high terraces and tablelands. Mixed conifer forest is dominant on the higher, more moist mountains.

The salt-desert shrubs and grasses on the alluvial flats consist of numerous plants that tolerate salinity, sodicity, and wetness. Plants such as shadscale, black greasewood, spiny hopsage, basin big sagebrush, basin wildrye, alkali sacaton, inland saltgrass, tufted hairgrass, and Indian ricegrass are dominant. These typically are shallow-rooted plants, and layers of duff are not present except in areas immediately under individual shrubs. The vegetation in many areas is sparse. In wet areas adjacent to open water areas, cattails and various sedges form an organic surface layer such as that in soils of the Crump series (Histic Humaquepts).

The grasses and shrubs on the middle and high terraces and tablelands are the dominant vegetation in the survey area. Plants such as bluebunch wheatgrass, Idaho fescue, Sandberg bluegrass, Thurber needlegrass, bottlebrush squirreltail, low sagebrush, Wyoming big sagebrush, mountain big sagebrush, and antelope bitterbrush are included. Although layers of duff are not present, the plant cover is more continuous in these areas than on the adjacent low terraces. The shallow-rooted grasses are important in the development of surface soil structure and the accumulation of organic matter. The shrubs, which are more deeply rooted, are important in the development of subsoil structure.

The forested mountains and plateaus have the most abundant plant cover. Plants such as ponderosa pine, white fir, lodgepole pine, western juniper, mountain big sagebrush, common snowberry, antelope bitterbrush, Idaho fescue, and Wheeler bluegrass are dominant. These plants provide a layer of duff 1 inch to 3 inches thick that protects the soil from erosion. The surface layer typically is thick and dark-colored because of the slow rate of decomposition of the organic matter.

Small animals, earthworms, insects, and micro-organisms influence the formation of soils in several ways. Seed-eating ants inhabit a high percentage of the soils on tablelands at the lower elevations. The mounds of plant material left by these ants show their importance in breaking down the remains of plants. Small animals burrow into the soil and mix the layers, which improves soil structure. Earthworms and other small invertebrates feed on the organic matter in the upper few inches of soil material. They slowly, but continually, mix the soil material and alter its chemistry. Bacteria, fungi, and other micro-organisms hasten the weathering of rocks and the decomposition of organic matter.

Man also has influenced soil development. Management practices such as irrigation, drainage, reclamation, land leveling, ripping, and fertilizing have changed the environment of the soils locally. The Crump and Ozamis soils are very poorly drained and poorly drained. Thousands of acres of these soils and similar soils in the Warner, Chewaucan, and Goose Lake Valleys have been diked, drained, and irrigated.

Drainage allows more oxygen to enter the upper part of the soils, and the increased oxygen results in a decrease in the content of organic matter. In some areas minor subsidence is also evident as in drained areas of the Crump soils that do not have a histic epipedon. The hardpan of the Drewsgap soil has been ripped to increase the rooting depth and available water capacity of the soil. Land leveling on the Deter and Drews soils for more uniform application of irrigation water has resulted in the destruction or thickening of the mollic epipedon. Fire control and grazing management have had a direct effect on plant community composition, plant competition, and plant succession. Controlling fire results in an increase in woody shrubs and a decrease in grasses.

Parent Material

The parent material of the soils in this survey area is derived from extensive interbedded basalt and tuff flows, rhyolitic dikes, and eolian ash deposits from Mt. Mazama ***(12, 14, 25, 45, 46, 47)***. The basin and mountain range landscape is a result of the faulting and tilting of the flows. The last major fault episode resulted in fault-block mountain ranges. The displacement along the fault and the exposed north-to-south-tending escarpments are 5,000 feet high or more from base to summit ***(28)***. The exposed flows can be seen along Abert Rim, Winter Rim, Hart Mountain, and Dougherty Slide. The parent material of the soils in basins is derived from these flows.

The soils on the alluvial flats and low terraces formed in lacustrine deposits from the Pleistocene lakes episode. These deposits are very thick and typically are medium textured and fine textured. Sandy material, where present, is below a depth of 40 inches. Soils that formed in this material include loamy soils of the Helphenstein, Icene, Mesman, Ozamis, Reese, Stockdrive, and Turpin series and clayey soils of the Alvodest, Berdugo, Pit, Spangenburg, and Thunderegg series. Scattered throughout the basins are younger soils superimposed over these older soils. These younger soils formed in eolian sand deposits, colluvial fan material, and coarse-textured alluvial lake shore deposits. Soils that formed in eolian sand include those of the Als, Kewake, and Zorravista series. Soils that formed in colluvial fan material include those of the Pait and Rutab series. Soils that formed in lake shore deposits include those of the Donica, Hinton, McConnel, McNye, and Wildhill series.

The soils on the middle and high terraces formed in older alluvium. These terrace deposits are very thick, as is evident from the relief and topography of these landforms. The soils typically are fine textured and medium textured, are high in content of montmorillonitic clay, and overlie deposits of older alluvial gravel and cobbles. Soils that formed in this material include loamy soils of the Deppy, Drews, Drewsgap, and Harriman series and clayey soils of the Chewaucan, Deter, Oxwall, Salisbury, and Tumtum series.

The soils on tablelands formed in colluvium and residuum derived from basalt and tuff. Because the degree of soil development varies within short distances in these areas, erosional and depositional episodes may have occurred prior to the faulting and uplifting of the fault-block tablelands. The soils are fine textured and medium textured, are high in content of montmorillonitic clay, and have few rock fragments other than those on the surface. Soils that formed in this material include clayey soils of the Anawalt, Carryback, Coglin, Drakesflat, Fertaline, Floke, Freznik, Hart, Madeline, Merlin, and Ninemile series and loamy soils of the Brace, Coztur, Oreneva, and Raz series.

The soils on mountains formed in colluvium and residuum derived from basalt, tuff, and rhyolite. Those that formed in material derived from basalt and tuff typically are fine textured and have varying amounts of rock fragments. The kind and amount of clay minerals are associated with a change in climate and the amount of weathering. Soils that typically receive less than 30 inches of precipitation have a high content of montmorillonitic clay. Soils of the Bullump, Eglirim, Erakatak, Felcher, Lambring, Mound, Royst, Westbutte, and Winterim series are examples. Soils that receive more than 30 inches of precipitation have mixed mineralogy and contain kaolinitic clay. Soils of the Chocktoot, Hammersley, Rogger, and Woodchopper series are examples.

The soils on mountains that formed in material derived from rhyolite typically are coarse textured and have varying amounts of rock fragments. The soils have andic properties and are light colored. Soils of the Hallihan, Kittleson, Longjohn, Polander, and Twelvemile series are examples.

Geomorphology and Associated Landforms

Geomorphology is the study of the configuration of the Earth‘s surface, including the classification, description, nature, origin, and development of landforms. There are three major landscapes in the survey area—basins, tablelands, and mountains. The basins are comprised of alluvial flats; low, middle, and high lake terraces; dunes; and alluvial and colluvial fans. The tablelands are comprised of low and high tablelands with upland basins and narrow flood plains. The mountains are comprised of active and stable side slopes. These landscapes and their component landforms greatly influence soil formation (see figs. 27, 28, 29, next 3 pages).

Basins. The soils in the basins in the Chewaucan and Warner Valleys typically receive 8 to 10 inches of precipitation (aridic), and those in Goose Lake Valley receive 14 to 18 inches of precipitation (xeric). The mean annual air temperature is 45 to 50 degrees F (mesic). Elevation is about 4,100 to 5,300 feet. The landforms in the basins have been affected by faulting. Because of this tectonic displacement, terraces that are coequal in age are at different elevations across a basin. This makes it difficult to interpret soil-geomorphic relationships.

Alluvial flats are of the Holocene and are at the lowest positions in the lake basins. These areas are equivalent in geomorphic age to the Horseshoe geomorphic surface of the Willamette Valley ***(6)***. The soils are ponded annually for long periods. Vegetation is sparse or is absent in many areas. Because the soils are wet for long periods, soil development is minimal. The main evidences of soil formation are organic matter accumulation and weak structural development. The soils associated with these landforms include those of the Alvodest series (Natric Camborthids), Crump series (Histic Humaquepts), Ozamis series (Fluvaquentic Haplaquolls), Pit series (Chromic Pelloxererts), Reese series (Aeric Halaquepts), and Tulana series (Aquandic Humaquepts) in Chewaucan and Warner Valleys and those of the Malin series (Fluvaquentic Haplaquolls) and Tandy series (Aquic Udifluvents) in Goose Lake Valley. The Crump soils have a histic epipedon. The Malin, Ozamis, and Tulana soils have a mollic epipedon. The Alvodest, Langslet, and Reese soils have a cambic horizon. All of the soils on alluvial flats are subject to deposition and erosion. The Ozamis and Tulana soils have thin strata of volcanic ash or pumice at a depth of 40 inches or less. In the other soils, deposits of ash and pumice occur only sporadically. The ash and pumice is from the eruption of Mt. Mazama about 6,600 years ago ***(2)***.

Low, sodic lake terraces are of the Holocene and are adjacent to alluvial flats. These terraces are equivalent in geomorphic age to the Ingram geomorphic surface of the Willamette Valley, but they also include remnants of the Winkle geomorphic surface ***(6)*** and the Turupah Formation of the Lahonton Valley Group ***(7, 8, 9, 19, 23)***. The soils on these terraces are influenced by sodium and salts deposited by receding pluvial lakes ***(2, 10)***. These soils are nearly level to gently sloping. The moderately well drained to poorly drained soils in the lower, nearly level positions correlate to the Ingram geomorphic surface. Soils of the Helphenstein series (Natric Camborthids) and Icene series (Aquollic Salorthids) are examples. These soils have an ochric epipedon with minimal organic matter accumulation and a cambic horizon with weak structural development. The well drained soils in the higher positions correlate to the Winkle geomorphic surface. Soils of the Mesman series (Xerollic Natrargids) and Turpin series (Natric Camborthids) are examples. These soils have an ochric epipedon with minimal organic matter accumulation and a weakly developed argillic horizon or strongly developed cambic horizon. Soils that reflect past climatic conditions or episodes of lake deposition include those of the Stockdrive series (Typic Natrixeralfs) and Thunderegg series (Typic Natraquolls) that have a strongly developed argillic horizon and those of the Lofftus series (Vitrixerandic Durorthids) that have a duripan. Wetter and drier climatic conditions have been observed by local inhabitants during the past century ***(1, 2, 15, 17)***.

Low nonsodic lake terraces are similar in position and age to low sodic lake terraces. The soils are well drained and are not influenced by sodium or salts. Soil formation reflects the pedogenic soil characteristics associated with the Ingram geomorphic surface. Examples include soils of the Jesse Camp series (Xerollic Camborthids), which have an ochric epipedon with minimal organic matter accumulation and a cambic horizon with weak structural development, and those of the Berdugo and Spangenburg series (Xerollic Paleargids), which reflect past climatic conditions or episodes of lake deposition and have a strongly developed, clayey argillic horizon near the surface.

Middle lake terraces are most prevalent in Goose Lake Valley. The soils on these terraces are undulating and have slopes of as much as 30 percent. These terraces represent a distinct change in relief from the Holocene alluvial flats and low terraces. The middle lake terraces are equivalent in geomorphic age to the Senecal geomorphic surface of the Willamette Valley series ***(9)*** and the upper member of the Eetza Formation of the Lahonton Valley Group series ***(22, 41)***. The soils have been in place for sufficient time to develop a strong argillic horizon and a thick mollic series (pachic) epipedon. The soils are well drained and are underlain by thick stratified alluvium. Deep core samples indicate that these soils have a duripan below a depth of 72 inches. Soils of the Deter and Drews series (Pachic Argixerolls) in Goose Lake

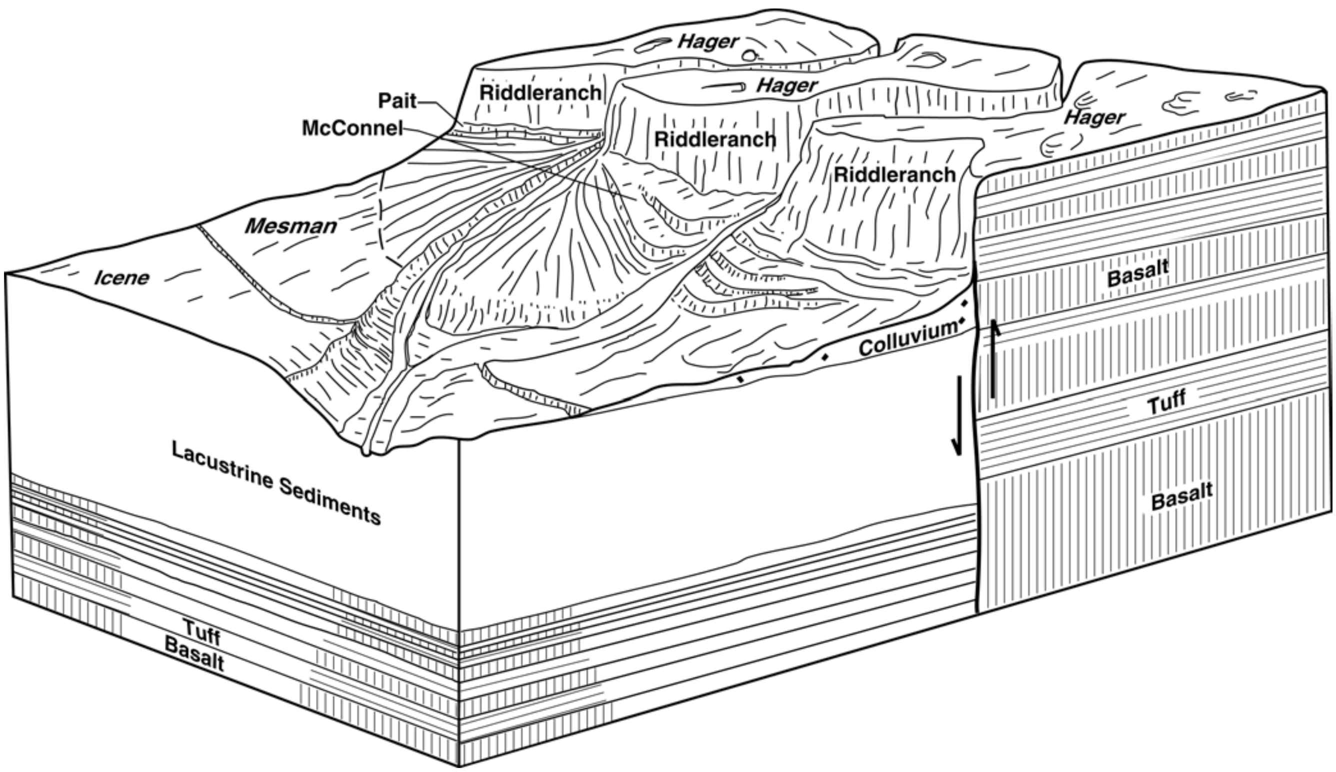


Figure 27.—Soil-landscape relationships in Warner Valley. Icene and Mesman soils on basin floor, McConnel soils on terraces, Pait soils on fans, Riddleranch soils on escarpments, and Hager soils on tablelands.

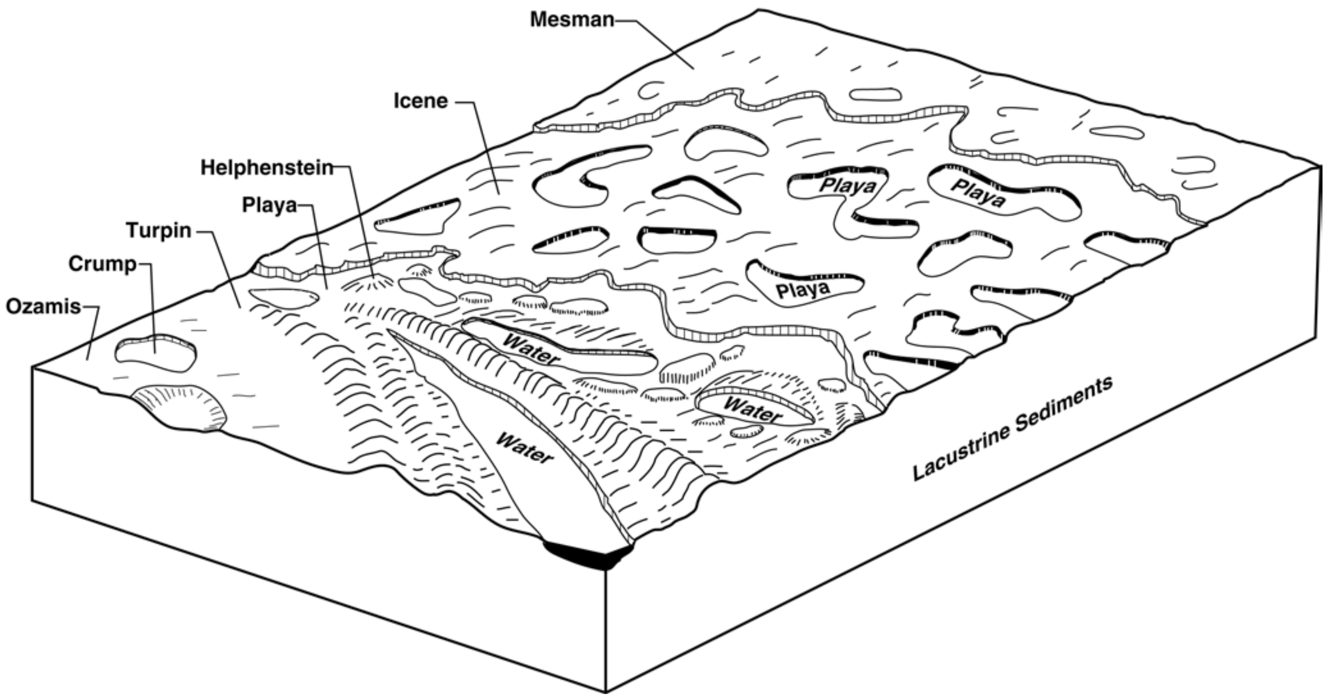


Figure 28.—Soil-landscape relationships in basins in Warner Valley.

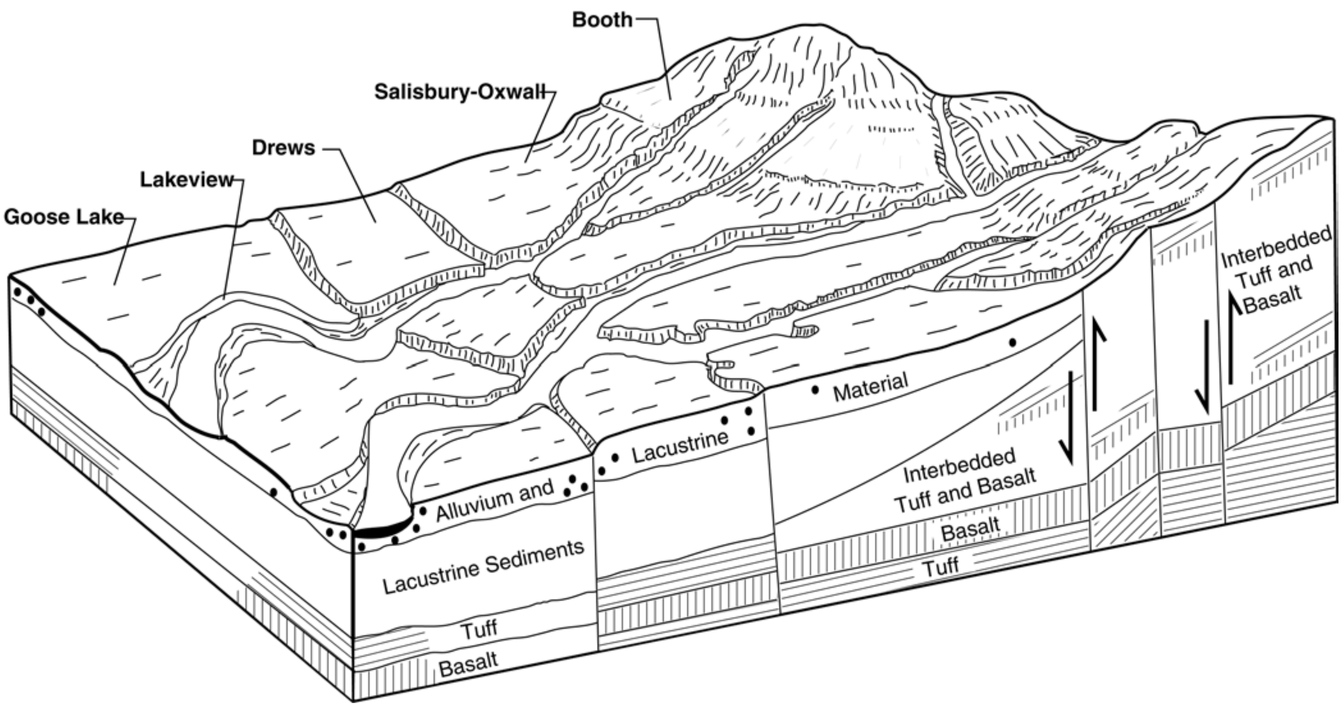


Figure 29.—Soil-landscape relationships in Goose Lake Valley. Goose Lake and Lakeview soils on basin floor, Drews soils on middle terraces, Salisbury and Oxwall soils on high terraces, and Booth soils on hills.

Valley and the Harriman series (Pachic Argixerolls) in Chewaucan Valley are examples.

High lake terraces are the oldest terraces and are in Goose Lake Valley. Similar topographic landforms adjacent to low and middle terraces in Chewaucan and Warner Valleys are referred to as low- or high-elevation, bedrock-controlled plateaus. The high lake terraces are nearly level to undulating. Slope is dominantly less than 5 percent, but it ranges to 15 percent. These terraces are equivalent in geomorphic age to the Dolph and Eola geomorphic surfaces of the Willamette Valley series ***(9)*** and the Paiute and Rye Patch Formations of the pre-Lake-Lahonton lacustrine surfaces series ***(19, 22)***. The lower lying high lake terraces correlate to the Dolph geomorphic surface. The Drewsgap series (Typic Durixerolls) is an example of soils on these terraces. These soils are characterized by a duripan and mollic epipedon. The duripan is indurated, and the lower part has several discontinuities of compacted sediment and weakly cemented to strongly cemented layers. The loamy argillic horizon reflects the age of development on the Dolph geomorphic surface. The higher lying high lake terraces correlate to the Eola geomorphic surface. The Oxwall series (Typic Durixerolls) and Salisbury series (Abruptic Durixerolls) are examples of soils on these terraces. These soils have a clayey argillic horizon that is dominantly montmorillonitic clay and a strongly cemented or indurated duripan.

Dunes are of the Holocene and are associated with the alluvial flats and low terraces. Dunes typically are on the eastern edge of the basins and valleys and reflect effects of the prevailing wind. Soil material continually is being added to or removed from the dunes; thus, little soil development has occurred. Examples of soils on dunes include those of the Als and Kewake series (Typic Torripsamments) and Zorravista series (Xeric Torripsamments). All of these soils have an ochric epipedon, but the amount of and depth to salts, sodium, and carbonates varies.

Alluvial and colluvial fans are of the Holocene and are associated with high water levels of Pleistocene lakes. These fans occur as alluvial shoreline deposits or colluvial deposits at the foot of fault-block escarpments. The fans correlate to the Dendritic Member of the Sehoo Formation of the Lahonton Valley Group ***(24)***. The soils are very deep and are gravelly or cobbly. They have a cambic horizon with weak structural development and an ochric epipedon with minimal organic matter accumulation. Soils in Goose Lake Valley that receive more precipitation than soils in other basins or valleys and soils at the foot of escarpments that receive supplemental moisture from runoff have a weak mollic epipedon. Examples are soils of the McConnel and McNye series (Xerollic Camborthids) and Hinton series (Durixerollic Camborthids) on shoreline terraces in Chewaucan and Warner Valleys; soils of the Donica series (Aridic Haploxerolls) in Goose Lake Valley; and soils of the Pait series (Aridic Haploxerolls) on colluvial fans.

Tablelands. The soils on tablelands typically receive 8 to 16 inches of precipitation (aridic and xeric). The mean annual air temperature is 43 to 47 degrees F (frigid). Elevation is about 4,700 to 6,500 feet. The tablelands are characterized by basalt and tuff flows that have been uplifted by faulting.

Low tablelands are characterized by the absence of appreciable relief. Slopes typically are less than 15 percent, but they range to as much as 30 percent. The soils on these tablelands are equivalent in geomorphic age to the Calapooyia geomorphic surface of the Willamette Valley ***(9)*** and the lower member of the Eetza Formation of the Lahonton Valley Group ***(19, 20, 22)***. These soils reflect both present and past soil formation processes or episodes. All of these soils have an argillic horizon, but the degree of development ranges from loamy to clayey. The presence or absence of a duripan is also variable. Because the distinct diagnostic subhorizons vary across this relatively uniform landform, the soil formation processes appear to have been interrupted by different erosional and depositional episodes. These low tablelands receive 8 to 12 inches of precipitation and generally are at an elevation of about 4,700 to 5,500 feet. The soils that receive less than 10 inches of precipitation and are at elevations of less than 5,000 feet dominantly have an ochric epipedon, and the soils that receive more precipitation and are at the higher elevations dominantly have a mollic epipedon. Examples of soils on low tablelands include those of the Brace series (Xerollic Durargids, fine-loamy), Coglin series (Xerollic Paleargids, fine), Drakesflat series (Aridic Calcic Argixerolls, fine), Ratto series (Xerollic Durargids, clayey), and Raz series (Xerollic Durorthids, loamy).

High tablelands also are characterized by the absence of appreciable relief. Slopes typically are less than 15 percent, but they range to as much as 50 percent. The age of soil development on these tablelands is similar to that of the soils on high lake terraces. The soils on the high tablelands reflect both present and past soil formation processes or episodes. These soils have a clayey argillic horizon that dominantly contains montmorillonitic clay. Intermittent to continuous, thin duripans or silica deposits are common below the argillic horizon. The surface layer is relatively thin, and there is an abrupt textural change from the surface layer to the dense clay subsoil. The dense clay layer and associated silica deposits reflect past climatic conditions or episodes of deposition.

The high tablelands receive 10 to 16 inches of precipitation and generally are at an elevation of about 5,000 to 6,500 feet. Ochric epipedons are dominant at the lower ranges of elevation and precipitation, and mollic epipedons are dominant at the higher ranges. Examples of soils on these tablelands include those of the Anawalt series (Lithic Xerollic Haplargids), Booth series (Typic Palexerolls), Carryback and Hart series (Aridic Palexerolls), Floke series (Abruptic Xerollic Durargids), Freznik series (Xerollic Paleargids), Merlin and Ninemile series (Lithic Argixerolls), and Observation series (Typic Argixerolls).

Upland basins and flood plains are of the Holocene. The soils in these basins and flood plains are equivalent in geomorphic age to the Ingram geomorphic surface of the Willamette Valley ***(9)***. The soils on the flood plains are subject to cutting and filling during periods of flooding. The reworking of the soil material is evident by the irregular decrease in organic matter as depth increases. Examples include soils of the Cressler series (Fluvaquentic Haplaquolls) and Degarmo and Welch series (Cumulic Haplaquolls). The soils in basins reflect past climatic conditions or episodes of erosion and deposition. These soils have a dense clay layer that has a high content of montmorillonitic clay. Examples include soils of the Boulder Lake series (Aquic Chromoxererts), Macyflet series (Xerollic Paleargids), Mudpot series (Typic Haplaquepts), and Swalesilver series (Aquic Palexeralfs). Many of the basins and flood plains are narrow and small and are associated with older geomorphic surfaces such as the Dolph, Eola, and Looney surfaces ***(9, 26)***.

Mountains. The soils on mountains typically receive 10 to 35 inches of precipitation (aridic, xeric, or udic). The mean annual air temperature is 41 to 47 degrees F (mesic, frigid, or cryic). Elevation is about 4,700 to 8,400 feet. The mountains consist of stable and active slopes that adjoin rock escarpments ***(27)***. Slopes range from 0 to 70 percent. Vegetation ranges from desert to forest plant communities.

The soils on these active and stable slopes are extremely variable. Because of the variability of the parent material and climate, soil development ranges from weak to strong. On the more active, steep slopes, soils such as those of the Felcher series (Xerollic Camborthids), Riddleranch series (Aridic Haploxerolls), Derapter series (Aridic Calcic Argixerolls), Westbutte series (Pachic Haploxerolls), Harcany series (Pachic Cryoborolls), Rogger series (Ultic Haploxerolls), Chocktoot series (Vitrandic Cryoborolls), and Drakespeak series (Typic Cryumbrepts) reflect soil development changes in relation to the increase in soil moisture and decrease in soil temperature. In the less dissected areas, the soils typically exhibit a stronger degree of development that is associated with the Dolph or Eola geomorphic surface of the Willamette Valley ***(9)*** and the Lovelock Formation of the pre-Lake Lahonton lacustrine surfaces ***(21)***. Soils associated with the more stable slopes include those of the Lorella series (Lithic Argixerolls), Royst and Winterim series (Pachic Argixerolls), Mound and Woodchopper series (Pachic Ultic Argixerolls), and Hammersley series (Argic Pachic Cryoborolls).

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial cone. The material washed down the sides of mountains and hills by ephemeral streams and deposited at the mouth of gorges in the form of a moderately steep, conical mass descending equally in all directions from the point of issue.

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.

Andic soil properties. A collection of physical and chemical properties given in “Keys to Soil Taxonomy” that are the taxonomic criteria for the Andisol order.

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.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial silicate clay. This horizon has a minimum thickness, depending on the thickness of the solum; a minimum content of clay as compared to the overlying eluvial horizon; and generally has coatings of oriented clay on the surface of pores or peds or bridging sand grains.

Ash, volcanic. Fine pyroclastic material less than 2 millimeters in diameter.

Aspect. The direction in which a slope faces.

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.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Back slopes in profile are commonly steep, are linear, and may or may not include cliff segments.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Basal till. Compact glacial till deposited beneath the ice.

Basalt. A dark, commonly extrusive (locally, intrusive as in dikes) mafic igneous rock composed mainly of calcic plagioclase, generally labradorite, and clinopyroxene in a glassy or fine grained mass. The extrusive equivalent of gabbro.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Basin. A broad, structural lowland between mountain ranges. It commonly is elongated and many miles wide. Also used to refer to a depressional area that has few, if any, outlets.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte. An isolated small mountain or hill with steep or precipitous sides and a top variously flat, rounded, or pointed that may be a residual mass isolated by erosion or an exposed volcanic neck.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Calcic horizon. A subsurface horizon that has an accumulation of calcium carbonate or of calcium and magnesium carbonate. It has secondary carbonate of at least 5 percent more than the C horizon or is 5 percent, by volume, identifiable secondary carbonates; is at least 15 centimeters thick; and has 15 percent calcium carbonate equivalent or more.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.

Cambic horizon. A subsurface horizon that is finer than loamy fine sand and consists of material that has been altered or removed but has not accumulated. Evidences of alteration include the elimination of fine strata; changes caused by wetness, such as gray colors and mottles; redistribution of carbonates; and colors that are yellower or redder than those in the underlying horizons.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Canyon. A long, deep, narrow, very steep sided valley with high, precipitous walls in an area of high local relief.

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.

Catena. A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

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.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Cement rock. Shaly limestone used in the manufacture of cement.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

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.

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 stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

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.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

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

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

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.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

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

Conglomerate. A coarse grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the “Soil Survey Manual.”

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

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 or 80 inches.

Coppice dune. A small dune of fine grained soil material stabilized around shrubs or small trees.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Desert pavement. On a desert surface, a layer of gravel or larger fragments that was emplaced by upward movement of the underlying sediments or that remains after finer particles have been removed by running water or the wind.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—***excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,*** and ***very poorly drained***. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

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.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

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

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

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess sulfur (in tables). Excessive amount of sulfur in the soil. The sulfur causes extreme acidity if the soil is drained, and the growth of most plants is restricted.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

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***.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

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 (300 meters) and fringes a mountain range or high-plateau escarpment.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

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.

Geomorphic surface. A surface consisting of one or more landforms that represents an episode of landscape development. It is a mappable part of the land surface that is defined in terms of morphology, age, origin, and stability of component landforms.

Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

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.

Head out. To form a flower head.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Holocene. The second epoch of the Quaternary, extending from the end of the Pleistocene (about ten thousand years ago) to the present.

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 uppercase letter represents the major horizons. Numbers or lowercase 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 B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

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, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

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

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

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.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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 capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches 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.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

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.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

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.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble 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.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mesa. A broad, nearly flat topped and commonly isolated upland mass characterized by summit widths that are more than the heights of bounding erosional scarps.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

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. Descriptive terms are as follows: abundance—***few, common,*** and ***many;*** size—***fine, medium,*** and ***coarse;*** and contrast—***faint, distinct,*** and ***prominent***. The size measurements are of the diameter along the greatest dimension. ***Fine*** indicates less than 5 millimeters (about 0.2 inch); ***medium,*** from 5 to 15 millimeters (about 0.2 to 0.6 inch); and ***coarse,*** more than 15 millimeters (about 0.6 inch).

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. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Mountainside. The part of a mountain between the summit and the foot.

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. It is similar to a broad-base terrace, except for the width of the ridge and channel.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nutrient, 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.

Ochric epipedon. A surface layer that is too light in color (has higher value of chroma than a mollic epipedon), too low in content of organic matter, or too thin to be either a mollic epipedon or an umbric epipedon.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Paleosol. A soil with distinctive morphological features, such as color and structure, that can be described consistently and that formed on a landscape that resulted from a soil-forming environment that no longer exists at the site. The former pedogenic process was altered because of changes in the external environment or was interrupted by burial.

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***.

Paralithic contact. The boundary between soil and continuous, coherent underlying material that has a hardness of less than 3 (Mohs scale).

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pediment. A gently sloping, erosional surface at the foot of a receding hill or mountain.

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

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

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

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting around ice. They form on the soil after plant cover is removed.

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.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary ponding occurs primarily in response to precipitation and runoff.

Pleistocene. The first epoch of the Quaternary (about two million to ten thousand years ago).

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Pluvial lake. A lake that formed during a period of exceptionally heavy rainfall; a lake that formed during the Pleistocene at a time of glacial advance and is now either extinct or exists as a remnant.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective 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. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

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 practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Puddling. A process by which a soil loses its structure and becomes massive as a result of traffic or tillage during wet periods. The soil becomes hard and cloddy when dry.

Pumice. Light-colored, vesicular, glassy volcanic rock fragments that can float on water.

Quaternary. The second period of the Cenozic Era extending from the end of the Tertiary (about two million years ago) to the present and comprising the Pleistocene (ice age) and the Holocene (present).

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.

Rangeland. Land on which the potential natural vegetation is predominantly 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 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 degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	less than 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

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 generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Riparian areas. Wetland ecosystems that have a high water table because of proximity to aquatic ecosystems or subsurface water. Riparian areas usually occur as an ecotone between aquatic and upland ecosystems, but they have distinct plant and soil characteristics. Riparian areas are uniquely characterized by a combination of high diversity, high density, and high productivity of species. Continuous interaction occurs among riparian, aquatic, and upland terrestrial ecosystems through exchange of energy, nutrients, and species.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 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.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts 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.

Salic horizon. A subsurface horizon that contains a secondary enrichment of salts that are more soluble in cold water than in gypsum. The horizon must be at least 15 centimeters thick and contain at least 2 percent salts. The product of its thickness, in centimeters, and percentage of salts, by weight, is 60 or more.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables). Water that is too salty for consumption by livestock.

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

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

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.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. 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 surface runoff.

Shrink-swell (in tables). 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.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

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.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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 (50-year). A set of related curves on a graph that shows the average height of dominant trees for the 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 trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that show the average height of dominant and codominant 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.

Skid trails. The paths created by skidding logs and the bulldozer or tractor used to pull them.

Skidding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most skidding systems involve pulling the trees with wire cables attached to a bulldozer or rubber-tired tractor. Generally, one end is lifted when the felled trees are skidded or pulled. As a result, friction and surface disturbance are minimized.

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.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). 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 distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

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 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
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, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

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.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

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).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

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

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

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

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

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

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Tableland. A broad upland with a large nearly level or undulating summit area and steep side slopes descending to surrounding lowlands. Types of tableland include plateaus and mesas.

Talus. Fragments of rock and other soil material accumulated by gravity at the foot of cliffs or steep slopes.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

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.”

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

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.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

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.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

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 a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.